UNCLASSIFIED

Supporting Data FY 2007 President's Budget
Submitted to OSD – February 2006

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 2007
PRESIDENT'S BUDGET SUBMISSION
FEBRUARY 2006

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 2007 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 2005 through FY 2007.

2. Relationship of the FY 2007 Budget Submission to the FY 2006/2007 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
0305206A/K98	MASINT Sensor Integration (JMIP)	0203744A/028
0604805A/615 & 61A	Joint Tactical Radio System	0604280A/162

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 2007 Program Elements/Projects. There are no major system new starts. Minor new initiatives for FY 2007 are shown below.

TITLE	PE/PROJECT
In-House Lab Independent Research – Medical (CA)	0601101A/91J
Basic Research Initiatives – MRMC (CA)	0601102A/T61

C. Establishment of New FY 2007 Program Elements/Projects. There are no major system new starts. Minor new initiatives for FY 2007 are shown below. (Continued)

TITLE	PE/PROJECT
Medical University Research Initiatives (CA)	0601103A/D66
Tactical Space Research	0602120A/TS1
Computer and Software Technology (CA)	0602783A/Y11
Medical Technology Initiatives (CA)	0602787A/VB3
Medical Advanced Technology Initiatives (CA)	0603002A/MM2
Small Arms Advanced Technology Development (CA)	0603607A/62D
Environmental Quality Technology (EQT) Dem/Val (CA)	0603779A/EP1
Nuclear Arms Control Technology Sensor Engineering	0604870A/SE1
Utility Fixed Wing Cargo Aircraft	0203744A/D18

D. FY 2007 programs for which funding existed in the FY 2006/2007 President's Budget Submit (February 2005), but which are no longer funded in FY 2007.

PE/PROJECT	TITLE	BRIEF EXPLANATION
0604817A/482	Ground Combat Identification	Program Delayed
0605326A/308	Concepts Experimentation	Program Terminated

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

0203806A	0603005A/C66	0604328A
0203808A	0603009A	
0301359A	0603020A	
0602122A	0603322A	
0602786A/C60	0603710A/C65	

4. Performance Metrics. Performance metrics used in the preparation of this justification book may be found in the FY 2007 Army Performance Budget Justification Book, dated March 2006.

Department of the Army
FY 2007 RDT&E Program
President's Budget FY 2007
Summary

Exhibit R-1

30-Jan-2006

Summary Recap of Budget Activities	Thousands of Dollars FY 2005	FY 2006	FY 2007
Basic research	392,802	372,251	311,931
Applied Research	1,137,821	1,250,026	685,245
Advanced technology development	1,479,844	1,388,924	721,661
Advanced Component Development and Prototypes	871,241	507,353	441,086
System Development and Demonstration	4,370,672	5,061,368	6,239,030
Management support	1,196,969	1,138,936	1,163,638
Operational system development	1,126,709	1,307,189	1,292,968
Total RDT&E, Army	10,576,058	11,026,047	10,855,559

			Summary Recap of Budget Activities	Thousands of Dollars FY 2005	FY 2006	FY 2007
			Basic research			
1	0601101A	01	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	23,065	21,236	19,402
2	0601102A	01	DEFENSE RESEARCH SCIENCES	164,449	173,533	137,568
3	0601103A	01	UNIVERSITY RESEARCH SCIENCES (H)	82,959	76,984	68,545
4	0601104A	01	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	100,021	100,498	86,416
5	0601105A	01	FORCE HEALTH PROTECTION	22,308	0	0
			Total: Basic research	392,802	372,251	311,931
			Applied Research			
6	0602105A	02	MATERIALS TECHNOLOGY	48,274	35,051	18,822
7	0602120A	02	SENSORS AND ELECTRONIC SURVIVABILITY	56,267	51,327	38,428
8	0602122A	02	TRACTOR HIP	6,403	7,693	8,466
9	0602211A	02	AVIATION TECHNOLOGY	47,536	39,424	32,804
10	0602270A	02	EW TECHNOLOGY	19,694	29,305	19,218
11	0602303A	02	MISSILE TECHNOLOGY	79,358	90,712	59,439
12	0602307A	02	ADVANCED WEAPONS TECHNOLOGY	27,121	36,233	19,430
13	0602308A	02	ADVANCED CONCEPTS AND SIMULATION	22,710	27,416	16,181
14	0602601A	02	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	110,057	92,857	59,304
15	0602618A	02	BALLISTICS TECHNOLOGY	55,305	52,010	52,221
16	0602622A	02	CHEMICAL, SMOKE AND EQUIPMENT DEFEATING TECHNOLOGY	9,977	10,567	2,212
17	0602623A	02	JOINT SERVICE SMALL ARMS PROGRAM	11,271	6,607	6,247
18	0602624A	02	WEAPONS AND MUNITIONS TECHNOLOGY	103,533	125,267	35,344
19	0602705A	02	ELECTRONICS AND ELECTRONIC DEVICES	101,771	91,925	42,175
20	0602709A	02	NIGHT VISION TECHNOLOGY	26,393	31,664	23,907
21	0602712A	02	COUNTERMINE SYSTEMS	26,267	29,171	22,088
22	0602716A	02	HUMAN FACTORS ENGINEERING TECHNOLOGY	20,746	28,420	18,858
23	0602720A	02	ENVIRONMENTAL QUALITY TECHNOLOGY	22,358	17,859	17,923
24	0602782A	02	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	28,774	49,242	21,193
25	0602783A	02	COMPUTER AND SOFTWARE TECHNOLOGY	5,346	4,521	3,844
26	0602784A	02	MILITARY ENGINEERING TECHNOLOGY	52,477	50,318	50,098
27	0602785A	02	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	14,839	14,990	16,200
28	0602786A	02	LOGISTICS TECHNOLOGY	54,385	47,667	25,436
29	0602787A	02	MEDICAL TECHNOLOGY	186,959	279,780	75,407
			Total: Applied Research	1,137,821	1,250,026	685,245
			Advanced technology development			
30	0603001A	03	WARFIGHTER ADVANCED TECHNOLOGY	78,821	77,434	45,666

Summary Recap of Budget Activities				Thousands of Dollars FY 2005	FY 2006	FY 2007
31	0603002A	03	MEDICAL ADVANCED TECHNOLOGY	300,328	300,784	50,757
32	0603003A	03	AVIATION ADVANCED TECHNOLOGY	92,788	106,577	64,654
33	0603004A	03	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	84,538	101,841	74,717
34	0603005A	03	COMBAT VEHICLE AND AUTOMOTIVE ADVANCED TECHNOLOGY	284,720	242,013	109,952
35	0603006A	03	COMMAND, CONTROL, COMMUNICATIONS ADVANCED TECHNOLO	9,540	12,880	10,851
36	0603007A	03	MANPOWER, PERSONNEL AND TRAINING ADVANCED TECHNOLO	8,390	10,235	6,794
37	0603008A	03	ELECTRONIC WARFARE ADVANCED TECHNOLOGY	58,185	60,515	44,022
38	0603009A	03	TRACTOR HIKE	7,720	8,652	9,324
39	0603015A	03	NEXT GENERATION TRAINING & SIMULATION SYSTEMS	26,888	27,927	18,296
40	0603020A	03	TRACTOR ROSE	4,527	4,885	5,183
41	0603100A	03	IED DEFEAT TECHNOLOGY DEVELOPMENT	30,000	5,500	0
42	0603103A	03	EXPLOSIVE DEMILITARIZATION TECHNOLOGY	18,397	21,041	10,376
43	0603105A	03	MILITARY HIV RESEARCH	13,545	13,644	7,042
44	0603125A	03	COMBATING TERRORISM, TECHNOLOGY DEVELOPMENT FOR	30,427	10,159	7,497
45	0603238A	03	GLOBAL SURVEILLANCE/AIR DEFENSE/PRECISION STRIKE T	10,280	11,939	12,995
46	0603270A	03	EW TECHNOLOGY	36,347	22,280	18,612
47	0603313A	03	MISSILE AND ROCKET ADVANCED TECHNOLOGY	136,319	114,018	42,127
48	0603322A	03	TRACTOR CAGE	12,770	15,186	19,192
49	0603606A	03	LANDMINE WARFARE AND BARRIER ADVANCED TECHNOLOGY	37,246	30,092	25,554
50	0603607A	03	JOINT SERVICE SMALL ARMS PROGRAM	5,732	7,474	7,202
51	0603710A	03	NIGHT VISION ADVANCED TECHNOLOGY	102,002	101,690	44,307
52	0603728A	03	ENVIRONMENTAL QUALITY TECHNOLOGY DEMONSTRATIONS	16,919	15,777	14,089
53	0603734A	03	MILITARY ENGINEERING ADVANCED TECHNOLOGY	21,716	21,390	7,848
54	0603772A	03	ADVANCED TACTICAL COMPUTER SCIENCE AND SENSOR TECH	51,699	44,991	64,604
	Total: Advanced technology development			1,479,844	1,388,924	721,661
	Advanced Component Development and Prototypes					
55	0603024A	04	UNIQUE ITEM IDENTIFICATION (UID)	0	1,479	1,520
56	0603305A	04	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION	109,799	81,494	11,233
57	0603308A	04	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION (DEM/VAL)	31,776	48,186	11,771
58	0603327A	04	AIR AND MISSILE DEFENSE SYSTEMS ENGINEERING	109,170	100,190	143,417
59	0603619A	04	LANDMINE WARFARE AND BARRIER - ADV DEV	11,141	0	8,439
60	0603627A	04	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ADV DEV	6,943	5,651	10,714
61	0603639A	04	TANK AND MEDIUM CALIBER AMMUNITION	26,764	8,281	0
62	0603653A	04	ADVANCED TANK ARMAMENT SYSTEM (ATAS)	49,689	26,332	5,415
63	0603747A	04	SOLDIER SUPPORT AND SURVIVABILITY	19,482	3,344	2,778
64	0603766A	04	TACTICAL SUPPORT DEVELOPMENT - ADV DEV (TIARA)	15,211	18,637	20,077

Summary Recap of Budget Activities				Thousands of Dollars FY 2005	FY 2006	FY 2007
65	0603774A	04	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	17,044	6,787	5,337
66	0603779A	04	ENVIRONMENTAL QUALITY TECHNOLOGY DEM/VAL	43,637	35,255	5,166
67	0603782A	04	WARFIGHTER INFORMATION NETWORK-TACTICAL - DEM/VAL	94,991	98,057	158,157
68	0603790A	04	NATO RESEARCH AND DEVELOPMENT	4,598	4,832	4,946
69	0603801A	04	AVIATION - ADV DEV	22,809	7,146	6,542
70	0603802A	04	WEAPONS AND MUNITIONS - ADV DEV	8,797	0	0
71	0603804A	04	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	9,543	13,184	13,216
72	0603805A	04	COMBAT SERVICE SUPPORT CONTROL SYSTEM EVALUATION A	6,117	10,507	8,645
73	0603807A	04	MEDICAL SYSTEMS - ADV DEV	20,277	23,149	11,973
74	0603827A	04	SOLDIER SYSTEMS - ADVANCED DEVELOPMENT	0	12,119	10,605
75	0603850A	04	INTEGRATED BROADCAST SERVICE (JMIP/DISTP)	4,292	2,723	1,135
76	0603856A	04	SCAMP BLOCK II	7,863	0	0
77	0603869A	04	MEADS CONCEPTS - DEM/VAL	251,298	0	0
	Total: Advanced Component Development and Prototypes			871,241	507,353	441,086
	System Development and Demonstration					
78	0604201A	05	AIRCRAFT AVIONICS	72,521	13,259	61,946
79	0604220A	05	ARMED, DEPLOYABLE OH-58D	43,315	91,860	132,781
80	0604270A	05	EW DEVELOPMENT	18,106	33,397	41,655
81	0604280A	05	JOINT TACTICAL RADIO SYSTEM	151,274	139,546	832,259
82	0604321A	05	ALL SOURCE ANALYSIS SYSTEM	6,586	9,042	7,074
83	0604328A	05	TRACTOR CAGE	13,571	15,869	16,057
84	0604329A	05	COMMON MISSILE	112,376	25,630	0
85	0604601A	05	INFANTRY SUPPORT WEAPONS	33,697	53,257	31,748
86	0604604A	05	MEDIUM TACTICAL VEHICLES	12,540	18,518	1,925
87	0604609A	05	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ENG DEV	3,637	0	5,297
88	0604611A	05	JAVELIN	904	0	0
89	0604622A	05	FAMILY OF HEAVY TACTICAL VEHICLES	13,938	20,913	3,960
90	0604633A	05	AIR TRAFFIC CONTROL	2,011	4,444	4,527
91	0604642A	05	LIGHT TACTICAL WHEELED VEHICLES	9,581	7,393	0
92	0604645A	05	ARMORED SYSTEMS MODERNIZATION (ASM)-ENG. DEV.	2,098,130	2,745,716	3,310,477
93	0604646A	05	NON LINE OF SIGHT LAUNCH SYSTEM	119,767	231,209	322,880
94	0604647A	05	NON LINE OF SIGHT CANNON	286,853	146,271	112,237
95	0604710A	05	NIGHT VISION SYSTEMS - ENG DEV	34,107	28,980	38,821
96	0604713A	05	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	107,912	3,334	3,017
97	0604715A	05	NON-SYSTEM TRAINING DEVICES - ENG DEV	42,784	60,219	121,553
98	0604716A	05	TERRAIN INFORMATION - ENG DEV	3,140	0	0

			Summary Recap of Budget Activities	Thousands of Dollars FY 2005	FY 2006	FY 2007
99	0604726A	05	INTEGRATED METEOROLOGICAL SUPPORT SYSTEM	2,442	0	0
100	0604741A	05	AIR DEFENSE COMMAND, CONTROL AND INTEL - ENG	72,052	41,512	21,757
101	0604742A	05	CONSTRUCTIVE SIMULATION SYSTEMS DEVELOPMENT	41,052	39,993	40,006
102	0604746A	05	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	9,074	2,221	8,136
103	0604760A	05	DISTRIBUTIVE INTERACTIVE SIMULATIONS (DIS) - ENGIN	26,323	29,628	19,596
104	0604766A	05	TACTICAL EXPLOITATION SYSTEM/DCGS (TIARA)	21,496	0	0
105	0604768A	05	BRILLIANT ANTI-ARMOR SUBMUNITION (BAT)	1,748	0	0
106	0604778A	05	POSITIONING SYSTEMS DEVELOPMENT (SPACE)	1,961	0	0
107	0604780A	05	COMBINED ARMS TACTICAL TRAINER (CATT)	16,304	43,344	39,901
108	0604783A	05	JOINT NETWORK MANAGEMENT SYSTEM	10,244	5,019	5,187
109	0604801A	05	AVIATION - ENG DEV	3,236	1,380	0
110	0604802A	05	WEAPONS AND MUNITIONS - ENG DEV	150,030	104,029	130,581
111	0604804A	05	LOGISTICS AND ENGINEER EQUIPMENT - ENG DEV	86,918	14,150	40,301
112	0604805A	05	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ENG DEV	217,686	318,947	10,783
113	0604807A	05	MEDICAL MATERIEL/MEDICAL BIOLOGICAL DEFENSE EQUIPM	19,315	16,487	14,509
114	0604808A	05	LANDMINE WARFARE/BARRIER - ENG DEV	57,090	74,482	118,078
115	0604814A	05	ARTILLERY MUNITIONS - EMD	137,391	114,709	102,554
116	0604817A	05	COMBAT IDENTIFICATION	12,068	5,395	39
117	0604818A	05	ARMY TACTICAL COMMAND & CONTROL HARDWARE & SOFTWAR	64,585	66,026	69,172
118	0604819A	05	LOSAT	17,403	0	0
119	0604820A	05	RADAR DEVELOPMENT	5,848	5,008	2,527
120	0604822A	05	GENERAL FUND ENTERPRISE BUSINESS SYSTEM (GFEBS)	58,007	70,105	61,194
121	0604823A	05	FIREFINDER	10,332	45,405	70,151
122	0604827A	05	SOLDIER SYSTEMS - WARRIOR DEM/VAL	0	58,473	27,498
123	0604854A	05	ARTILLERY SYSTEMS - EMD	12,016	5,397	1,650
124	0604865A	05	PATRIOT PAC-3 THEATER MISSILE DEFENSE ACQ - EMD	60,408	0	0
125	0604869A	05	PATRIOT/MEADS COMBINED AGGREGATE PROGRAM (CAP)	0	284,695	329,583
126	0604870A	05	NUCLEAR ARMS CONTROL MONITORING SENSOR NETWORK	0	0	7,428
127	0605013A	05	INFORMATION TECHNOLOGY DEVELOPMENT	68,893	66,106	70,185
			Total: System Development and Demonstration	4,370,672	5,061,368	6,239,030
			Management support			
128	0604256A	06	THREAT SIMULATOR DEVELOPMENT	32,292	28,878	21,180
129	0604258A	06	TARGET SYSTEMS DEVELOPMENT	14,882	11,784	10,928
130	0604759A	06	MAJOR T&E INVESTMENT	65,999	66,030	64,953
131	0605103A	06	RAND ARROYO CENTER	21,846	23,460	20,171
132	0605301A	06	ARMY KWAJALEIN ATOLL	139,339	153,317	178,891

Summary Recap of Budget Activities				Thousands of Dollars FY 2005	FY 2006	FY 2007
133	0605326A	06	CONCEPTS EXPERIMENTATION	20,866	38,496	21,626
134	0605502A	06	SMALL BUSINESS INNOVATIVE RESEARCH	261,896	0	0
135	0605601A	06	ARMY TEST RANGES AND FACILITIES	188,226	364,007	389,840
136	0605602A	06	ARMY TECHNICAL TEST INSTRUMENTATION AND TARGETS	71,804	68,299	74,066
137	0605604A	06	SURVIVABILITY/LETHALITY ANALYSIS	44,104	41,703	40,780
138	0605605A	06	DOD HIGH ENERGY LASER TEST FACILITY	17,300	19,505	16,622
139	0605606A	06	AIRCRAFT CERTIFICATION	2,920	2,709	4,580
140	0605702A	06	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	9,440	8,703	8,571
141	0605706A	06	MATERIEL SYSTEMS ANALYSIS	15,908	15,296	16,526
142	0605709A	06	EXPLOITATION OF FOREIGN ITEMS	4,670	4,643	4,993
143	0605712A	06	SUPPORT OF OPERATIONAL TESTING	70,181	75,891	80,057
144	0605716A	06	ARMY EVALUATION CENTER	56,837	56,388	60,129
145	0605718A	06	SIMULATION & MODELING FOR ACQ, RQTS, & TNG (SMART)	1,853	5,360	5,441
146	0605737A	06	DEFENSE FOREIGN LANGUAGE TRAINING	4,800	0	0
147	0605801A	06	PROGRAMWIDE ACTIVITIES	59,484	53,496	72,214
148	0605803A	06	TECHNICAL INFORMATION ACTIVITIES	37,525	46,760	34,834
149	0605805A	06	MUNITIONS STANDARDIZATION, EFFECTIVENESS & SAFETY	38,042	37,530	18,726
150	0605857A	06	ENVIRONMENTAL QUALITY TECHNOLOGY MGMT SUPPORT	4,334	3,957	4,418
151	0605898A	06	MANAGEMENT HEADQUARTERS (RESEARCH AND DEVELOPMENT)	12,386	12,724	14,092
152	0909999A	06	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS	35	0	0
	Total: Management support			1,196,969	1,138,936	1,163,638
	Operational system development					
153	0603778A	07	MLRS PRODUCT IMPROVEMENT PROGRAM	105,395	113,652	74,506
154	0603820A	07	WEAPONS CAPABILITY MODIFICATIONS UAV	0	5,323	16,532
155	0102419A	07	JOINT LAND ATTACK CRUISE MISSILES DEFENSE (JLENS)	79,279	105,888	264,491
156	0203726A	07	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	18,846	16,820	17,394
157	0203735A	07	COMBAT VEHICLE IMPROVEMENT PROGRAMS	17,162	31,080	12,741
158	0203740A	07	MANEUVER CONTROL SYSTEM	31,050	40,813	37,976
159	0203744A	07	AIRCRAFT MODIFICATIONS/PRODUCT IMPROVEMENT PROGRAM	297,917	336,884	301,739
160	0203752A	07	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	7,117	2,036	860
161	0203758A	07	DIGITIZATION	24,055	13,152	13,373
162	0203759A	07	FORCE XXI BATTLE COMMAND, BRIGADE AND BELOW (FBCB2	43,668	19,913	26,375
163	0203801A	07	MISSILE/AIR DEFENSE PRODUCT IMPROVEMENT PROGRAM	32,067	15,957	10,770
164	0203802A	07	OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS	0	18,414	19,706
165	0203806A	07	TRACTOR RUT	3,179	0	0
166	0203808A	07	TRACTOR CARD	8,640	6,700	7,242

Summary Recap of Budget Activities				Thousands of Dollars FY 2005	FY 2006	FY 2007
167	0208010A	07	JOINT TACTICAL COMMUNICATIONS PROGRAM (TRI-TAC)	17,354	24,550	5,804
168	0208053A	07	JOINT TACTICAL GROUND SYSTEM	9,817	12,670	15,044
169	0208058A	07	JOINT HIGH SPEED VESSEL (JHSV)	0	3,215	20,397
170	0303028A	07	SECURITY AND INTELLIGENCE ACTIVITIES	14,391	11,130	3,170
171	0303140A	07	INFORMATION SYSTEMS SECURITY PROGRAM	28,531	26,323	23,828
172	0303141A	07	GLOBAL COMBAT SUPPORT SYSTEM	90,310	68,264	55,272
173	0303142A	07	SATCOM GROUND ENVIRONMENT (SPACE)	51,759	57,822	41,336
174	0303150A	07	WWMCCS/GLOBAL COMMAND AND CONTROL SYSTEM	18,394	13,452	12,200
175	0303158A	07	JOINT COMMAND AND CONTROL - ARMY	0	1,672	4,057
176	0305204A	07	TACTICAL UNMANNED AERIAL VEHICLES	53,900	147,040	114,087
177	0305206A	07	AIRBORNE RECONNAISSANCE ADV DEVELOPMENT	8,108	5,321	12
178	0305208A	07	DISTRIBUTED COMMON GROUND/SURFACE SYSTEMS (JMIP)	54,013	91,859	120,562
179	0702239A	07	AVIONICS COMPONENT IMPROVEMENT PROGRAM	954	980	1,031
180	0708045A	07	END ITEM INDUSTRIAL PREPAREDNESS ACTIVITIES	100,349	111,788	68,075
181	0P0GMTOT	07	OTHER ARMY PROGRAMS	9,867	3,910	3,700
182	1001018A	07	NATO JOINT STARS	587	561	688
	Total: Operational system development			1,126,709	1,307,189	1,292,968
				10,576,058	11,026,047	10,855,559

Total: RDT&E, Army

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EXPECT FEDERAL PROGRAMS TO PERFORM WELL, AND BETTER EVERY YEAR.

PROGRAM ASSESSMENT

PROGRAM
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Defense Basic Research

This program supports scientific study and experimentation to increase fundamental knowledge in the physical, engineering, environmental and life sciences of potential importance to the defense mission. The program is carried out primarily through grants to universities and non-profit organizations.

RATING
What This Rating Means

PERFORMING

Effective

- **The program has clear purposes.** It helps develop technologies that provide options for new weapons, helps prevent technological suprise by adversaries and develops new scientists who will contribute to the DoD mission in the future.
- **The program is reviewed regularly by technically capable outside expets, who recommend improvements they believe should be implemented.** The experts indicate that the work is of overall high quality.
- **Research earmarks have increased dramatically in the past 15-20 years.** Such projects contribute less than typical projects to meeting the Department's mission, as they don't have to be screened for relevance or quality, and cost more to administer. Earmarks also reduce incentives for other projects to perform to peak potential, as non-earmarked projects encounter less competition for funding.

IMPROVEMENT PLAN
About Improvement Plans

We are taking the following actions to improve the performance of the program:

- Emphasizing the use of independent review panels in assessing the performance of the program.
- Working with the research community and Congress to explain the need to limit claims on research grant funds to proposals that independently can meet the standards of a strict merit-review process.

LEARN MORE

- **Details and Current Status of this program assessment.**
- How all Federal programs are assessed.
- Learn more about Defense Basic Research.

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PROGRAM ASSESSMENT

PROGRAM
View Similar Programs

Defense Applied Research Program

This program supports scientific study of physical, biomedical, behavioral or other phenomena to determine the means by which a particular military need may be met. This work is a little more advanced and applied than the basic research from which it may arise.

RATING
What This Rating Means

PERFORMING

Moderately Effective

- **Program purpose and design are clear.** The purpose is to support quality science with potential application to the defense mission. The Department has established methodical processes for setting program goals and for reviewing progress.
- **Reviews of the program by external review panels are not independent of program officials.** Some reviewers are government employees with financial associations to the program areas under review.
- **A large part of the program is executed either without the benefit of military or scientific expertise in choosing the funded work or without allowing the applications process to be open to all capable researchers.** Earmarking of projects in the program has increased in the recent past and has led to these problems.

IMPROVEMENT PLAN
About Improvement Plans

We are taking the following actions to improve the performance of the program:

- Ensuring that adequate funding exists to carry promising basic research results through the applied research phase.
- Changing the expert evaluation process to use fully independent review panels in assessing the performance of the program.
- Working with the research community and Congress to explain the need to limit claims on research grant funds to proposals that independently can meet the standards of a strict merit-review process.

LEARN MORE

- **Details and Current Status of this program assessment.**
- How all Federal programs are assessed.
- Learn more about Defense Applied Research Program.

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		23065	21236	19402	18416	18824	18178	18236
91A	ILIR-AMC	17001	15050	14261	13223	13662	13033	13036
91C	ILIR-MED R&D CMD	4572	3688	3632	3668	3621	3661	3697
91D	ILIR-CORPS OF ENGR	1251	1200	1317	1327	1337	1273	1286
91E	ILIR-ARI	241	312	192	198	204	211	217
91J	IN-HOUSE LAB INDEPENDENT RESEARCH - MEDICAL (CA)	0	986	0	0	0	0	0

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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the DoD Basic Research Plan (BRP). 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 for the Behavioral and Social Sciences (ARI).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	23077	20542	21199
Current BES/President's Budget (FY 2007)	23065	21236	19402
Total Adjustments	-12	694	-1797
Congressional Program Reductions		-92	
Congressional Rescissions		-214	
Congressional Increases		1000	
Reprogrammings	-12		
SBIR/STTR Transfer			
Adjustments to Budget Years			-1797

One FY06 Congressional add totaling $1000 was added to this PE.

FY06 Congressional add with no R-2A (appropriated amount is shown):
($1000) Tesla Human Whole-Body Research MRI

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
91A ILIR-AMC	17001	15050	14261	13223	13662	13033	13036

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 Strategic Planning Guidance, the DoD Research Plan (BRP), the Army Science and Technology Master Plan (ASTMP), and the Army Modernization Plan. Work in this project is performed by the Army Materiel Command and the Army Research Institute.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Edgewood Chemical Biological Center - In FY05, completed work on scale-up production of photonic material bachteriorhodopsin, continued work on multigenic engineering for enhanced antibody production, and conducted principal components analysis of biomarkers for low level chemical agent exposure. The latter effort will establish molecular fingerprints for forensics analysis of agent exposure. In FY06, the biomarkers project will be expanded to include proteins in multiple tissues, as well as a hair follicle assay. Will explore novel genomics signatures of ricinus species, development of vibrio cholerae as a model for hyper-variable mutator strains, and multiplexed protein separation technology. The vibrio study is significant for the detection of genetically engineered pathogens. In addition, the multigenically engineered antibody lines will be completed. In FY07, will solicit new and continuing basic research efforts focused on fundamental questions pertaining to CBD and applied biotechnology that address Army requirements.	1879	1612	1262
- Armaments RDEC - In FY05 conducted basic research in new synthetic methodologies for high density, high energy materials, carbon nanotubes as energetic/strengthening materials; acoustic sensors for discrimination of chemical, biological, and high-explosive artillery rounds; E-field sensors and sensor fusion. In FY06, conduct basic research in energetics, smart munitions, armament materials, directed energy, and nanomaterials applied to armaments/munitions to achieve higher lethality on target, affordable increase in munitions accuracy, and directed energy target effects. In FY07 will continue basic research in energetics, smart munitions, armament materials, directed energy, and nanomaterials applied to armaments/munitions to achieve higher lethality on target, affordable increase in munitions accuracy, and directed energy target effects.	2826	2706	2198
- Tank-automotive RDEC - In FY05, fabricated and tested real-time four-Stokes parameter optical apparatus for robotic vehicle perception and signature measurement; formulated mathematical models of diesel engine flame propagation in terms of multi-fuel performance parameters; compared theoretical and experimental liquid heat capillary tube thermal transfer performance characteristics for passive, low signature cooling of military electronics; formulated intelligent agent architectures for swarming ground robot behaviors. In FY06 formulate evolutionary computing algorithms for adaptive path planning and navigation; develop in-situ combustion chamber temperature and pressure sensors to validate high performance engine thermodynamic combustion models; solve multi-body equations of motion for forward and inverse ground vehicle dynamic models. In FY07, will develop reinforcement learning algorithms and compare performance with bio-inspired robot behaviors; compute liquid heat pipe (LHP) heat transfer coefficients for ground vehicle environments and compare with NASA zero-gravity spacecraft data; model advanced ground propulsion phenomena in support of Army's Future Combat Systems (FCS) requirements.	1837	1900	1473

- Natick Soldier Center - In FY05, extended model on inactivation of pressure resistant bacterial spores; researched strategies for overcoming claustro-intolerance in warfighters; investigated interaction between movement in complex environments and cognitive processing of information; and examined self-assembled phage based fibers (collaboration with Institute for Collaborative Biotechnologies). In FY06, investigate relationship between electrical and mechanical characteristics of flexible conducting materials; will confirm essential features of mathematical representation of permeation kinetics in model foods; examine electronic conduction in novel conducting polymers for use in fibers. In FY07, will establish/confirm theoretical foundation for electrical and physical effects in hybrid conductive yarns useful in robust e-textiles; will use Lie Group theory and dynamical systems analysis to investigate common characteristics in problems/solutions of interest to Soldier mission; will examine means for coupling biorecognition elements to polymers with potential to sense food pathogens.	1581	1387	1509
- Aviation and Missile RDEC Missile Efforts - In FY05, (1) transitioned transparent metal photonic crystal technology to troops in Iraq for a solar protective film on riot shields, (2) transitioned third order interactions technology for optical limiting in photonic bandgap structures to demonstration of a seeker counter-countermeasure, (3) transitioned hypersonic heatshield research to the Compact Kinetic Energy Missile (CKEM) as the primary thermal protection system, (4) demonstrated real-time 3-D stereoscopic display for use in remotely guided vehicles, and (5) demonstrated materials suitable for multimode seeker domes. In FY06, investigate and demonstrate shifter-less beam steering for a new ultra-wideband radar concept, and demonstrate optical limiting effect in infrared photonic crystal fibers. In addition develop model of self focusing and second harmonic generation for short pulses in negative index materials, and demonstrate nanomachining in optical waveguides for frequency selective devices. In FY07, will demonstrate new concepts in specific focus areas of terahertz pulsed sources, nano technology, complex chaotic systems, quantum computing and photonic bandgap structures for applications in RF devices, sensor protection and other missile systems.	3991	2623	2774
- Aviation and Missile RDEC Aviation Efforts - In FY05, performed research to achieve robust control architecture for UAV missions. Conducted research to measure boundary layer properties in separated-flow regions to construct new turbulence models. Generated new high order dissipation schemes to reduce the spurious vortex dissipation in the OVERFLOW code. In FY 06, analyze the particle image velocimetry (PIV) measured data, and develop new turbulence model based on the PIV measurement of boundary layer properties in separated-flow regions. Generate the background oriented stereo Schleiren technique. In FY07, will generate unstructured grid algorithms for rotorcraft/UAV aerodynamics. Will investigate the modeling and suppression of rotorcraft disturbance response.	2443	2483	2155
- Communications-Electronics RDEC - In FY05, investigated models for fused sensors and improved automatic/aided target recognition algorithms. Identified techniques for practical electrolyte research for Lithium Ion Batteries. Characterized membrane-based oxygen-enriched combustion of liquid hydrocarbon fuels. Investigated an entropy based network architecture for improved communication, conducted basic research into highly efficient small antennas. Investigated the enhancement of electromagnetic signals utilizing surface plasmonic properties. In FY06, complete analysis of ultraviolet-C band muzzle flash intensity and detection range for counter sniper applications. Perform research enabling high bandwidth, high-efficiency small antennas at lower frequencies with reduced co-site interference. Formulate and investigate new high-energy cathode materials for advanced lithium batteries. In FY07, will investigate new radio frequency absorption material for warfighters body-wearable vest. Will explore techniques for more reliable (terahertz band) communication and for improving information encoding in noisy channels. Will investigate polymer and polymer blends with high breakdown voltage characteristics for electrochemical systems. Will investigate the feasibility of using modified Bayesian Belief Networks to express essential knowledge in order to perform selected core data fusion tasks for Level 2 data fusion.	2444	2339	1890
- Peer reviewed proposal efforts- This is a new effort within the ILIR Program beginning in FY 07. Proposal efforts will be selected at the start of each Fiscal Year through competitive applications among the Army laboratories with ILIR funding. It is intended to provide increased quality and responsiveness in exploring new technological concepts in basic research that are highly relevant to Army needs.	0	0	1000

This funding will also enhance recruitment, development, and retention of outstanding scientists and engineers engaged in high quality basic research for the Army.			
Total	17001	15050	14261

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
91C ILIR-MED R&D CMD	4572	3688	3632	3668	3621	3661	3697

A. Mission Description and Budget Item Justification: This project addresses medical and force protection research initiatives at the six U.S. Army Medical Research and Materiel Command laboratories: the U.S. Army Aeromedical Research Laboratory (USAARL), the U.S. Army Institute of Surgical Research (USAISR), the U.S. Army Research Institute of Environmental Medicine (USARIEM), the U.S. Army Medical Research Institute of Chemical Defense (USAMRICD), the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), and the Walter Reed Army Institute of Research (WRAIR). 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 Strategic Planning Guidance, the DoD Basic Research Plan (BRP), the Army Science and Technology Master Plan (ASTMP), and the Army Modernization Plan. Work in this project is performed by the WRAIR, Silver Spring, MD; USAMRICD, Aberdeen Proving Ground, MD; USAMRIID, Fort Detrick, MD; USARIEM, Natick, MA; USAISR, Fort Sam Houston, TX; and USAARL Fort Rucker, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, discovered that phytase (an enzyme found in plants) increased bioavailability of zinc in plant-derived foods, which may be an important strategy to reduce the prevalence of marginal zinc deficiency in Soldiers, which contributes to neurocognitive deficits and decreased resistance to disease. Acquired software for the analysis of gene expression data derived from rodent microarrays and reanalyzed previously acquired data to validate program's methods of analysis. Determined effects of hazardous noise on human vestibular (an oval cavity in the ear) function. Prepared germination-inhibiting antibodies to Bacillus anthracis. In FY06, investigate mineral metabolism and bone biology using an atomic force microscope equipped with a custom built cell; investigate fundamental autonomic neural oscillations and blood pressure control mechanisms in humans; research novel infectious disease and bio/chem threat treatments, diagnostics, and delivery systems; determine if insertional mutagenesis (induction of genetic mutation) into Ebola virus minigenome leader and trailer regions disrupts replication; and adapt a mouse model of hemorrhagic shock for evaluation of the effects of C-reactive protein on inflammatory gene expression, complement activation, and tissue injury in hemorrhage and resuscitation. In FY07, will research novel infectious disease threat treatments, diagnostics, and delivery systems; will research novel medical treatments, diagnostics, and countermeasures to chemical and biological warfare threat agents; will conduct basic research/studies to enhance the health and performance of Soldiers in operational and training environments, and research novel state-of-the-art trauma, burn, critical care, and combat casualty care medical solutions from self-aid through definitive care across the full spectrum of military operations.	4572	3688	3632
Total	4572	3688	3632

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
91D ILIR-CORPS OF ENGR	1251	1200	1317	1327	1337	1273	1286

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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the DoD Basic Research Plan (BRP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Battlespace Environment/Military Engineering/Environmental Quality and Installations - In FY05, developed a theoretical physical model for the effect of temperature and particle size on soil hydraulic properties to correctly simulate the ground state and interpret mobility within the battlespace environment. Conducted research on soil electromagnetic models to be incorporated into state-of-ground models supporting terrain reasoning and awareness. In FY06, investigate radar signal reflectance to remotely map soil moisture and strength for mobility and landing site assessments for aircraft. Investigate innovative acoustic processing methods that will allow soldiers to locate targets in urban areas. In FY07, will investigate environmentally responsive hydrogels for innovative applications in environmental monitoring, engineering, and nanomaterials synthesis. Will study and validate a discrete element model for simulating the mechanical properties of dry soil.	1251	1200	1317
Total	1251	1200	1317

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	164449	173533	137568	141819	143742	143434	144323
305	ATR RESEARCH	1213	1181	1216	1326	1341	1353	1363
31B	INFRARED OPTICS RSCH	2317	2259	2328	2540	2576	2600	2619
52C	MAPPING & REMOTE SENS	2387	2311	2380	2662	2696	2720	2741
53A	BATTLEFIELD ENV & SIG	2797	2709	2790	2917	2992	3018	3042
74A	HUMAN ENGINEERING	2747	2674	2754	2984	3025	3052	3076
74F	PERS PERF & TRAINING	2587	2535	3476	2508	2511	2534	2557
F20	ADV PROPULSION RSCH	2040	1996	2056	2236	2230	2252	2270
F22	RSCH IN VEH MOBILITY	491	475	490	549	557	561	566
H42	MATERIALS & MECHANICS	2039	1983	2043	2215	2245	2264	2283
H43	RESEARCH IN BALLISTICS	5959	6645	6839	6390	6341	6387	6423
H44	ADV SENSORS RESEARCH	3842	3743	3855	4174	4242	4281	4313
H45	AIR MOBILITY	2072	1996	2056	2313	2346	2366	2385
H47	APPLIED PHYSICS RSCH	2648	2603	2680	2879	2928	2956	2980
H48	BATTLESPACE INFO & COMM RSC	5504	5366	6527	6022	6032	6089	6138
H52	EQUIP FOR THE SOLDIER	1057	1030	1061	949	960	969	978
H57	SCI PROB W/ MIL APPLIC	55051	57433	61156	62843	63472	63923	64226
H66	ADV STRUCTURES RSCH	1518	1485	1530	1655	1675	1692	1705
H67	ENVIRONMENTAL RESEARCH	1484	775	798	822	906	915	921
H68	PROC POLLUT ABMT TECH	364	356	367	419	425	428	432
S04	MIL POLLUTANT/HLTH HAZ	616	599	617	698	710	716	721
S13	SCI BS/MED RSH INF DIS	9686	9449	9614	10579	10908	10247	10313
S14	SCI BS/CBT CAS CARE RS	4141	4046	4128	4552	4700	4420	4447
S15	SCI BS/ARMY OP MED RSH	5783	5650	6287	6367	6537	6246	6286
S19	T-MED/SOLDIER STATUS	643	645	664	725	753	717	731
T14	BASIC RESEARCH INITIATIVES - AMC (CA)	31045	37852	0	0	0	0	0
T22	SOIL & ROCK MECH	1970	1901	1957	2188	2217	2236	2252

T23	BASIC RES MIL CONST	1608	1558	1606	1812	1836	1853	1865
T24	SNOW/ICE & FROZEN SOIL	1291	1273	1312	1433	1446	1460	1471
T25	ENVIRONMENTAL RES-COE	4471	4351	4981	5062	5135	5179	5219
T59	PREDICTION OF LAND-ATMOSPHERE INTERACTIONS	1342	0	0	0	0	0	0
T60	BRAIN IMAGING RESEARCH	3736	1233	0	0	0	0	0
T61	Basic Research Initiatives - MRMC (CA)	0	5421	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element fosters fundamental scientific knowledge and contributes to the sustainment of U.S. 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 U.S. 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 & Technology Reliance (Defense Basic Research Advisory Group), the Defense Basic Research Technology Area Review and Assessment (TARA) process 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 Program Element 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. 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 PE is managed by: the U.S. Army Research Laboratory (ARL); the U.S. Army Aviation and Missile Research, Development and Engineering Center (AMRDEC); the U.S. Army Natick Soldier Center (NSC), the Medical Research and Materiel Command (MRMC), the U.S. Army Engineer Research and Development Center (ERDC), and the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI).

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	163443	137898	142898
Current BES/President's Budget (FY 2007)	164449	173533	137568
Total Adjustments	1006	35635	-5330
Congressional Program Reductions		-7765	
Congressional Rescissions		-1750	
Congressional Increases		45150	
Reprogrammings	1006		
SBIR/STTR Transfer			
Adjustments to Budget Years			-5330

Seventeen FY06 Congressional adds totaling $45150 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($3500) Advanced Carbon Nanotechnology Program
($1000) Advanced Ground Vehicle Reliability Research
($2300) Advanced Research and Technology Initiative
($1000) Advanced Portable Power Institute
($1000) Biological Raman and Optical Imaging Program
($1250) Brain Imaging and Deception Detection Research
($5500) Cyber TA
($2100) Desert Research Institute Desert Terrain Analysis for Enhancing Military Operations
($3500) Document Exploitation Technology Upgrade
($1800) Functionally Integrated Reactive Surfaces Technology Program
($1000) Knowledge Integration and Management Center of Excellence
($4500) Neurochemically-Based Mood Disorders
($4100) Optical Technologies Research
($6800) PASIS (Perpetually Assailable and Secure Information Systems)
($1000) Plastic-bone Artificial Bone Graft Development
($3400) Technology Commercialization and Management Network
($1400) Terrain Processes Research to Optimize Battlefield Operations

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
305 ATR RESEARCH	1213	1181	1216	1326	1341	1353	1363

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. It is increasingly desirable to have Army systems that can act independently of the human operator to detect and track 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 will utilize 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 radar (FLIR), and advanced multi-function laser radar (LADAR). 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 2005	FY 2006	FY 2007
- Investigate new algorithms to improve unaided target detection and identification. In FY05, devised detection and tracking algorithms based on FLIR video, incorporated other sensors to complement single sensor ATR algorithms, investigated new methods of feature extraction and classification algorithms, and studied the use of polarization to detect water and man-made objects for robotic autonomous mobility. In FY06, will devise false alarm reduction and multiple hypotheses tracking algorithms for FLIR video, and research and investigate the performance of new algorithm concepts and methods, such as kernel methods, to determine if there can be improvement in performance and reduction of false alarms. In FY07, will investigate 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 capabilities, and investigate more efficient and effective hyperspectral imagery () algorithms for target detection and classification.	1213	1181	1216
Total	1213	1181	1216

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
31B INFRARED OPTICS RSCH	2317	2259	2328	2540	2576	2600	2619

A. Mission Description and Budget Item Justification: This project supports Army research in materials and devices for active and passive infrared (IR) imaging systems. The impact of this research is to generate new technologies to obtain unprecedented awareness of the battlefield and to continue to not only own the night but also dominate it. 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 are needed. Research is focused on material growth, detector and laser design, and processing for large area multicolor IR FPAs and interband cascade lasers. The main efforts are directed towards novel materials for detectors and lasers and to investigate semiconductor energy band-gap engineered structures 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 waveguide structures to enable reconfigurable IR waveguide properties. Customized III-V IR 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 with time and thermal management, particularly as it applies to interband cascade lasers. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Defense Basic Research Plan (DBRP). Work is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- The objective of this project is to support the Army's research in materials and devices for active and passive IR imaging systems to enable increased situational awareness in open and complex terrain; improvements in target detection, identification and discrimination; and enhanced IR countermeasure (IRCM) protection against missile threats. This research has direct application to Army ground vehicles, aviation platforms, weapon systems, and the individual Soldier. In FY05, paved the way for producing state of the art imaging systems by investigating advanced IR materials and devices that will result in enhanced performance, reduced cost and logistics support for IR FPAs. Fabricated and evaluated medium wave IR (MWIR) FPA made of Type II superlattice material for high background applications. Evaluated Long Wave IR (LWIR) FPA made of Mercury Cadmium Telluride (MCT) detectors fabricated on lower cost Silicon (Si) substrates. Designed narrow and broadband large format LWIR FPAs from of lower cost Quantum Well Infrared Photodetectors (QWIP). Designed, modeled and fabricated IR waveguides incorporating photonic crystal structures and MEMs reconfigurability. Fabricated IR cascade lasers for IRCM systems with improved thermal performance for continuous wave operation at higher operating temperatures. In FY06, will investigate active IR materials and devices that will result in higher power output and increased IRCM protection against missiles. Will evaluate LWIR and MWIR FPAs made of Type II superlattice and high efficiency QWIPs. Will fabricate large format LWIR MCT detectors on Si. Will research wavelength beam combined IR lasers for IRCM systems. Will design high operating temperature IR detectors out of MCT and III-V semiconductor material. In FY07, will investigate high power IR lasers for IRCM and chem/bio sensing applications. Research dynamic IR photonic-crystal waveguides for control of Radio Frequency signals.	2317	2259	2328
Total	2317	2259	2328

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
52C MAPPING & REMOTE SENS	2387	2311	2380	2662	2696	2720	2741

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; 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 investigates new methods of exploiting 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 PE 0602784A Project 855, Mapping and Remote Sensing. 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 U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Sensor Phenomenology - In FY05, conducted multi-image manipulation experiments, and contrast and special feature manipulation experiments. In FY06, will research capability of new micro and nano sensors to characterize battlespace environment features. In FY07, will research exploitation of multiple types of sensors to characterize critical battlespace environment features.Active and Passive Fluorescence for Remote Sensing - In FY05, experimented with prototype capabilities for identifying biological hazards in water and tested polymer(s) in soil and water for photon recovery and target selectivity. Experimented with flourophores energy emission to trigger an electronic circuit powering a very small geo-location device that can detect chemical and biological hazards. In FY06, will experiment with flourophore- based detection of chemical and biological hazards under various environmental conditions. In FY07, will experiment with mimicking biological sensory functions to characterize the battlespace environment. Dynamic Situational Awareness - In FY05, investigated and analyzed critical measurement values for selection of Maneuver Course of Action (MCOA) solutions. In FY06, will investigate techniques for designing MCOA decision tools, and evaluate spatial-temporal knowledge-discovery concepts and models. In FY07, will investigate battlespace environment impacts on human decision making to support decision tool development, experimentation and simulations of spatial-temporal knowledge discovery models.	2387	2311	2380
Total	2387	2311	2380

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
53A BATTLEFIELD ENV & SIG	2797	2709	2790	2917	2992	3018	3042

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 have impacts on 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 and the Future Combat Systems (FCS) 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 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 2005	FY 2006	FY 2007
- Research in optical and acoustical propagation in the atmosphere for enhanced Intelligence, Surveillance and Reconnaissance (ISR) capabilities for the Future Force and Future Combat Systems(FCS) to support situational understanding and rapid targeting. In FY05, improved technologies that better quantify optical turbulence and characterize its different effects on performance of imaging sensors in battlefield environments. Performed research in high-fidelity acoustic signature simulation systems for devising synthetic acoustic signatures. In FY06, will investigate the capabilities for acoustic array tomography to be used for retrieving meteorological profiles. Will improve the optical technologies and processes used to enhance aerosol characterization. In FY07, will enhance urban acoustic propagation methodologies to improve modeling techniques and model performance.	1726	1653	1724
- 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 FY05, investigated new methods to determine the accuracy of small scale/limited domain models. Improved Army tactical urban meteorology modeling to include simplified physics and parametric micro-scale models that can account for mean transport and dispersion around individual structures. In FY06, will formulate new methods for use of improved near real-time three-dimensional environmental models to provide critical input to urban transport and dispersion models. In FY07, will investigate new methods for parameterization of mean heat and moisture fluxes that can be incorporated into an urban micro-scale meteorological model for improved transport/dispersion and signature modeling.	1071	1056	1066
Total	2797	2709	2790

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
74A HUMAN ENGINEERING	2747	2674	2754	2984	3025	3052	3076

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 and situational complexity and ambiguity, which 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 with which to characterize soldier-system performance phenomena, and provide a sharable conceptual and operational framework for militarily purposeful research on cognitive and perceptual processes. 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 2005	FY 2006	FY 2007
- Research to improve soldier auditory performance. In FY05, examined the effects of nonlinear hearing protection on soldier auditory performance in the presence of impulse noise. Investigated and transitioned optimal bone conduction microphone and vibrator placement to enable Future Force Warrior communication. In FY06, will formulate an algorithm for controlling perceived distance in immersive acoustic environments. Will evaluate operational constraints of a remotely controlled binaural microphone for the Future Force Warrior (FFW). In FY07, will formulate an algorithm for predicting localization error due to headgear. Will investigate synergy between bone conduction and tactile communication for military applications for sniper detection.	1591	1474	1548
- Research to assess, predict, and improve soldier performance. In FY05, investigated task performance and readiness as predictors of Soldier multimodal input and processing capacity in the field. In FY06, will expand capabilities for the prediction and maturation of cognitive readiness through assessment of neuro-cognitive functioning and time constraints under conditions of uncertainty. In FY07, will explore integrated use of real-time neuro-physiological and other objective measures and models to manage soldier situational overload in dynamic battlefield environments.	1156	1200	1206
Total	2747	2674	2754

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
74F PERS PERF & TRAINING	2587	2535	3476	2508	2511	2534	2557

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, and human performance. 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 and improved skill retention; 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; 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Basic Research Plan (DBRP). This project is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, identified key individual differences, team characteristics, and learning processes that predicted individual and team knowledge and skills needed for adaptive performance; and assessed spatial and temporal memory in electronic environments; developed test of mental flexibility. In FY06, will develop models of basic human emotions using genetic algorithms; validate tests for measuring mental flexibility; identify optimizing training principles to achieve efficiency, durability, and flexibility in complex task environments; determine the influence of seductive detail on technology-delivered instruction; determine the effects of discrete positive and negative emotions on citizenship and deviant work behaviors; identify moderators of emotion-behavior linkages; and provide insight into how leader behaviors affect emotion-behavior linkages. In FY07, will examine the human dimensions for optimizing training and performance for complex tasks; investigate methods for accelerating leader development; identify and model the development and relationships among the psychological, demographic and motivational factors that influence recruit enlistment, Soldier retention, productivity, and citizenship.	2587	2535	2476
In FY07, as part of the Army's new initiative in Network Science, will begin 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). This work will be conducted in collaboration with researchers at the Army's University Affiliated Research Centers, the Institute for Creative Technology at the University of Southern California, and the Institute for Collaborative Biotechnology at the University of California - Santa Barbara.	0	0	1000
Total	2587	2535	3476

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
F20	ADV PROPULSION RSCH	2040	1996	2056	2236	2230	2252	2270

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 conversion/sources, 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 2005	FY 2006	FY 2007
In FY05, investigated ceramic materials processing and life prediction methods for high temperature engines; assessed novel propulsion concepts for UAVs; investigated the influence of gear tooth surface treatments on gear operation after the loss-of-lubrication; evaluated oil-free foil air bearing misalignment tolerance limits and effects of ambient pressure on bearing performance. In FY06, evaluate diagnostics techniques for hybrid bearings (ceramic rolling elements with steel races); complete fatigue life analysis of a first stage ceramic matrix composite turbine; investigate thermal and environmental barrier coating systems with 3000F capability; transition unsteady compressor flow analysis code to industry. In FY07, will analyze autonomous diagnostic and repair concepts for gas turbine engine components; complete baseline experimentation of gear tooth bending strength at elevated temperatures experienced in helicopter transmissions.	2040	1996	2056
Total	2040	1996	2056

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H42 MATERIALS & MECHANICS	2039	1983	2043	2215	2245	2264	2283

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, chem./bio, 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 project 0602105A/AH84. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the DoD Basic Research Plan (BRP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Devise new materials and design capabilities, based upon fundamental concepts derived at the microscopic and nano-structural levels, for the Future Force. In FY05, showed specific multifunctional performance gains in power generating structures and assessed survivability gains that can be realized using novel photonic materials; examined nano-particle relationships between particle size and morphology for nano-systems synthesized in FY04; performed shock/re-shock/lateral release experiments on relevant armor ceramics to incorporate damaged material parameters into continuum codes and conducted benchmark analyses using new damage models; incorporated second generation dynamic fracture model into computational continuum mechanics code to enable development of improved anti-armor concepts. In FY06, will incorporate photonic materials and communications components into model survivable structures; use directed assembly techniques to control the nano-particle size and distribution of a functional nano-particles in a polymer matrix; fully transition ceramic damage model to armor design codes; and perform ballistic experiments of a fracture resistant penetrator prototype designed using new fracture models. In FY07, will enhance the synergistic effects of structure and electromagnetic interactions within model survivable structures; characterize transport behavior and relevant properties of nanoparticles.	2039	1983	2043
Total	2039	1983	2043

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H43 RESEARCH IN BALLISTICS	5959	6645	6839	6390	6341	6387	6423

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 lethal projectiles and missiles, and advanced armors for increased survivability of Army combat systems for the Future Force. This effort supports the OSD Advanced Energetics Initiative to mature the fundamental technologies required to transition the next generation of energetic materials into field use. 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 2005	FY 2006	FY 2007
- In support of the National Advanced Energetics Initiative and Army-specific basic research, expand and validate physics-based models and experimental techniques to devise and characterize chemical formulations that will enable design of novel insensitive high-energy propellants and explosives with tailored energy release for revolutionary Future Force lethality and survivability. In FY05, employed fundamental and advanced propulsion/detonation models and experimental techniques to understand managed energy release of insensitive high-energy propellants and explosives, including multiple-mode applications for energetic materials. In FY06, will devise condensed phase novel energetic materials models to couple and describe energy releasing processes within atomistic/molecular, micro, meso, and macro-scales for propellants and explosives; characterize nano-scale energetics in various stages of decomposition; devise functionally-graded nano-energetics; and model the effects of plasma ignition on multiple propellant grains. In FY07, will derive model-based relationships between energy localization from friction, fracturing, shock, jetting, void collapse, plastic deformation, viscous heating, adiabatic gas compression that control explosive and propellant formulation sensitivity supporting Insensitive Munitions.	3665	3766	4086
- 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 FY05, advanced understanding of damage evolution in ceramic materials and model penetration through advanced ceramic armor, captured the observed material response for each phase of penetration; incorporated a model for adiabatic shear into simulations of armor/anti-armor interactions and compared with ballistic experiments; and proved capability to model fully coupled steady-roll controlled pitch-up maneuver of precision munitions and validate full high performance computational capability of coupled models employing multiple processors. In FY06, will prove ability to accurately depict the degradation of ceramic materials in controlled high-rate experiments; devise generalized failure framework for combined fracture and shear localization of metallic materials; show bank to turn maneuver during vehicle thrust using coupled computational fluid mechanics, rigid body dynamics and guidance, navigation and control. In FY07, will prove ability to accurately depict the degradation of ceramic materials in the terminal effects environment; apply the generalized fracture framework to simulate failure penetrators.	2294	1943	2153
- Extramural research in non-lethal (NL) control methods to exploit potentially innovative approaches that offer unique battlefield and homeland defense capabilities. In FY06, will conduct research in NL Directed Energy Stimuli/Exposure, RF, Laser, NL Directed Energy Weapons, material, counter-capability missions and various NL flight body & new NL munition payloads for long range remote engagement; and other NL reactants. In FY07, conduct research analysis of precision targeting, and blunt impact issues, new	0	936	600

technologies and payloads, development of compact mm-wave and high powered microwave denial systems.			
Total	5959	6645	6839

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H44 ADV SENSORS RESEARCH	3842	3743	3855	4174	4242	4281	4313

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 RF sensors. The technical approach focus is on exploitation of large scale electromagnetic 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, environmental detection, remote sensing and intelligent system distributive interactive simulations, and battlefield acoustic signal processing algorithms. Research performed under this project supports survivable sensor systems, displays, and environmental monitoring, both point and remote. Monolithic and hybrid optoelectronic structures in gallium arsenide and lithium niobate are investigated as integrated processors for novel signal and radar processing and control. Diffractive and micro-optic elements are investigated to enhance performance of imagers and optical processors to include the transmission of laser energy through the atmosphere for directed energy applications and high-data-rate optical communications; and the investigation and development of novel adaptive, active, and intelligent optical systems and techniques. Payoffs include low cost diverse displays, improved radar signal processing techniques that will allow existing systems to improve spatial resolution, improved ultra wideband radar technology, improved signal processing techniques for acoustic/seismic sensing systems, improved cryptography techniques, biological and chemical environmental sensing, and improved sensor protection. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the DoD Basic Research Plan (BRP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Research addresses the maturation of technologies for adaptive, active, and intelligent optical systems for high-data-rate military communications and directed energy applications. In FY05, investigated hand-held laser communication applications; and performed research into adaptive beam control algorithms for target-in-the-loop Army self-defense laser weapon applications. In FY06 will investigate adaptive compression techniques and perform advanced analysis of target-in-the-loop scenarios with both cooperative and non-cooperative targets. In FY07, will perform research into the use of minimal configuration agile adaptive apertures for high-bandwidth optical communications and directed energy applications.	1537	1498	1544
- Research focused on improving sensor capabilities to create more survivable/secure systems and displays, and improved environmental monitoring. In FY05, developed improvements to ultra wideband (UWB) synthetic aperture radar (SAR) image formers to mitigate effects of uncompensated motion and high levels of radio frequency interference. Investigated Electron Beam Lithography (EBL) technology for generation of advanced Surface Enhanced Raman Scattering (SERS) substrates; explored efficient signal processing algorithms for data fusion and networks of sensors of various modalities; made recommendations for applications of quantum information processing. In FY06, will utilize more accurate soil descriptions to determine the role of spatial and temporal variability in difficult target deployments such as underground plastic mines; investigate networking options of Quantum Cryptographic (QC) test beds and new areas in quantum information processing, and investigate and report on sensitivity of magnetic field sensors. Will optimize fabrication parameters of EBL substrates for maximum SERS efficacy, and benchmark SERS signatures for reproducibility and enhancements factors. In FY07, will use modeling and imaging tools to evaluate UWB image formation options for building penetration, mapping,	2305	2245	2311

personnel detection, and arms cache location to include multi-static, airborne and ground-based sensor array configurations. Will collaborate with RDEC partners in performing QC test bed and networking studies, and assess transitionability of QC systems to future combat systems. Will procure and adapt commercially available Raman instrumentation for use in coordination with SERS substrate technology Research decentralized signal processing for ad-hoc sensor networks and report results.			
Total	3842	3743	3855

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H45 AIR MOBILITY	2072	1996	2056	2313	2346	2366	2385

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 DoD Basic Research Plan (BRP). Work in this PE is performed by the U.S. Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, Alabama.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, conducted rotor test to study the off-axis stability to increase helicopter handling quality. Conducted test to measure the Reynolds stress of the synthetic jet for blunt body drag reduction. In FY06, investigate rotor-induced power at high advance ratio flight and explore new acoustic prediction code for flight maneuvering. In FY07, will research unsteady aerodynamics for flapping wing for micro UAV. Will conduct water channel test to validate the unsteady aerodynamics for flapping wing theory.	2072	1996	2056
Total	2072	1996	2056

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H47 APPLIED PHYSICS RSCH	2648	2603	2680	2879	2928	2956	2980

A. Mission Description and Budget Item Justification: This project investigates electronic materials and structures and energetic batteries and fuel cells to enable higher performance and more efficient electronic systems. This includes 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; the manipulation of cold atoms in an atom chip environment for application to very sensitive sensors and ultra-stable clocks. Impact of these investigations will be 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Basic Research Plan (DBRP). Work is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- This research is focused on 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 sensitive gravitational, electric, and magnetic field sensors and ultra stable clocks. In FY05, synthesized and evaluated high energy phosphate cathode materials for Lithium (Li)-ion cells; evaluated catalysts for fuel processing for fuel cells; examined gallium nitride (GaN) structures and ohmic contacts for transition to efficient device designs, and reduced the surface roughness in Silicon Carbide (SiC) Metal-Oxide Semiconductor Field Effect Transistor (MOSFET) device structures to improve performance; and researched cold atom chip and atom waveguide techniques experimentally and through simulations. In FY06, will show that a field plant in a GaN High Electron Mobility Transistor (HEMT) can be fabricated using ion implantation, and SiC Junction Barrier Schottky (JBS) diodes can be improved using selective area epitaxy; and validate propagation of cold atom condensates in atomic waveguides as a first step to atom chip sensors and clocks. Will Explore oxidation stable electrolytes for Li ion batteries and investigate a catalyst for sulfur removal from diesel fuel. In FY07, will evaluate the improved SiC and GaN devices in test circuits; and advance and validate initial versions of atom chip beam splitter designs. Will explore highly reversible electrode materials for fast charge of Li ion batteries, design efficient air electrodes for lithium/oxygen cells, and explore sulfur tolerant catalyst for logistic fuel reformation.	2648	2603	2680
Total	2648	2603	2680

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H48 BATTLESPACE INFO & COMM RSC	5504	5366	6527	6022	6032	6089	6138

A. Mission Description and Budget Item Justification: This project supports basic research to enable intelligent and survivable command, 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, and the related signal processing for wireless battlefield communications, along with machine translation and intelligent systems for C4I. Major barriers to achieving the goals are overcoming 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, diverse networks with dynamic topologies, high level multi-path interference and fading, jamming and multi-access interference, 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 complex or urban terrain. 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 2005	FY 2006	FY 2007
- Perform research to provide communications capability for a fully mobile, fully-communicating, situation-aware force operating in a highly dynamic, wireless, mobile networking environment populated by hundreds to thousands of networked nodes. In FY05, enhanced signal processing for smart radios, coupled with network protocols providing intelligent multiple radio coexistence and radio frequency spectrum reuse, enabling rapid deployment and networked information dominance in future threat scenarios. In FY06, will conduct laboratory experimentation to mature technologies for adaptive communications in a mobile, wireless, tactical network. In FY07, will perform experimental analysis to incorporate technologies to sensor/radio platforms.	1554	1514	1565
- Design and implement a laboratory scale common information-processing infrastructure that aids in the transformation of data to knowledge to support decision-making under uncertainty. In FY05, devised analytical techniques to interface soldiers and robotic-based sensor elements in a seamless manner within a net-centric service oriented architecture. In FY06, will develop algorithms to detect tactical behaviors through mining for patterns/events over time/space and begin 3D scene reconstruction using geometry/texture from a moving robotic platform. In FY07, will perform laboratory experiments, evaluate and enhance agent generated patterns/events algorithms to refine and optimize algorithms for 3D scene reconstruction from a robotic platform.	1381	1336	1376
- 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 FY05, constructed and populated tactical environmental assurance lab for mobile ad hoc networks (MANET); and evaluated and implemented selected best of breed security services and embedded authentication services for unattended static and mobile sensor networks deployed on the battlefield. In FY06, will perform experimentation and research for intrusion detection in MANETs that addresses resource consumption issues. In FY07, will investigate high mobility, channel impairment issues which are MANET-unique.	1603	1554	1581

- 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 FY05, extended language translation capabilities from printed text to voice capability and conducted experimentation with translation of low density languages. In FY06, will perform laboratory demo of low-density automated language translation and refine evaluation metrics for machine translation. In FY07, will refine and optimize algorithms for automated language identification of speech and document machine translation.	966	962	1005
- Beginning in FY07, will study the behavior of Mobile Ad Hoc Networks (MANETs) as part of the Army's new initiative on Network Science. Emphasis will be on highly efficient communications networks in biological systems in collaboration with the researchers at the Army's University Affiliated Research Center, the Institute for Collaborative Biology, at the University of California - Santa Barbara.	0	0	1000
Total	5504	5366	6527

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H52**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H52	EQUIP FOR THE SOLDIER	1057	1030	1061	949	960	969	978

A. Mission Description and Budget Item Justification: This project supports basic research to achieve technologies for the Soldier of the future and support Army Transformation. The research is focused on core technology areas that include mathematical modeling, physical and cognitive performance, polymer science/textile technology, nanotechnology, biotechnology and combat ration research. Effort is targeted on enhancing the mission performance, survivability, and sustainability of the Soldier by advancing the state-of-the-art in the sciences underlying human performance, clothing and protective equipment to defend against battlefield threats and hazards such as ballistics, chemical agents, lasers, environmental extremes, and ration shortfalls. The cited work is consistent with the 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 US Army Natick Soldier Center, Natick, MA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, determined independent effects of load distribution and principal moments of inertia on the biomechanics of gait and performance. Completed data analysis of nutrient effects on cognitive performance during severe cold stress. In FY06, will examine effect of the interaction between center of mass location and principal moments of inertia on human biomechanics; improve understanding of thermoregulatory and other factors affecting warfighter appetite; and examine energy conversion and thermal behavior of selected nanomaterials of potential value in Soldier sustainment. In FY07, will perform basic research on nanocomposite fibers for advanced textiles; and will examine effects of warfighter attitude and perceptions on behavior and performance.	1057	1030	1061
Total	1057	1030	1061

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H57	SCI PROB W/ MIL APPLIC	55051	57433	61156	62843	63472	63923	64226

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, 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, and supports research at nearly 200 institutions in 46 states. 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 extramurally by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Basic research in environmental and life sciences for Chemical Biological Detection (CBD), mine detection and revolutionary advances in sensors for soldier survivability. In FY05, seek increased understanding of mechanisms of pathogenicity to combat terrorism and to aid in CB detection through intervention of organisms that cause disease; used molecular genetics to identify the molecular signals that affect soldier performance and endurance. In FY06, will study the structure of biofilms and the mechanisms of cell-to-cell communication to detect and prevent potential biological threats to water supplies; formulate atmospheric models of boundary layer to improve nighttime forecasts; and complete physics-based modeling for microscale particle simulation to improve terrain mobility. In FY07 will conduct research into neuro-cognitively adaptive information displays to automatically match soldier perceptual, cognitive and motor abilities; provide airborne Doppler lidar with 4-D wind measurement capabilities; provide new simulations for soil moisture estimation for Army ground operations.	5550	6027	6624
- Basic research in chemical sciences for advanced power generation, propellants, and protective materials. In FY05, expanded research in computational electrochemistry for electrochemical power sources; explored the physics of operating molecular machines for CBD, signature management and laser protection; and devised polymers, fibers and novel architectures for materials with superior protection from all environments. In FY06, will conduct research in high efficiency, low pressure blowers to support fuel-cell based power sources for the soldier; devise new models of the solid state properties of propellants and explosives that do not require large blocks of computer time. In FY07, will transfer new gas/surface interaction theory into Army models for gun erosion; devise user friendly chemical reaction and kinetics models with computational fluid dynamics for chemical weapons incinerators.	5800	6304	6597
- Basic research in physics for precision guidance, superior optics and signature management properties and secure communications In FY05, devised a theory for relativistic quantum information for use in assessing advanced Global Positioning System (GPS) and quantum	7965	8735	8771

computing protocols; determined electron dynamics in novel semiconductor heterostructures and nanostructures to guide the development of technology for efficient high power, low threshold lasers. In FY06, will devise negative index materials and photonic materials in the visible range for applications in imaging and sensing; prove a quantum algorithm that simulates hydrodynamics and aerodynamics much more efficiently than existing classical algorithms for improved design of munitions and vehicles; and devise instrumentation for study of soft materials systems for soldier protection. In FY07, will provide accurate computational tools for design of new drugs through molecular physics, thereby subsuming biochemistry and quantum biology for a firmer basis for nanoscience.			
- Basic research in communications and electronics for unmatched networked Command Control Communications Computing Intelligence Surveillance and Reconnaissance (C4ISR) capabilities. In FY05, explored advanced countermine techniques to enable faster and more accurate detection of mines by integrating seismo-acoustic and chemical sensors with electro-optics and advanced x-ray imaging. In FY06 will determine effects of 1-D nanostructures on the magnetic properties of ferromagnetic semiconductors; and create technologies to design and implement highly mobile ad-hoc wireless tactical and sensor communications networks. In FY07, will devise an integrated nano-scale sensor platform at THz frequencies for biological detection; investigate methods for secure, trustworthy information delivery in mobile tactical systems.	11630	12844	13340
- Basic research in mechanical and material sciences for survivable armor and more lethal anti-armor, improved mobility, and flexible displays for soldier systems. In FY05, devised wafer-scale fabrication techniques to manufacture microturbines at reduced costs; fabricated micro-rocket engines from previous advances in microturbine research; conducted research in transparent conductive and emissive materials. In FY06, will devise planetary gear analysis tools for improved rotorcraft transmissions; formulate practical micro active flow control schemes for transonic and supersonic projectiles to improve accuracy; and explore new concepts of phase inter-compatibility for maturation of passively "smart" materials. In FY07, will create adaptive multiple scale computational models to predict material failure; synthesize carbon nanotube-based damping polymers for vibration reduction in rotor blades; investigate optical switching behavior in novel polymer architectures and excited-state systems for laser protective films.	14790	13274	12933
- Basic research in mathematical and computer sciences as the backbone for complex, multi-system analysis, modeling and simulation, and information systems. In FY05, devised low-order mathematical models of hysteresis nonlinearity to improve the performance and real-time control of smart materials leading toward micro electro-mechanical (MEM) actuators for rotor-blade surface flow control; and integrated research in mathematics, electrical engineering and signal processing to create digital communications based on principles of nonlinear dynamics and chaos for uninterrupted digital communications. In FY06, will devise a computer program containing algorithms for real-time implementation of non-linear filter target tracker. In FY07, will devise software to implement real time algorithms for identifying targets in noisy battlefield scenes.	9316	10249	10891
- 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, perform research aimed at developing theoretical models that can explain and predict network behavior.	0	0	2000
Total	55051	57433	61156

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H66	ADV STRUCTURES RSCH	1518	1485	1530	1655	1675	1692	1705

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 an 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 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 2005	FY 2006	FY 2007
In FY05, characterized performance of advanced active twist rotor blade; investigated rotorcraft Computational Fluid Dynamic (CFD) modeling techniques to improve multi-body rotor aeroelastic modeling and simulation; investigated structural analysis methods to predict durability, damage tolerance, and failure of composite structures with embedded sensors/actuators. In FY06, will perform modeling and simulation studies of active control concepts for heavy lift rotorcraft; conduct subcomponent experiments to validate durability and damage tolerance predictions for composite structures with embedded sensors/actuators. In FY07, will conduct wind-tunnel experiments of innovative rotor configurations applicable for heavy lift rotorcraft to characterize structural and aeromechanical performance; and explore advanced concepts for lightweight, highly tailored and multi-functional composite structures using embedded sensors/actuators.	1518	1485	1530
Total	1518	1485	1530

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
S13 SCI BS/MED RSH INF DIS	9686	9449	9614	10579	10908	10247	10313

A. Mission Description and Budget Item Justification: This project supports focused research that provides for healthy, medically protected Soldiers for the Future Force. Research efforts focus on investigation of medical countermeasures for naturally occurring diseases that are militarily significant due to their historically severe impact on military operations. Establishment of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations. The Army is the lead service for infectious disease research, and work in this project is managed by the U.S. Army Medical Research and Materiel Command. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization 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, MD, and its overseas laboratories; U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, MD; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, enhanced and integrated techniques to exploit genomic information for vaccine and drug discovery efforts. Screened several thousand drugs using a malaria parasite target-directed functional assay for antimalarial activity coupled with computer based rational drug design technologies to provide early safety and stability assessment. Sequenced in partnership with consortium partners the entire genome of P. vivax and completed characterization of P. falciparum proteome. In FY06, continue to screen drug inventory and drug libraries for new classes of drugs against malaria; design new drug and vaccine candidates against malaria for optimization and animal testing. In FY07, will assess new genomic/proteomic (study of protein expression and function) technologies to identify new approaches to prevent malaria including better targets to be used for vaccine and drug discovery and evaluate alternative drug delivery systems; and refine new drug activity and evaluate malaria targets for inclusion in vaccine program.	4289	3080	4342
In FY05, refined field site assessment for diarrheal vaccine testing suitability, including showing that causal agents differ greatly between countries in the Middle East. Studied genetic diversity of diarrhea-causing strains including showing that most Campylobacter strains differed in their gene expression profile, but were still equally infectious. In FY06, study biology of genes of interest and incorporate this information into diarrheal disease vaccine program. In FY07, will perform studies to understand the mechanisms of pathogenesis (pathologic mechanisms occurring in the development of disease) and host/pathogen relationship of diarrheal organisms.	669	686	778
In FY05, determined dengue virus incidence rates and identified possible field sites for testing dengue vaccines in Iquitos, Peru, and Maracay, Venezuela. Generated a Lassa virus infection model in mice providing a valuable tool for characterizing the cellular immune response to the virus, and identified several antiviral reagents for potential to treat Lassa fever. In FY06, identify viral and host cellular factors that determine the outcome of dengue virus infection and study the immunological mechanisms of protection in dengue. In FY07, will study host-virus interactions between different dengue viruses that may affect vaccine strategies.	1601	1501	1266
In FY05, evaluated effectiveness of integrated dengue vector preventive medicine control system in Central and South America and Thailand that included finding a superior trap for capturing mosquitoes. Assessed approaches to sand fly control. Found current bednet ineffective in protecting against sand flies. In FY06, enhance Web-based insect vector identification resources and expand range of insect-borne diseases detected by current and new test systems. In FY07, will move insect-based disease tests to the concept exploration phase.	2036	3098	2440

In FY05, identified approaches to supplement infectious disease diagnostics such as point of care diagnostics. In FY06, evaluate a multiplexed real-time polymerase chain reaction (PCR, a technique to exponentially expand specific portions of DNA) for the detection and identification of rickettsial and other diseases of military importance. In FY07, will assess reagents for potential use in diagnostics systems.	1091	1084	788
Total	9686	9449	9614

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
S14	SCI BS/CBT CAS CARE RS	4141	4046	4128	4552	4700	4420	4447

A. Mission Description and Budget Item Justification: This project supports 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 nonbattle injuries, and provide military medical capabilities for far-forward medical/surgical care of battle and nonbattle injuries. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization 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, MD, and the U.S. Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, evaluated brain cooling to preserve brain tissue and function after penetrating brain injury (PBI); evaluated molecular mechanisms in response to a PBI; conducted early preclinical screening studies to select candidate compounds that may block effects of severe blood loss; defined the impact of stabilizing body potassium concentrations on casualty survival; identified markers of resuscitation failure due to hemorrhage; and attained regulatory approval for and completed studies in accelerating soft-tissue wound healing. Continued basic research collaboration efforts with the National Heart, Lung, and Blood Institute (NHLBI). In FY06, evaluate molecular mechanisms in response to PBI following neuroprotective drug treatment; identify and characterize agents for accelerating soft-tissue wound healing; investigate results of treatment to reduce hemorrhage-induced tissue damage; and continue basic research collaboration efforts with NHLBI. In FY07, will begin to define biomarkers in the PBI model after drug treatment; determine most effective agent for accelerating soft-tissue wound healing; and will continue basic research collaboration efforts with NHLBI.	4141	4046	4128
Total	4141	4046	4128

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
S15	SCI BS/ARMY OP MED RSH	5783	5650	6287	6367	6537	6246	6286

A. Mission Description and Budget Item Justification: This project supports research for healthy, medically protected soldiers for the Future Force, 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, including development of 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization 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, MD; U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; and the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, applied proteomic and genomic evaluations to characterize laser injury mechanism and treatment responses. In FY06, identify mechanism of laser-induced retinal injuries that result in secondary effects, such as retinal detachment. In FY07, will extend findings of retinal injury mechanisms to animal models.	1933	1494	1936
In FY05, conducted studies on sleep genomics in collaboration with extramural genomics researchers. In FY06, explore genomic basis of individual differences in resilience during sleep deprivation. In FY07, will mature a model of key determinants of individual fatigue resistance.	1980	2680	1984
In FY05, evaluated projected Future Force Warrior (FFW) factors that increase cold strain and adversely impact performance during cold-weather operations. In FY06, evaluate countermeasures to sustain performance in cold weather. In FY07, will mature models and software applications for predicting cold strain and cold-weather performance during wet/water-borne conditions in fatigued Soldiers.	1870	1476	1867
In FY07, will begin development of computational systems to model biological networks, such as genomic, proteomic or neuronal networks, in support of the Army's new initiative in Network Science. This work will be conducted in collaboration with researchers at the Institute for Collaborative Biotechnology, an Army University Affiliated Research Center.	0	0	500
Total	5783	5650	6287

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T22 SOIL & ROCK MECH	1970	1901	1957	2188	2217	2236	2252

A. Mission Description and Budget Item Justification: The objective of this basic research project is to create fundamental knowledge of 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 revolutionize the understanding of sensor data within a heterogeneous geological system. This encompasses geologic and structural material behavior, structural systems, and the interaction with dynamic and static loadings. Research needs include: 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 that supports the civil engineering technologies for force projection, mobility, maneuver support, and survivability of the Future Force in PE 0602784A Project T40, Mobility/Weapons Effects Technology. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the DoD Basic Research Plan (BRP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Military Engineering Basic Research - In FY05, investigated the microstructure of a soil system using micro-electrical mechanical sensors. Investigated signal processing techniques that exploit electromagnetic profile inversion to improve anomaly (mine) detection. In FY06, will identify and characterize the magnetic properties of soils that can mask the detection of mines and unexploded ordnance and will produce techniques for improving the bond between concrete and steel. In FY07, will determine the feasibility of biological stabilization of soils for rapid construction of military surfaces; will produce techniques for optimizing hardening reactions in organic cements allowing them to become the basis for high-strength, lightweight composites; and wil produce concept for low-velocity probe that could provide capability to remotely determine soil properties.	1970	1901	1957
Total	1970	1901	1957

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T23 BASIC RES MIL CONST	1608	1558	1606	1812	1836	1853	1865

A. Mission Description and Budget Item Justification: The objective of this basic research project is to support facilities research initiatives: 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 capability for a range of facilities that optimize facility mission performance, enhance facility security, reduce design and construction errors and omissions, reduce resource requirements, and reduce the environmental burdens over the facility's life. This project provides leap-ahead technologies to solve military-unique problems in the planning, programming, design, construction, and sustainment of deployed facilities and energy and utility infrastructure. This project supports exploratory development efforts in PE 0602784A 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 DoD Basic Research Plan (BRP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Facilities Research - In FY05, formulated optimization algorithms suitable for rapid and flexible design of the continuum of facilities needed by the Future Force. Determined the conceptual feasibility of using electrokinetic techniques to generate anion and cation species that form biocide films that are lethal to airborne pathogens. Used an organic dye-based optical system that produces light with wavelengths that are bacteria-specific for the detection of bacterial simulants for biological warfare agents. In FY06, will investigate the efficiency of mechanisms in a semi-conducting optical system to detect and quantify simulants for spores, such as anthrax. Will complete experimental measurements of anomalous enhanced thermal conductivity using carbon nanotube (CNT) nanoparticles. In FY07, will develop physics based constitutive equations for heat transfer of fluids containing CNT nanoparticles. Will mature molecular level design tool for CNT reinforced composite materials.	1608	1558	1606
Total	1608	1558	1606

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T24	SNOW/ICE & FROZEN SOIL	1291	1273	1312	1433	1446	1460	1471

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 in response to changing terrain state. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the DoD Basic Research Plan (BRP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Terrain State and Signature Physics - In FY05, established effects of buildings and barriers on acoustic-seismic propagation in urban settings and defined the turbulence and topographic roughness interaction for acoustic signals. Established an understanding of pavement mechanical properties and pavement degradation processes as a function of soil, pavement type, and moisture-temperature variations. Investigated methods to remotely extract or infer soil, moisture, temperature at depth, and vegetation attributes. In FY06, will formulate a new invertible two-dimensional theory of low-frequency acoustic signal propagation that includes the relevant effects of reverberation, diffraction, and scattering to understand acoustic signature modulation between target and sensors and provide a potential means for non line-of-sight source detection. In FY07, will investigate characteristic length scales (one to one thousand meters) of terrain response to atmosphere forcing, and relate to scale effects on electromagnetic and acoustic propagation.	1291	1273	1312
Total	1291	1273	1312

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T25 ENVIRONMENTAL RES-COE	4471	4351	4981	5062	5135	5179	5219

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 foster technology progress and innovation directed toward: 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 study ecosystem genomics and proteomics in support of the Army's new Network Science initiative. The project supports applied research under PE 0602720A, Projects F25, 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 U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Environmental and Ecological Fate of Explosives, Energetics, and Other Contaminants - In FY05, correlated molecular spectral characteristics with computational chemistry to determine the affinity of contaminants to produce fast forming less toxic chemical byproducts, and correlated biosensor response to explosive additions as a function of soil condition. In FY06, will determine the potential mechanisms of toxicity and sub-lethal effects of individual and interactive mixtures of explosives. Will use bioinformatics (computational biology) as the basis for constructing Deoxyribonucleic Acid (DNA) probes and to characterize DNA isolated from soil. In FY07, will continue to establish a basic understanding of physical, chemical, and biological phenomena specific to contaminant toxicity assessment and environmental risk assessment. As part of the Network Science initiative, will initiate 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; this research will be done in collaboration with researchers at the Army's University Affiliated Research Center, the Institute for Collaborative Biology at the University of California - Santa Barbara.	1480	1440	1950
Remediation of Explosives, Energetics, and UXO - In FY05, described propellant attenuation on ranges via the management of natural soil cycles. Pursued in situ explosive biodegradation mechanisms and direct analysis methods to identify explosives degradation mechanisms of contaminated soils. Began characterization of explosive degrading microbial communities using molecular methods. In FY06, will use thermal desorption with ion trap mass spectrometry to relate the binding/transport properties of explosives to soil characteristics (geochemistry and soil mineralogy), in and on soils. Will establish the relationship of explosives-energetics affinity of being bio/chemically transformed into other toxic/non-toxic chemicals using kinetic models. Will refine UXO signature prediction capabilities with new models that enhance subsurface physical property characterization based on the overall geology of a site and related distributions and amplitudes of naturally occurring geophysical anomalies. Will continue characterization of explosive degrading microbial communities using molecular methods. In FY07, will continue to establish a basic understanding of physical, chemical, and	1611	1568	1628

biological phenomena specific to contaminant mineralization.			
Training Land Natural Resources - In FY05, described physical, chemical, and biological phenomena impacting ecosystem maintenance, mitigation, and rehabilitation for Army lands. Evaluated changes in endangered bats' hearing sensitivity due to shock wave pressure associated with Army test and training ranges. In FY06, will determine viable population levels of threatened and endangered species, as affected by the genetic diversity within populations, and quantify the amount of genetic exchange between populations due to habitat fragmentation. In FY07, will continue to establish a basic understanding of physical, chemical, and biological phenomena specific to ecosystem maintenance, mitigation, and rehabilitation.	1380	1343	1403
Total	4471	4351	4981

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601103A - University Research Sciences (H)**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		82959	76984	68545	66507	67755	68974	70230
D55	University Research Initiative	71942	66240	68545	66507	67755	68974	70230
D58	URI ACTIVITIES (CA)	8144	6900	0	0	0	0	0
D62	BIOINFORMATICS RESEARCH (CA)	1916	0	0	0	0	0	0
D63	INST OF BIOENGINEERING AND NANOSCIENCE IN ADV MED	957	986	0	0	0	0	0
D66	MEDICAL UNIVERSITY RESEARCH INITIATIVES (CA)	0	2858	0	0	0	0	0

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 U.S. land combat technology superiority. Army MURI program efforts involve teams of researchers investigating high-priority; transformational topics that intersect more than one traditional technical discipline (e.g. Intelligent Luminescence for Communication, Display, and Identification). For many complex problems, this multidisciplinary approach serves to accelerate research progress and expedite transition of results to application. The DURIP provides funds to acquire major research equipment to augment current, or devise new, research capabilities in support of Army transformational research. The PECASE program funds single-investigator research efforts performed by outstanding academic scientists and engineers early in their independent research careers. Project D58 includes funding for specific Congressional Interest URIs. 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 on this project is performed extramurally by the Army Research Laboratory (ARL).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601103A - University Research Sciences (H)**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	83959	67201	67510
Current BES/President's Budget (FY 2007)	82959	76984	68545
Total Adjustments	-1000	9783	1035
Congressional Program Reductions		-338	
Congressional Rescissions		-779	
Congressional Increases		10900	
Reprogrammings	-1000		
SBIR/STTR Transfer			
Adjustments to Budget Years			1035

Nine FY06 Congressional adds totaling $10900 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1000) Advanced Imaging Technology Research
($1400) Burn and Shock Trauma Research
($1000) High Resolution Analytical Transmission Electron Microscope
($1000) Institute of Bioengineering and Nanoscience in Advanced Medicine
($1400) Integrated Systems in Sensing, Imaging and Communications Research
($1200) Laboratory for Engineered Human Protection
($1400) Low Temperature Vehicle Research
($1500) Nanotechnology and Health Research
($1000) Phase 2 SmartResponsive Nanocomposite (SRN) Systems

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601103A - University Research Sciences (H)**	**D55**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
D55 University Research Initiative	71942	66240	68545	66507	67755	68974	70230

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 U.S. 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 PE 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 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 on this project is performed extramurally by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
MURI - In FY05, continued supporting MURI awards made in prior years and made 8 new awards. Topic areas for the FY05 MURI research competition were Wireless Communications Networks, Autonomous and Semi-Autonomous Vehicle Swarms, Electronic Systems, Quantum Imaging, Network Battlefield Training, Materials Engineering, and Future Force Insensitive Munitions. Topic areas for the FY06 MURI research competition will be in Bio-integrating Structural and Neural Prosthetic Materials, Spatial-temporal Event Pattern Recognition, Self Assembling Metallic/Metalloid Cluster Materials, OMNI-Optical Materials with Negative Index, Monolithic Silicon Microbolometer Materials for Uncooled IR Detectors, Ultrafast Switching for Optical Imaging, Ultrafast, Non-equilibrium Laser-Material Interactions, and Urban Target Recognition by Ad-hoc Networks of Imaging Sensors and Low-cost, Non-imaging Sensors. In FY06 and FY07 will support MURI awards made in prior years and initiate new awards in research critical to the Army's Future Operating Capabilities with an emphasis on biomolecular electronics, bio-electrochemical sensors, and human engineering research for humans-in-automation systems.	57189	49381	53200
PECASE - Continue supporting those PECASE investigators started in prior years. In FY05, selected two new young investigators. In FY06 and FY07, plan to select two new young investigators each year.	1053	940	1029
DURIP - In FY05, the DURIP program awarded 63 competitive grants for the acquisition of research instrumentation under the Defense University Research Instrumentation Program (DURIP). In FY06, DURIP will continue instrumentation that enhances the research infrastructure and provides new research capabilities to enable scientific exploration and discovery in burgeoning areas vital to Army transformational technologies. In FY05 awarded, and in FY06, FY07 will continue to fund competitive grants for research instrumentation to enhance universities' capabilities to conduct world class research critical to Army Transformation.	13700	15919	14316
Total	71942	66240	68545

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	100979	100498	86416	90338	93203	91842	93529
H04	HBCU/MI CENTERS - TRADOC BATTLELABS	4558	4937	2627	2681	2737	2790	2847
H05	INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES	4835	6727	7118	7224	7332	7478	7627
H09	ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)	2401	2474	2627	2681	2737	2790	2847
H50	Comms & Networks Collab Tech Alliance (CTA)	7759	8062	7593	7837	7961	8139	8322
H53	ADV DIS INTR SIM RSCH	2363	2581	2750	2817	2883	2939	2999
H54	Advanced Sensors Collab Tech Alliance (CTA)	6122	6421	5791	5993	6077	6218	6362
H56	Adv Decision Arch Collab Tech Alliance (CTA)	5849	6114	6165	6343	6718	6861	7009
H59	UNIV CENTERS OF EXCEL	6066	1837	1948	1999	2036	2077	2119
H62	ELECTROMECH/HYPER PHYS	5355	5709	6207	6315	6415	6542	6672
H64	MATERIALS CENTER	3075	2429	2699	2766	2828	2884	2941
H65	MICROELECTRONICS CTR	896	933	1065	1092	1116	1138	1161
H73	NAT AUTO CENTER	7419	4592	2880	2915	2954	2980	3002
J08	INSTITUTE FOR CREATIVE TECHNOLOGY	10577	7082	7412	7642	7862	8018	8179
J09	POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	5496	5566	5815	5961	6098	6219	6343
J12	NANOTECHNOLOGY	9093	9791	10414	10674	10915	11132	11355
J13	UNIVERSITY AND INDUSTRY INITIATIVES (CA)	19115	15575	0	0	0	0	0
J14	ECYBERMISSION	0	4740	5029	5158	5254	5359	5466
J15	NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC	0	4928	6200	7240	8280	8278	8278
J16	NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE	0	0	2076	3000	3000	0	0

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. This program element 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 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 PE is managed by: the Army Research Lab (ARL); the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC); the Simulation & Training Technology Center (STTC); and the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	100066	81953	85938
Current BES/President's Budget (FY 2007)	100021	100498	86416
Total Adjustments	-45	18545	478
Congressional Program Reductions		-441	
Congressional Rescissions		-1014	
Congressional Increases		20000	
Reprogrammings	-45		
SBIR/STTR Transfer			
Adjustments to Budget Years			478

Fourteen FY06 Congressional adds totaling $20000 were added to this PE.
Exhibit R2 Resource Table includes includes $958 in FY05 for a Congressional Add for Partnership for the Next Generation of Vehicles/TACOM which was not included in the data base lock.
FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1200) Advanced Coating Systems for Ground-based Military Vehicles
($500) Advanced, Multifunctional Composites for Joint Rapid Airfield Construction
($1000) Advanced Sensors Research
($1000) Advanced Steel Casting Technology for Weapons Systems
($1700) Automotive Research
($2500) Centers of Excellence
($2000) Ferroelectric Electronic - Photonic Nanodevices
($1000) Nanoscience and Nanotechnology Research
($2000) Nanotubes Optimized for Lightweight Exceptional Strength Composite Materials
($1200) Next Generation Joining Technology Research
($1700) Photonics Research
($1200) Real Time Classification Through Wall Sensor
($2000) Strategic Defense Systems Manufacturing Technology Photonics Research
($1000) Visualization for Training and Simulation in Urban Terrains

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H04	HBCU/MI CENTERS - TRADOC BATTLELABS	4558	4937	2627	2681	2737	2790	2847

A. Mission Description and Budget Item Justification: Centers of Excellence have proven to be 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 the 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) Battlelabs to gain first hand perspective of the end-user's needs. Through these Centers, the Army user begins the collaboration with university researchers from the outset of the research. These Centers of Excellence will join with Army and industrial partners to accelerate the transition from research phase to actual technology demonstration. In addition, these Centers of Excellence will recruit, educate and train outstanding students and post doctoral researchers in science and technology areas relevant to Army Transformation. This project was previously funded in PE 0601104A Project H59 and is a restructuring of ongoing research into a distinct project for visibility and management. 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 on this project is performed extramurally by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- In FY05, established the HBCU/MI Centers of Excellence for Battlefield Capability Enhancements: Tuskegee University - research on flexible extremities protection; North Carolina A&T University - research on flexible displays and human engineering research in cognitive strategies, for example "sense making"; Tennessee State University - research on sensor fusion; and Prairie View University - research on Beyond-Line-of-Sight. Continued to forge close collaborative working relationships with TRADOC Battle Labs and accelerate technology transitions to Army Labs/Centers and Industry. In FY06, will conduct rheological characterization studies of fabric composites for flexible extremities protection; investigate 2D stationary and non-stationary distributed sensors with varying operational modalities; characterize non-crystalline wide band gap materials for environmentally stable flexible displays; conduct cognitive process experiments for human-centric decision making. In FY07, will model and simulate wave propagation of shear thickening fluid/fabric composites for extremities protection; expand sensing taxonomy to 3D located sensors and combine with 2D and 3D non-stationary sensor nodes; characterize electrical and optical properties of organic multilayer films for flexible displays; model adaptivity of decision maker in dynamic situations.	2308	2473	2627
- The purpose of this Congressional add in FY05 and FY06 is to support basic research at Lincoln University, a Historically Black University. No additional funding is required to complete this project.	2250	2464	0
Total	4558	4937	2627

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H05	INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES	4835	6727	7118	7224	7332	7478	7627

A. Mission Description and Budget Item Justification: This Project supports the Army's Institute for Collaborative Biotechnologies (ICB), a University Affiliated Research Center located at the University of California-Santa Barbara, and two major subcontractors, 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 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. 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 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).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Institute for Collaborative Biotechnologies: In FY05, explored biologically derived and biologically inspired synthesis and processing for enhanced performance materials properties; investigated and leveraged design and characterization of biological networks as insight for battlefield networks. In FY06, will formulate fastest available method for generating binding peptides for Army biosensing, diagnostics and therapeutics applications; will devise the collective optical response of multichromophore macromolecules and DNA-specific electrode surfaces and microfabrication for detection and identification of multiple DNA sequences for threat, Identification Friend or Foe (IFF) and soldier status-analysis; will adapt unique proteomics technology and diagnostic markers into microfluidics-based modified proteomics libraries for advanced analysis in early detection of human pathology; and will establish the roles of interfaces for potential use of biological + non-biological hybrid components in advanced electronic and photonic devices. In FY07, will provide foundation for incorporation of deterministic and stochastic dynamic models from biological systems, endowing engineered Army networks with robustness; will use 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; will enable controlled surface functionalization and ligand display on, and integration into, materials for application in sensors, multi-functional materials, and device assembly; and will devise genetically engineered microbial systems that efficiently incorporate unnatural amino acids into proteins for unique materials application for the Army.	4835	6727	7118
Total	4835	6727	7118

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H09	ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)	2401	2474	2627	2681	2737	2790	2847

A. Mission Description and Budget Item Justification: This project conducts basic research in key scientific 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 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 research program, 0602618A 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 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 2005	FY 2006	FY 2007
- Robotics Collaborative Technology Alliance: Explore new opportunities to enable revolutionary autonomous mobility for the Future Force. Research is an integral part of the larger Army Robotics Program and feeds technology into PE 0602618 (Robotics Technology). 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 FY05, focused on understanding sensor phenomenology and determined new methodologies to enable accurate terrain classification in the local environment permitting intelligent autonomous tactical movement through complex terrain. Specialized algorithms able to classify distinct objects, e.g., water, wire structures, embedded in a complex background to enable higher speed cross-country mobility required for Future Combat Systems unmanned ground elements were matured. Investigated control concepts that allow autonomous systems to adapt to dynamic environments and learn from past performance in a mixed manned/unmanned collaborative environment thus reducing the cognitive workload placed upon soldiers controlling unmanned systems. Characterized the performance of a probabilistic, genetic algorithm and market based algorithms in Modeling and Simulation evaluation framework for autonomous robot scout systems. In FY06, will compare adaptive capability of tactical behaviors to a baseline approach utilizing task decomposition/case-based machine behavior; and will perform assessment for Improvised Explosive Devices (IED) threat mitigation designed to stress both perception and control strategies, proving concept viability and mitigating the risk associated with meeting FCS objectives. In FY07, will evaluate tactical behavior of core algorithmic structures and determine performance of best features of each in various tactical behavior applications stressing performance in changing tactical situations in complex environments.	2401	2474	2627
Total	2401	2474	2627

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H50	Comms & Networks Collab Tech Alliance (CTA)	7759	8062	7593	7837	7961	8139	8322

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 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 NRC BAST study. When the International Technology Alliance on Network and Information Sciences (0601104/J15) is established in 2006, joint planning of the research programs will prevent redundancies. 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 2005	FY 2006	FY 2007
- 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. In FY05, validated self-organizing and auto configuring subnet protocols enabling persistent on-the-move communication sessions in highly mobile conditions. In FY06, will devise and validate auto configuration protocols that allow mobile networks to adapt to dynamic conditions. In FY07, will conduct analytical and experimental studies validating dynamic and survivable resource pooling to enable mobile networks to exploit distributed network infrastructures.	2668	2821	2812
- 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 FY05, conducted analytical and experimental studies validating high performance multiple access techniques and high spectral efficiency modulation schemes for communications on the move. In FY06, will conduct analytic and experimental studies of Multi-Input, Multi-Output systems that are spectrally-efficient and robust for non-line-of-sight mobile communications. In FY07, will conduct analytical and experimental studies of signal processing aided medium access control algorithms that improves communications performance while on-the-move.	1961	2015	1801
- 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 FY05, conducted analytical and experimental studies validating low probability of detection waveforms, interference mitigation techniques, and anti-jam modulation to enable survivable communications and spectrum reuse. Investigated ultra-violet non-line-of-sight sensor communications. In FY06, will conduct analytical and experimental studies of frequency-hopping systems that enable robust and mobile anti-jam effectiveness. In FY07, will devise and study sensor array processing and interference techniques that enable adaptive antennas for improved interference rejection and spectrum	1574	1613	1361

reuse.			
- Tactical Information Protection: perform research in scaleable, efficient, adaptive, and secure information protection for very resource-constrained and highly mobile ad hoc networks. In FY05, conducted analytical and experimental studies validating a highly efficient and noise robust security suite with distributed trust, distributed key management, and intrusion detection. In FY06, will conduct analytical and experimental studies of intrusion detection algorithms that are effective in mobile ad hoc networks with no concentration points where traffic can be analyzed. In FY07, will devise and study security schemes for distributed servers supporting dynamic network infrastructures.	1556	1613	1619
Total	7759	8062	7593

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H53	ADV DIS INTR SIM RSCH	2363	2581	2750	2817	2883	2939	2999

A. Mission Description and Budget Item Justification: This project supports Army critical research at the Army High Performance Computing Research Center (AHPCRC). The AHPCRC research is focused on the Future Force, including: structural response of armored vehicles to perforating and non-perforating projectiles, investigating more efficient gun projectile and missile propulsion systems, evaluating materials suitable for armor/anti-armor applications, defense from chemical/biological agents, signature modeling, and associated enabling technologies. This project also supports a long-term collaboration between the Army Research Laboratory and competitively selected Army Center of Excellence in Information Sciences (ACEIS). The objective of this center is to perform research in knowledge fusion technology in support of global and tactical battle command for the Future Force. The most significant technical barrier is determining how fusion can function usefully as a service in the rapidly evolving, universal distributed web environment to build systems to support reasoning and inference of human decision processes. Areas of emphasis include real-time and near-real-time multi-sensor fusion for situational awareness and threat prediction. A key problem to be solved is information overload. Major portions of the work of the ACEIS are performed at Clark Atlanta University and Morgan State University; both are HBCU institutions. 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 2005	FY 2006	FY 2007
- Perform research at the Army High Performance Computing Research Center (AHPCRC) that requires computationally intensive algorithms in the areas of projectile target interaction, signature modeling, chemical/biological defense, nano-science and nano-mechanics, and enabling technologies to include scientific visualization that support the Future Force transition path. In FY05, created novel computational algorithms for chemical-biological defense at the cell level; explored algorithms at nano-level and mechanics towards multifunctional nano-materials; explored coupled approaches for integrating Army meteorology models with electromagnetics; investigated new higher order techniques in mechanics and electromagnetics; explored scientific visualization approaches to meet new hardware, software, and user requirements. In FY06, will integrate software for intrusion detection and validate for Army application; will implement dial-up software to enhance interior ballistics and validate for Army application; and will explore nanotechnologies algorithm toward relevant Army applications. In FY07, will complete an infrastructure to allow for nanoscale optical, magnetic, and biosensors on a deployable chip; explore multi-sensory visualization approaches to better understand and process multivariate data; and will devise algorithms for flexible-rigid multi-body dynamics and new methods for nonlinear computational structural mechanics.	2000	2000	2000
- Perform research into knowledge fusion technologies and systems that enhance situational awareness and threat prediction on the battlefield to improve tactical and global battle command. In FY05, showed distributed streaming video fused with geographic data to present real-time battlefield on-request information delivery. In FY06, will extend research to include indexing and queries that cluster around time and space using superimposed visualization to enhance imagery. In FY07, will investigate additional heterogeneous multimedia data sources for potential extension and experimentation in a mobile environment.	363	581	750
Total	2363	2581	2750

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H54	Advanced Sensors Collab Tech Alliance (CTA)	6122	6421	5791	5993	6077	6218	6362

A. Mission Description and Budget Item Justification: This project supports a competitively selected industry/university consortium, the Advanced Sensor Collaborative Technology Alliance (CTA), for the purpose of leveraging world-class commercial research necessary to address Future Force and Army Transformation needs. The CTA links a broad range of government technology agencies and industry/academia partners with the Army Research Lab (ARL). This Advanced Sensors CTA conducts innovative research focusing on three main technical areas: micro-sensors, electro-optic smart sensors, and advanced radar concepts. The payoff to the warfighter will be advanced sensing technologies to support Future Force requirements. The technical areas addressed under this project include overcoming technical barriers associated with: autonomous calibration and management of micro sensor networks; multi-domain smart sensors (includes multi-spectral infrared focal plane arrays); a novel concept for laser radar (LADAR); multifunction radar sensors; and sensor modeling and algorithms for automatic target recognition (ATR) involving fusion of data from multiple sensors and signal processing. 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. Work in this CTA accelerates the transition of technology to PE 0602120 (Sensors and Electronic Survivability). 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 2005	FY 2006	FY 2007
- This project has been restructured to increase the emphasis on microsensors and reduce the efforts in both the radar and electro-optics factors. As such, the following deliverables are planned to perform microsensor research focused on various passive and active sensors, algorithms, low-power signal processing, and autonomous sensor/network management for the unattended sensor network component, resulting in technology transfer and delivery of sensor nodes to applied research. For FY06, will complete a mathematical framework for decentralized detection, identification and tracking of vehicles and people across a cluster of nodes. For FY07, will experimentally validate autonomous sensor management capability.	2448	2569	2367
- Perform electro-optics research focused on infrared sensors, laser radar, hyperspectral imaging, and automatic target recognition algorithms for improved situational awareness and targeting. In FY05, devised prototype 8x8-pixel integrated active/passive imager; fabricated a medium wavelength infrared (MWIR) 320 x 256 gallium antimonide passive imaging array; validated mercury cadmium telluride MWIR passive imaging array with operating temperature of 120 Kelvin. In FY06, will validate a 32 x 32 active imager on custom readout circuit. In FY 07, will fabricate a long wavelength infrared 320x256 gallium antimonide passive array.	2143	2247	2024
- Perform radar research focused on low-cost electronically scanned antennas; integration of analog and digital components, advanced materials and device designs; and system studies to increase radar performance and reduce the detection of FCS platforms. In FY05, verified low-power Micro-Electrical-Mechanical System (MEMS) phase shifters for electronically scanned antennas. In FY06, will show a novel, multi-beam all dielectric lens for phase array antennas. In FY07, will prove out a highly robust Low Noise Amplifier Monolithic Microwave Integrated Circuit (MMIC) for use in hostile electromagnetic environments of the electronic battlefield.	1531	1605	1400
Total	6122	6421	5791

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H56	Adv Decision Arch Collab Tech Alliance (CTA)	5849	6114	6165	6343	6718	6861	7009

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 that will provide real-time situation awareness, distributed commander-staff-subordinate collaboration and planning, and execution monitoring in a high tempo, high stress battlefield environment with 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 situation 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; architecture; 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 PE 0602716 (Human Factors Engineering Technology) and PE 0602783 (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 (0601104/J08) and the Flexible Display Center (0602705/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 2005	FY 2006	FY 2007
- Modeling and measurements of cognitive processes of Army commanders and staffs (decision makers). In FY05, validated computational models of cognitive processing to include models which predict operator performance while interacting with graphic displays. In FY06, will investigate applicability of social network models of commander and staff interactions for organizational design. In FY07, will validate architecture for information fusion, which uses diagrammatic reasoning as an aid to evaluate the commander's preferred course of action.	2162	2262	2418
- 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 FY05, integrated concepts, equipment, and software to examine multi-national coalition collaboration in a stability and support operation. In FY06, will design and complete experiments to examine variations on decision-making processes and procedures and the use of advanced digital tools for continuous planning in a distributed environment. In FY07, will complete prototype architecture for collaboration and visualization test bed.	1145	1193	1099
- User-adaptive interfaces: explore ideas, frameworks, and technologies that assist the Soldier in understanding, problem solving, planning and decision-making. In FY05, provided solutions for identification and fusion of information necessary to make and control decisions from generally distributed and disparate databases with varied data uncertainties. In FY06, will integrate advanced haptic (touch) displays	1578	1651	1751

into a multi-modal test bed and evaluate effect on soldier performance. In FY07, will integrate capability for multinational, multilingual communication in stability and support test bed.			
- Auto-adaptive information presentation: investigate how to make autonomous machines team players with their human partners or supervisors in warfighting operations. In FY05, validated baseline system for improving the flexibility of Future Combat Systems (FCS) through dynamically reconfigurable software agent systems. In FY06, will validate test bed for multi-modal information exchange and dynamic adaptation. In FY07, will extend software agent systems to provide an agile computing infrastructure for Unit of Action.	964	1008	897
Total	5849	6114	6165

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H59 UNIV CENTERS OF EXCEL	6066	1837	1948	1999	2036	2077	2119

A. Mission Description and Budget Item Justification: Army Centers of Excellence 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. This project supports the Rotorcraft Center of Excellence and 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. Starting in FY06, the eCYBERMISSION effort will be restructured to Project J14 for increased visibility and management oversight, leaving the Rotorcraft Center of Excellence as the only program funded in this project in FY06 and 07. In FY06 and FY07, this project 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 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 2005	FY 2006	FY 2007
eCYBERMISSION national competition to stimulate interest in science, mathematics and technology in middle and high school students. In FY 05, sustained eCYBERMISSION and implemented enhancements as necessary based on previous years' lessons learned and expanded student and teacher participation. For FY06, this effort was restructured into PE 0601104A Project J14 for increased visibility and management oversight.	4311	0	0
Rotorcraft Centers of Excellence. In FY05, investigated limit detection and limit avoidance methods for carefree maneuvering. Devised experimental and computational analysis capabilities on rotor wakes and tip vortices. In FY06, refocus efforts to address vertical lift technologies which will provide major cost reductions in heavy lift vehicles. Develop active flow control concepts for improving rotorcraft performance and reducing noise and vibratory loads. Investigate advanced adaptive flight control systems and autonomous control functionality. Investigate low Reynolds number aerodynamics for small Unmanned Air Vehicle (UAV) design analysis. Develop advanced concepts for rotorcraft UAV systems. In FY07, will investigate high-lift airfoil concepts for delaying dynamic stall onset and reducing adverse pitching moments; will develop data fusion and biomimetic materials for rotorcraft health monitoring systems; 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.	1755	1837	1948
Total	6066	1837	1948

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H62 ELECTROMECH/HYPER PHYS	5355	5709	6207	6315	6415	6542	6672

A. Mission Description and Budget Item Justification: This project funds Army basic research in electromechanics and hypervelocity physics relating to electromechanical components (electromagnetic launchers and power supplies) for applications to electromagnetic (EM) guns. Additionally, this project provides for research, evaluation and computer modeling of advanced hypervelocity projectiles. This project funds a University Affiliated Research Center, the Institute for Advanced Technology (IAT), at the University of Texas. In keeping with the Army EM Armaments Program strategy, highest emphasis has been placed on advancing the state-of-the-art in pulsed power, materials and techniques to achieve extended rail life, and on establishing the utility of hypervelocity projectiles. This project will research underpinning technologies for EM gun pulsed power; address technical barriers associated with EM gun launch; and research 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 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 monitored and guided by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Pulsed Power: In FY05, included thermal effects in parametric model; analyzed constitutive behavior of candidate materials in short EM pulse testers; and matured advanced topology Silicon Carbide(SiC) switches. In FY06, will conduct component material experiments and mature a parallel SiC switch module. In FY07, will model electromagnetic, mechanical and thermal properties of candidate EM pulsed power systems.	2087	2168	2386
- Launch: In FY05, investigated novel, high efficiency launcher configurations and developed model of sliding electric contact. In FY06, will incorporate launcher model into pulsed power model. In FY07, will show long-life, multi-shot EM launcher operation.	1232	1471	1476
- Electromagnetic Lethality: In FY05, evaluated concepts for enhanced behind-armor debris and evaluated against full-scale targets. In FY06, will flight test complete novel kinetic energy penetrator (NKEP) and incorporate NKEP into half-scale launch package for EM launch. In FY07, will prove NKEP launch from full-scale EM launcher.	2036	2070	2345
Total	5355	5709	6207

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H64 MATERIALS CENTER	3075	2429	2699	2766	2828	2884	2941

A. Mission Description and Budget Item Justification: This project concentrates scientific resources on research to advance innovative materials technologies and exploit breakthroughs in materials science and engineering through Materials Cooperative Research Agreements (MCRAs). MCRAs promote long-term synergistic collaboration between the Army Research Laboratory (ARL) scientists and university researchers. The MCRAs provide for mutual exchange of personnel and sharing of research facilities with U. Delaware, Johns Hopkins U., Rutgers U., and U. Massachusetts. The MCRAs focus research on armor, anti-armor, personnel protection, ground vehicle, rotorcraft and tactical missile applications. Lightweight, multi-functional composites, advanced armor ceramics, bulk amorphous metals, nanomaterials technology, and new polymer hybrid materials for flexible extremities (combat warrior) protection are emphasized. Closely coordinated with ARL in-house materials research projects (PE 0601102A, Project H42), this effort enables the effective and efficient transfer of fundamental scientific research to address requirements for the Future Force. The center accelerates the transition of technology to PE 0602105A (Materials Technology). 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 2005	FY 2006	FY 2007
In FY05, devised electro-optical composite structural materials; explored practical strategies to scale-up synthesis and processing of hierarchical polymers and polymer-inorganic hybrid materials; and devised physics based models to predict the effects of microstructure on the behavior of metallic and ceramic material systems under dynamic loading conditions. In FY06, will characterize fundamental behavior of multifunctional composite materials; will devise materials concepts that utilize self-assembly methods to produce polymers, fibers, or coatings with unprecedented properties; and will validate physics based models to predict the effects of microstructure on inorganic materials systems. In FY07, will devise appropriate physics based models that describe the attributes of multifunctional materials; will determine the fundamental response of hierarchical polymer based materials; will devise new inorganic materials that incorporate microstructures designed for specific armor related properties.	2249	2429	2699
Composite Materials Research. The objective of this Congressional Add is to perform composite materials research. In FY05, advanced the fundamental composite materials research ongoing at the University of Delaware. No additional funding is required to complete this project.	826	0	0
Total	3075	2429	2699

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H65**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H65 MICROELECTRONICS CTR	896	933	1065	1092	1116	1138	1161

A. Mission Description and Budget Item Justification: This project conducts basic research in the area of micro/nano electronics and photonics which have broad application to many enduring Army requirements, including power and energy (from soldier micro power to high power high temperature electronics for electric vehicles), prognostics and diagnostics, networked microsensors, radio frequency electronics for secure communications, chemical-biological detection and electro-optical sensing. The focus will be on increased integration of these heterogeneous technologies by functionalizing materials to enhance sensing, processing, and communications. The benefits and impact to the Warfighter will be to provide basic semiconductor electronics research to support the required electronics for future army applications - both mounted and dismounted. This includes the research to support cost effective, smaller, lighter weight semiconductor electronics that can operate in harsh environments with increased reliability. This basic research effort is conducted through a cooperative agreement between the U.S. Army Research Laboratory and academia, which includes: (1) basic research projects pairing an Army Research Laboratory principal investigator and a principal investigator from academia; (2) the undergraduate student education program, which brings in high quality students to learn the principles of basic research; and (3) a graduate fellowship program. This agreement funds academics to solve current technical barriers and cultivates future talent. Technical barriers include: (1) identifying, understanding and resolving materials defects that can dramatically affect device performance; (2) identifying appropriate materials candidates and device designs in order to investigate devices that can operate under a variety of harsh conditions required by military applications, such as, high power, high temperature, intense vibration and corrosive environments; (3) associated micro-power issues; 4) thermal management; and 5) scaling issues associated with shrinking device sizes from the macro scale to the micro/nano scale. This project will serve to enhance the survivability, lethality, and mobility, while reducing logistics, of future Army platforms. This center accelerates the transition of microelectronics technology to PE 0602705A(Electronics and Electronic Devices). 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 2005	FY 2006	FY 2007
- The objective of this effort is to conduct basic research in the area micro/nano electronics and photonics and the integration of these heterogeneous technologies. The research supports future army applications and requirements for electronics that are cost effective, smaller, lighter, and that can operate under realistic military environments including high temperature, high power, intense vibration and corrosion while increasing reliability, enabling future army applications to meet the demands of a lighter weight force with increased/improved capabilities. In FY05, investigated Aluminum Nitride (AlN) as an alternative passivation dielectric to Silicon Dioxide (SiO2) for Silicon Carbide (SiC) power devices that operate at high temperatures (300 degrees Celsius and above). State-of-the-art SiC Metal Oxide Semiconductor Field Effects Transistor (MOSFETs) for high power and temperature electronics were successfully modeled at room temperature. Fabricated PZT (lead zirconium titanate) based Micro Electro-Mechanical Systems (MEMS) test structures and measured mechanical properties at the micrometer scale. In FY06, will investigate applications of focused ion beam nanofabrication and other nanofabrication techniques to novel devices for general applicability to a wide array of required Army nanoscale electronic devices. Investigate the use of carbon nanotubes for thermal management in high power high temperature electronics. In FY07, mature interface electronics for PZT piezo-ceramic-based MEMS sensors and actuators with Si-based and other semiconductor devices. Specifically, will explore the ARL developed pressure sensor and shock sensors for prognostics and diagnostics.	896	933	1065
Total	896	933	1065

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H73 NAT AUTO CENTER	7419	4592	2880	2915	2954	2980	3002

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 U.S. 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 while maximizing technological achievement. 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 phased in as improvements to vehicles over the next several decades. 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 U.S. automotive manufacturers and suppliers. Automotive Research Center (ARC) formulates and evaluates advanced automotive technologies relative to the Future Combat System (FCS) vehicular platforms. This effort advances state-of-the-art modeling and simulation for the Army's automotive technologies with strong emphasis on the Army's FCS program. 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 TARDEC, Warren, MI. FY05 Total for this R2 does not match FY07PB due to administrative error which excluded one congressional add.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Automotive Research Center (ARC): In FY05, evaluated and analyzed models suitable for ground vehicle design decisions relative to collision avoidance warning systems, rollover warning, active yaw control, path departure, wireless intelligence systems, and advanced propulsion systems. In FY06, formulate and analyze modeling and simulation tools relating to systems engineering of advanced and alternative energy powered ground vehicles for improved vehicle fuel economy, reduced visual signature, reduced pollutant emissions through the use of advanced diesel and hybrid power trains, and potential applications of fuel cell auxiliary power units and lightweight material structures; evaluate new concepts, hybrid architectures, component designs and control strategies for duty cycles representing realistic missions of medium and large trucks, including off-road use of tactical trucks with the human in the loop. In FY07, will evaluate and analyze 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.	2867	2918	2880
University Based Automotive Research. This one year Congressional add developed modeling and simulation tools for military ground vehicles. No additional funds are required to complete this project.	3594	0	0
Partnership for the Next Generation of Vehicles / TACOM: This one-year Congressional add performed fundamental research that may improve the fuel economy in the Army's current and future fleet of ground vehicles. No additional funds are required to complete this project.	958	0	0
University Based Automotive Research. This one year Congressional add continues developement of modeling and simulation tools for	0	1674	0

military ground vehicles. No additional funds are required to complete this project.			
Total	7419	4592	2880

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
J08	INSTITUTE FOR CREATIVE TECHNOLOGY	10577	7082	7412	7642	7862	8018	8179

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 capabilities 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, the types 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 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 2005	FY 2006	FY 2007
- Conduct basic research in immersive environments, to include virtual humans, three dimensional (3D) sound and visual media, to achieve more efficient and affordable training and 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 FY05, investigated hardware and software solutions to timing and processing of multimodal, synchronized, queued media in synthetic environments, including blending virtual and physical objects into the mixed reality aspects of the test beds. In FY 06, will explore the computational hardware and software approaches for representing the immersive environment using holographic imaging techniques. In FY 07, will investigate the timing, synchronization and rendering techniques for augmenting the test beds with holographic imagery.	5648	2698	2849
- 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 FY05, explored techniques for the sonification (using sound, alone or in combination with visual imaging techniques) of data; investigated the recovery of shape and reflectivity for highly reflective objects, and investigated sound as a source of emotion in an immersive environment. In FY 06, will explore Multiview Object and Imaging techniques; and will examine sound cancellation techniques to improve auditory cues in noisy environments. In FY 07, will investigate the concept of generalized reciprocity as it relates to how objects transform incident illumination into reflected light; and will extend the concept of virtual loudspeakers to address multiple participants in a given mixed reality setting.	2427	1645	1675
techniques and human - virtual human interaction. In FY07, will explore a - Conduct research on intelligent avatars for virtual environments to enhance realism of interactions with trainee(s) and increase training effectiveness. In FY05, completed draft specification	2502	2739	2888

of data elements and parameters for non-verbal communications techniques; and integrated emotional models and timing constraints into the draft specification. In FY 06, will investigate an intelligent agent architecture concept that accounts for the emotional models, cultural/ethnic impact on verbal and non-verbal communication, synchronized verbal communication conceptual framework for intelligent agents to enable adaptation of the environment based on human and virtual human interactions.			
Total	10577	7082	7412

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J09**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
J09	POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	5496	5566	5815	5961	6098	6219	6343

A. Mission Description and Budget Item Justification: This project supports the Collaborative Technology Alliance (CTA) in Power and Energy Technologies. This CTA is a long-term collaboration between the Army Research Laboratory (ARL) and a competitively selected industry/university consortium for the purpose of leveraging world-class commercial research relevant to Army needs. Power and energy research supports lightweight, compact power for the individual Soldier, and energy conversion and control technologies for advanced electric mobility, survivability, and lethality applications - such as hybrid electric drive, electromagnetic armor, and electro-thermal-chemical gun - for fuel efficient Future Force Systems including manned and unmanned platforms. Technical barriers include overcoming energy density limitations of traditional electrochemical portable power sources, reforming logistics fuels to generate fuel for fuel cells, and reducing the size and weight of electric power components and systems. The CTA focuses on three main technical areas: portable compact power sources (non-electrochemical), fuel cells and fuel reforming, and hybrid electric propulsion and pulsed power for survivability and lethality. These technologies are fundamental elements required to realize the Army Transformation and support the Future Force. The research in pulsed power and hybrid electric is done in coordination with the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC). 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. Work in this CTA accelerates the transition of technology to PE 0602705 (Electronics and Electronic Devices). 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 Lab (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Research, design, investigate and characterize micro electromechanical sytems (MEMS) based button sized gas turbine generator as a battery replacement for the dismounted Soldier of the Future Force. In FY05, produced electric power from high speed micro-generators for the first time, implemented a height variation capability in a micro-compressor, and designed a self-sustaining micro-gas turbine engine. In FY06, will fabricate and evaluate first micro-gas turbine engine. In FY07, will design and fabricate first micro-gas turbine engine operating on liquid fuel.	2145	2171	2276
- Research, investigation and characterization of novel fuel cells/components and logistic fuel reformation techniques to produce electricity for the dismounted soldiers of the Future Force, as well as produce electricity for vehicle prime power and accessory power for the Future Combat Systems. In FY05, integrated a catalytic partial oxidation fuel reformer with a solid oxide fuel cell designed to operate with partially reformed logistics fuels for vehicle and robotic platforms, and implemented in test rig. In FY06, will validate a compact direct methanol fueled 20W cell with improved performance over current state of the art. Determine the appropriate silicon carbide switch for different applications from the choices of a bipolar junction transistor (BJT), a metal oxide semiconductor field effect transistor (MOSFET) or an insulated gate bipolar transistor (IGBT). In FY07, will validate a 'bench top' solid oxide fuel cell operating on Army Logistics fuel without the addition of water.	3351	3395	3539
Total	5496	5566	5815

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
J12 NANOTECHNOLOGY	9093	9791	10414	10674	10915	11132	11355

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. Computational models will be created that predict the Soldier's performance with the new technologies. 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 work cited is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Department of Defense Basic Research Plan (BRP). Work in this project is performed extramurally by the ARL and by visiting RDECOM scientists.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Conduct research in nano-based multifunctional materials for Soldier protection. In FY05, devised innovative materials processes and techniques to construct high performance layered structures to provide multifunctionality, including waterproofing, microbiocidal protection, and sensing, for light-weight fabrics and non-woven materials to improve Soldier protection. In FY06, will create hierarchical structures which demonstrate a range of material properties and improved protection against various Soldier threats. In FY07, will provide materials for evaluation that have improved survivability capabilities with nano-tailored surfaces, to provide capabilities such as nutrient delivery, water harvesting, and moisture repellency.	1868	2011	2139
- Conduct research in nano-structured polymer actuators to improve Soldier performance. In FY05, explored biomimetic muscular and structural behavior with potential to provide new approaches to outperform natural systems. In FY06, will characterize elastomeric, electrical and mechanical properties experimentally and with advanced modeling and simulation. In FY07, will create prototype hierarchical structures that deflect strains and stresses resulting from environmental and man-made threats while also providing improved performance.	3707	3994	4247
- Conduct research on integration, fabrication and modeling of nano-structured materials to create mechanically-active devices and sensors. In FY05, integrated new measurement and characterization research, including femtosecond laser characterization; and proved out and enhanced innovative methodologies to transition breakthroughs to Army labs/centers and industrial partners. In FY06, will begin fabrication of model systems of two or more nano-components to provide useful macro capabilities; and will use modeling and simulation to advance systems architecture for integrating multiple, nano-enabled survivability capabilities into Soldier systems. In FY07, will integrate subassemblies into larger assemblies to assess potential benefit for improved survivability.	3518	3786	4028

Total	9093	9791	10414

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
J14 ECYBERMISSION	0	4740	5029	5158	5254	5359	5466

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 education competition that encourages the nation's youth to pursue advanced education and careers in Science, Mathematics, and Engineering, thereby providing a pool of technologically trained potential soldiers and civilians for the Army workforce of tomorrow. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, the Department of Defense Basic Research Plan (BRP), and supports the President's initiative for education. Work in this project is performed extramurally by the Army Research Laboratory (ARL). Note: This project was previously funded in PE 0601104A Project H59 and is a restructuring of ongoing research into a distinct project for increased visibility and management oversight

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- In FY05, this effort was funded in this Program Element under Project H59. eCYBERMISSION is a national competition to stimulate interest in science, math and technology in middle and high school students. In FY06, will continue 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, with the goal of increasing student and teacher participation beyond the results of FY05. In FY07, will sustain eCYBERMISSION and implement enhancements as necessary based on previous years' lessons learned.	0	4740	5029
Total	0	4740	5029

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
J15	NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC	0	4928	6200	7240	8280	8278	8278

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 collaborative fundamental research on topics relevant to US/UK military requirements. The US Army Research Laboratory (ARL) and the UK Ministry of Defense (MOD) will establish a jointly funded and managed US and UK consortium, to be known as an International Technology Alliance (ITA) on Network and Information Sciences. The goal is fundamental science breakthroughs to enable superior coalition operations. Emphasis is on integration of multiple technical disciplines in an international arena. The "Network and Information Sciences" scope includes basic research into sensors exploitation, human dimension, and networking technologies. This program supports the Future Force transition path of the Transformation Campaign Plan (TCP). 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.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Network & Information Sciences ITA: Perform research into fundamental scientific underpinnings and theory for application to network and information science in the areas of network theory, security across a system of systems, sensor processing and information exploitation, and distributed coalition planning and decision making. In FY06, will award a competitive procurement establishing the US/UK International Technology Alliance in Network and Information Sciences for fundamental research into sensors exploitation, human dimension (distributed coalition decision-making), and networking technologies. In FY07, will conduct analytical and experimental studies in network theory and the interaction of networks, information exploitation and distributed decision making.	0	4928	6200
Total	0	4928	6200

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
J16	NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE	0	0	2076	3000	3000	0	0

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 of nanotechnology that can be used to integrate with microscale systems. The objective is not to duplicate existing nano electronics research programs but to focus on applications where nanotechnology can be integrated into microelectronics systems while not necessarily replacing microelectronics with nano electronics. By focusing on applications where nanotechnology complements rather then replaces microelectronics we hope to accelerate the deployment of nanotechnology for military applications. The research program will concentrate on four technologies 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 a primary limit on the performance of small devices. Nanotechnology may improve the performance of thermal management systems by enhancing the properties of materials, interfaces and fluids for microelectronics cooling; 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, even to cryogenic temperatures improving performance.

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).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY07, will research enhanced materials for thermal management for tailoring the thermal conductivity of materials, fluids and reducing interface resistance; will research low power nano-electronics; will research nanotechnology-enhanced transparent electronic materials that may enhance portable and flexible display technology; will research advanced nanotechnology-enhanced cooling including thermoelectric coolers and adsorption/desorption cooling.	0	0	2076
Total	0	0	2076

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		48274	35051	18822	19209	19563	19850	20123
H7B	Advanced Materials Initiatives (CA)	33250	17743	0	0	0	0	0
H7G	NANOMATERIALS APPLIED RESEARCH	4553	4934	5262	5393	5543	5653	5766
H84	MATERIALS	10471	12374	13560	13816	14020	14197	14357

A. Mission Description and Budget Item Justification: This program element (PE) researches and evaluates materials technologies for armor and armaments that will significantly enhance the survivability and lethality of Future Combat Systems (FCS) and Future Force systems and, where feasible, can be exploited to enhance Current Force capabilities. The PE builds on the materials research transitioned from PE 0601102 (Defense Research Sciences) H42 (Materials and Mechanics) and applies it to specific Army platforms and the individual soldier. Project H84 is directed toward developing materials technology that contributes to making our heavy forces lighter and more deployable, and our light forces more lethal and survivable. It provides the technology base required for solving materials-related problems in individual soldier support equipment, armor, armaments, aircraft, ground and combat vehicles and combat support. Project H7G funds the collaborative research efforts in nanomaterials technology between the ARL and the Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute for Technology, MA and the ISN industry partners. The effort is focused specifically on the improvement in individual soldier protection. Project H7B funds Congressional special interests associated with advanced materials for the full range of Army applications. 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). 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) is intended to transition materials technologies and support the Army materiel efforts at the Armaments Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ; the Tank and Automotive Research, Development and Engineering Center (TARDEC), Warren, MI; the Aviation and Missile Research, Development and Engineering Center (AMRDEC), Huntsville, AL; the Natick Soldier Center, Natick, MA; the Edgewood Chemical and Biological Center, Edgewood, MD; and the Communications and Electronics Research Development and Engineering Center (CERDEC), Fort Monmouth, NJ.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	50788	17559	18236
Current BES/President's Budget (FY 2007)	48274	35051	18822
Total Adjustments	-2514	17492	586
Congressional Program Reductions		-154	
Congressional Rescissions		-354	
Congressional Increases		18000	
Reprogrammings	-2514		
SBIR/STTR Transfer			
Adjustments to Budget Years			586

Ten FY06 Congressional adds totaling $18000 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1000) Advanced Ceramic Armor High Mobility Combat Vehicles
($1000) Advanced Lightweight Composite Armor Materials for Ballistic Impact and Blast Protection
($1500) Advanced Materials for Mine Detection and Blast Mitigation
($1500) Composite Materials Technology for Future Combat System
($3000) Future Affordable Multi-Utility Materials for Future Army Combat
($1400) Lightweight Blast Containment Vessel Development
($2200) LRIP LASSO
($2000) MEMS Sensors for Rolling Bearings
($2400) Multifunctional, Nanostructured Materials for FCS
($2000) Tactical Armor Manufacturing

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H7G	NANOMATERIALS APPLIED RESEARCH	4553	4934	5262	5393	5543	5653	5766

A. Mission Description and Budget Item Justification: This project integrates government and industry scientific capabilities on research to advance innovative nanomaterials technologies and exploit breakthroughs in nanomaterials basic research toward improving Future Force Warrior survivability, lethality, and sustainability. This project funds a collaborative research effort in nanomaterials technology between the Army Research Laboratory (ARL), the Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute of Technology and the ISN's 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. 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 2005	FY 2006	FY 2007
- 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 Force Warrior protection capabilities. Coordinated research program conducted internally, by ARL, externally by ISN industry partners, and through collaboration with ARL and ISN industry partners. In FY05, devised protective materials concepts that could be incorporated into multifunctional capabilities (e.g., ballistic, blast and fire/flame protection) with reduced weight within a single integrated system. Exploited selected processing methodology to fabricate prototype nanomaterials-based, functionally integrated specimens for evaluation with improved survivability and lethality. In FY06, will investigate materials technologies and incorporate into flexible multi-material assemblies and determine performance of newly developed materials systems. In FY07, will mature multi-functional materials concepts to include addressing scalable processing and fabrication methods.	4553	4934	5262
Total	4553	4934	5262

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H84 MATERIALS	10471	12374	13560	13816	14020	14197	14357

A. Mission Description and Budget Item Justification: The goal of this project is to provide the technical foundation for materials technology in metals, ceramics, polymers, and composites that are essential for lethal and survivable Future Combat Systems (FCS), Future Force Warrior (FFW) and other Future Force platforms. 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 materials and structures solutions that offer significant weight reduction with improved performance, durability and cost reduction for application to individual soldier support equipment, armor, 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, mechanics, 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 the 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 FCS and FFW. The work is conducted by the Army Research Laboratory (ARL), 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 (ARDEC), Picatinny Arsenal, NJ; the Tank and Automotive Research, Development and Engineering Center (TARDEC), Warren, MI; the Aviation and Missile Research, Development and Engineering Center (AMRDEC), Huntsville, AL; the Natick Soldier 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 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 2005	FY 2006	FY 2007
- 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 FCS, Current and Future Force Platforms and Ground Tactical Vehicles. In FY05, validated enhanced structural armor, metallics, and ceramics to enable advanced armor technology formulation; and validated computational methodologies for design of blast and impact-resistant multifunctional composite structures critical to improving the survivability of Current and Future Force platforms. In FY06, the validated computational models will be used to design and fabricate multi-material assemblies to achieve optimized multi-spectral properties. In FY07, will evaluate these multi-functional assemblies against ballistic, mine blast and other emerging threats.	4199	4160	4808
- Optimize lightweight armor materials and defeat mechanisms against emerging threats to enable affordable design of future multifunctional ballistic protective systems for the Future Warrior. Provide quantitative scientific basis for modeling and simulation that result in new lethal mechanisms/protection schemes for the individual warfighter. In FY05, devised new physics-based simulation capability to model the effects of ballistic, blast, or shock impact and stab incidence on the warfighter; investigated novel armor materials and processing techniques to devise concepts for soldier extremities protection. In FY06, will exercise initial simulation codes against known threats and current protection schemes and refine models as required; will incorporate lightweight armor materials and novel defeat mechanisms into concepts to improve Soldier extremity protection. In FY07, will validate simulation and design tools for individual	2251	2398	2564

warfighter protection and lethality applications and transition promising protection/lethality concepts to development community.			
- 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 Future Force lethality. In FY05, validated full-pressure (65ksi) ceramic barrel section in 25mm, and produced sub scale penetrators from emerging amorphous metals and unique alloys. In FY06, will characterize full scale penetrators and provide alloy/penetrator manufacturing process diagrams for production and transition to industrial partners; will investigate behavior of metal matrix composites subjected to tensile load over the range of operational temperatures typical for cannons. In FY07, will mature processes and techniques for fabricating ultra-fine grain materials that result in penetrators with improved strength and stiffness; will identify and prove out a process for application of an erosion-resistant appliqué on a lightweight composite cylinder to enable future lightweight armaments.	3521	3398	3640
- Design and optimize electro-ceramic materials and processing techniques for integration by CERDEC into advanced antennas that will enable affordable, reliable Command, Control, Communications (C3) information for FCS and Future Force platforms. In FY05, transitioned a low loss Barium Strontium Titanate (BST) based thin film material to CERDEC's industry partner (Agile Materials and Technology, Inc) for use in next generation phase shifting devices that will have higher tunability and hence will be smaller and less costly and more aptly integrated into structures and equipment carried or worn by soldiers. In FY06, will establish life testing methodologies to evaluate reliability of thin film-based structures. In FY07, will investigate novel materials concepts to increase the temperature stability of active thin film materials.	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 H7G. In FY06, will devise nanomaterial concepts to produce lightweight transparent structural materials systems; will mature processing methods to produce nanometallic materials; will validate nanomaterial enhancements to improve structural and impact properties of polymer composite materials; will devise nanomaterial additives for use in military coatings system improvements; and will mature unique experimental and numerical methods to characterize the mechanical response of nanomaterials. In FY07, will mature design capabilities for advanced nanomaterials and validate scalable processing methods; will investigate effects of nanoengineering on the mechanical and physical properties of composite materials; will quantify effects of nanomaterial modified coating systems on materials performance; will modify and mature improved physics-based nanomaterials property models.	0	1918	2048
Total	10471	12374	13560

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		56267	51327	38428	39295	40792	41255	41683
140	HI-POWER MICROWAVE TEC	2948	4927	5812	6202	6220	6275	6323
H15	GROUND COMBAT ID TECH	4602	5526	5940	6020	7891	7960	8020
H16	S3I TECHNOLOGY	19662	17462	19457	19927	19235	19409	19561
SA1	Sensors and Electronic Initiatives (CA)	17602	13899	0	0	0	0	0
SA2	BIOTECHNOLOGY APPLIED RESEARCH	2638	3599	5669	5546	5796	5911	6029
SA3	COMBAT IDENTIFICATION COMPONENT TECHNOLOGIES (CA)	8815	5914	0	0	0	0	0
TS1	TACTICAL SPACE RESEARCH	0	0	1550	1600	1650	1700	1750

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), and fire control systems, as well as the fuzing and guidance-integrated fuzing functions in future munitions; and significantly improving the survivability, lethality, deployability, and sustainability of FCS by devising high-power electronic components and technologies for compact, light-weight power and energy storage, conversion and conditioning, and radio frequency (RF)-microwave directed energy (RF-DE) weapons. Project 140 researches, develops, and evaluates Radio Frequency Weapon technology, as well as high power components. Project H15 will provide the ability for joint fires to locate, identify, track, and engage targets as necessary with overall goal of increasing lethality and survivability through the reduction of fratricide. Project H16 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 Institute for Collaborative Biotechnology (ICB) industry partners will conduct applied research focused on biological sensors and biological photovoltaics for power generation. Work in SA2 will exploit breakthroughs in biotechnology basic research transitioning from the ICB, a University Affiliated Research Center, to enable Future Force capabilities in sensors, electronics and photonics. Projects SA1 and SA3 fund Congressional special interest items. Project TS1 is a new project that researches, develops, and evaluates space-based remote sensing, signal and information processing technology in collaboration with other DOD and Government Agencies to support space force enhancement and space superiority advanced technology integration into Army battlefield operating systems.

Work in this PE is related to and fully coordinated with efforts in PE 0602307 (Advanced Weapons Technology), PE 0602705 (Electronics and Electronic Devices), PE 0602709 (Night Vision Technology), PE 0602782 (Command, Control, Communications Technology), PE 0603772 (Advanced Tactical Computer Science and Sensor Technology), PE 0603006 (Command, Control, Communications Advanced Technology), and PE 0603008 (CommandElectronic Warfare Advanced Technology). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	38433	32147	36102
Current BES/President's Budget (FY 2007)	56267	51327	38428
Total Adjustments	17834	19180	2326
Congressional Program Reductions		-390	
Congressional Rescissions		-530	
Congressional Increases		20100	
Reprogrammings	17834		
SBIR/STTR Transfer			
Adjustments to Budget Years			2326

FY05 $4.8 million increase attributed to a reprogramming in support of a classified program. FY05 $13.05 million increase attributed to a reprogramming in support of a supplemental item IED Defeat (Mohawk Stare)

Twelve FY06 Congressional adds totaling $20100 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1500) Advanced Detection of Explosives Program
($2800) Digital Radio Frequency Tags
($1500) Disposable Sensors for Battlefield and Urban Warfare
($1500) Network Enabled Combat Identification (CID)
($1700) Optical Combat Indentification System (OCIDS)
($1000) Persistent Multi-Dimensional Surveillance In Non-Permissive Environment
($1050) Project 12
($2000) Scalable High Efficiency Solid Laser
($1500) Small Airship Surveillance System
($1250) SmartCam 3D Technology
($3000) Urban Warfare Analysis Center
($1300) Wireless Networking and Smart Power for Small or Mini-UAVs

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
140 HI-POWER MICROWAVE TEC	2948	4927	5812	6202	6220	6275	6323

A. Mission Description and Budget Item Justification: This project researches, develops and evaluates traditional and non-traditional RF and laser electronic attack. This includes traditional jammers and Radio Frequency (RF) Directed Energy Weapon (DEW) technology, as well as high power components that will significantly enhance the survivability and lethality of Future Combat Systems (FCS) platforms and related systems. The DEW effort studies both RF microwave and laser system capabilities and effects against various threats such as electronic off and on route mines, including improvised explosive devices (IEDs) and electronically guided and fuzed missiles/munitions. Realizing DEW capabilities for diverse targets at a variety of lethality levels and operational ranges on FCS requires optimizing the DEW system, and developing compact, high density power systems meeting stringent FCS 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., studying 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 components work is coordinated with and, as appropriate, leveraged by DEW and power/energy programs in the Air Force, Navy, High Energy Laser Joint Technology Office, Defense Threat Reduction Agency, national labs, university consortia and relevant industry and foreign partners. The 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 on this project is performed by the Army Research Laboratory in coordination with the US Army Research, Development and Engineering Command's Tank and Automotive Research, Development and Engineering Center (TARDEC), the Armaments Research, Development and Engineering Center (ARDEC), and the Communications and Electronics Research, Development and Engineering Center (CERDEC).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Research and mature high power converters and enabling technology, such as high-temperature devices to achieve high-power and temperature operation for high power demand capabilities, including DEW, while meeting the stringent weight/volume requirements for FCS and related platforms for the Future Force. In FY05, investigated and matured high-temperature silicon carbide (SiC) power modules for >20 kW-level power conversion at 150 degrees Celsius (C) for motor control, vehicle power bus, and vehicle survivability and lethality systems. In FY06, continue maturation of high-temperature SiC power modules for >100 kW-level power conversion at 150 C for motor control, vehicle power bus, and vehicle survivability and lethality systems. In FY07, will investigate high-temperature SiC power modules for >200kW level power conversion at 150 C for motor control, for vehicle power bus and for vehicle survivability and lethality. This effort supports Tank and Automotive Research Development and Engineering Center (TARDEC) work on power generation, conditioning and control for hybrid electric vehicles and pulse power for Future Combat Systems.	1394	1361	1168
- Research and mature novel solid-state laser concepts, architectures and design components enabling High Energy Laser (HEL) Technology for Army-specific DEW applications. Exploit breakthroughs in laser technology and photonics basic research to meet the stringent weight/volume requirements for FCS and related platforms for the Future Force. In FY06, will investigate and mature the most promising laser ceramic materials for efficiency and effects, while fostering on-shore material development; design and breadboard efficient high-power laser based on highly concentrated neodymium-doped yttrium aluminum garnet (Nd:YAG) ceramics while implementing the latest in diamond-cooling technologies for advanced thermal management and beam quality improvement. In FY07, will investigate and demonstrate efficient, ultra-low-quantum-defect, high power "eye-safe" laser (~1.5 mm) with direct diode pumping by	0	1440	2050

the most advanced long-wavelength laser diodes and show correlation between predicted and measured effects on target materials. Applied research will be conducted by ARL in close collaboration with domestic ceramic (and other) material vendors and laser diode manufacturers.			
- 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 Future Combat Systems platforms. In FY05, investigated RF DE effects on two types of off-route mines and three types of electronically-triggered IEDs, measured power/modulation needed to neutralize, and provided to CERDEC/ARDEC. Designed breadboard counter-IED neutralization demonstrator and evaluated in lab test. Verified/updated RF coupling algorithms in Directed RF assessment model for Joint Aircraft Survivability Program Office. In FY06, will collect, analyze and summarize RF effects data on Radio Controlled (RC) and non-RC Improvised Explosive Devices (IEDs); will investigate at least two remotely-controlled IEDs of interest to CERDEC; will design and fabricate counter off-route mine neutralization breadboard and evaluate in lab; and will research back-door, out-of-band coupling of RF energy into network components. In FY07, will evaluate feasibility of countermine concept by surveying technology to identify existing hardware vs requirements; will create models to help predict military effectiveness of proposed neutralization systems; will investigate low power microwave effects on routers, laptops, network switches and other network components will transition counter-mine system design to CERDEC next year; will determine power requirements for Enhanced Area Air Defense System and transition system design; and will measure susceptibility profiles (with respect to frequency, power, modulation, polarization) of network components to assess vulnerability of FCS network.	1554	2126	2594
Total	2948	4927	5812

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H15	GROUND COMBAT ID TECH	4602	5526	5940	6020	7891	7960	8020

A. Mission Description and Budget Item Justification: This project researches and investigates 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, exploit opportunities to enhance Current Force capabilities. Efforts research 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 researches embedded radio algorithm developments as well as soldier RF Tag hardware for multiband and aerial platform interoperability. This project increases 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 program investigates 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. MANPRINT will be addressed in all activities. Efforts in this PE are coordinated with PE 0603270 (EW Technology), PE 0602270 (EW Techniques), PE 0603772 (Advanced Tactical Computer Science and Sensor Technology), PE 0602783 (Computer and Software Technology), and PE 0602784 (Advanced Concepts and Simulation).

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Combat Identification (CID) Technologies: In FY05, conducted technical, operational, and military utility testing of Radio Frequency (RF) tags in conjunction with Synthetic Aperture Radar/Moving Target Indicator (SAR/MTI) radar to provide passive CID. In FY06, identify the best approach for implementing Geometric Pairing (GP) and RF Tag/Interrogator CID functionality and crypto into application specific integrated circuits. In FY07, will design GP and RF Tag hardware for the Ground Soldier System ensemble to demonstrate dismounted integration concepts and technical performance characteristics; will conduct first technical testing of GP situation awareness and RF Tag concepts. Work on this effort is also accomplished under PE/Project 63270/K16.	546	1426	2067
- Cueing Sensor: In FY06, investigate algorithms for on-the-move frame registration, clutter suppression, and specific threat classification for active protection threat cueing sensor; develop focal plane arrays with required array uniformity, operability, sensitivity in the desired spectral bands. In FY07, will develop cueing sensor algorithms and processing; perform live-fire test of prototype sensors and systems. Work on this effort is also accomplished under PE/Project: 62270/442; 63270/K15; 63772/243.	0	2140	2847
- Fusion Based Knowledge for the Future Force: In FY06, investigate and evaluate fusion architectures, algorithms, representations, and data mining capabilities; initiate software generation in situation development; evaluate fusion capabilities by expanding to a moderate-sized set of reports (structured, semi-structured and unstructured situational input); demonstrate 3K reports/hr processed (scenario-specific performance, and sophisticated spatial/temporal reasoning); demonstrate data retrieval integrated with search engine. In FY07, will implement blackboard, abductive and other reasoners with increasingly realistic knowledge sources; will demonstrate prototype for fusion inferencing integrated with Intelligence planning; will demonstrate information retrieval across at least 3 sources.	0	1960	1026

- Coalition Combat Identification Advanced Concept Technology Demonstration (ACTD): In FY05, conducted international exercise (United States, United Kingdom, France, Italy, Germany) using Battlefield Target Identification (BTID), Radio Based Combat Identification (RBCI) and Radio Frequency (RF) tags; tested RBCI operating in Advanced SINCGARS Improvement Program (ASIP) Single Channel Ground Airborne Radio System (SINCGARS) with Digital Knee-Board interface, integrated on an Apache and unmanned aerial vehicle; demonstrated ground based RBCI during the final ACTD operational exercise.	4056	0	0
Total	4602	5526	5940

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H16 S3I TECHNOLOGY	19662	17462	19457	19927	19235	19409	19561

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 Combat Systems (FCS) and other emerging thrusts. The ultimate impact and utility of this work will be to protect our Soldiers and to greatly increase their lethality and range and speed of engagement. Emphasis is on solving critical Army-specific battlefield sensing and information management problems such as dealing with 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; fusion of diverse sensors such as acoustic, seismic, magnetic, radar, infrared (IR), 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 will enable buried mine detection and target imaging through dense foliage and will greatly enhance robotic mobility; aided/automatic target recognition (ATR) to allow 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 outside 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 PE 0602709A (Night Vision Technology), PE 0603710A (Night Vision Advanced Technologies), and PE 0603001A (Warfighter Advanced Technology). This work supports the following Army Programs: FCS, Future Force Warrior (FFW), and Networked Sensors for the Future Force (NSfFF) Advanced Technology Demonstration (ATD), Multi-Function Starting Sensors Suite (MFS3), and the Cave and Urban Assault Advanced Concept Technology Demonstration (ACTD)The cited work is consistent with the 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 area is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Mature underpinning technologies for low-cost unattended ground sensors (UGS) for homeland defense, counter-terrorism, FCS and the future soldier. Implement and mature advanced passive acoustic/seismic algorithms to detect, track and ID targets for UGS. Investigate level 0/1 sensor fusion algorithms using collocated, multi-modal sensing phenomenology's including acoustic, seismic, magnetic, electric field, passive Infra Red (PIR), and Radio Frequency (RF) in order to increase probability of target detection and reduce false alarm rates. In FY05 provided mature Army Acoustic Algorithm to CERDEC for use in Networked Sensors for the Future Force Advanced Technology Demonstration; provided mature sensor nodes and algorithms and transition to Cave & Urban Assault Advanced Concept Technology Demonstration. In FY06, evaluate multi-modal database and fusion algorithms using RF, magnetic, electric field, seismic and	5415	6369	6795

acoustic sensor technologies required for providing baseline personnel and human activity detection capability to the Human Infrastructure Detection & Exploitation (HIDE) in Urban Operations Army Technology Objective and other programs. In FY07, will evaluate performance of fusion algorithms at the node level; will devise and mature algorithms for persistent sensing and change detection in urban areas using low cost disposable sensor nodes.			
- Research, mature and validate electro-optical techniques and components to detect/identify targets in clutter and to protect sensors and eyes from threat laser sources on the battlefield; mature low cost Laser Detection and Ranging (LADAR) and target recognition techniques for 3rd generation Forward Looking Infrared (FLIR) in support of CERDEC program for FCS sensors; and redesign optical devices and explore new nonlinear optical materials. In FY05, applied moving target indicator (MTI) algorithms for force protection applications, collected data for devising change detection algorithms, investigated hyperspectral algorithms for target and personnel detection, implemented a super-resolution technique for ATR applications, and matured a standard dataset and metrics of synthetic targets for classification algorithms. Built, characterized, and evaluated additional components, including mirrors of amalgam composition. In FY06, will investigate advanced force protection concepts and implementations, adapt classification, hyperspectral, and change detection algorithms for various applications, and study the fusion of multi-band IR sensors for target detection; and mature and evaluate magneto-optical and electro-optical switches for fast shuttering of optical systems. In FY07, will design and evaluate fusion algorithms for multi-band IR sensor target detection, integrate advanced multi-target tracking techniques to enhance force protection and adapt ATR methods for multi-modal fusion. Design and evaluate multi-element magneto-optical switches and characterize response time.	2007	3316	4472
- Mature technical underpinnings of ultra wideband (UWB) radar for several key Army requirements including surface and buried mine detection, thru the walls sensing, robotic perception and underground sensing. 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 wide area mine detection, thru the wall sensing and robotic programs. In FY05, characterized synthetic aperture radar (SAR) data from Army mine detection experiments and developed a suite of detection algorithms for prescreening the data. In FY06, implement and evaluate an advanced, affordable UWB radar in support of unmanned ground vehicle (UGV) perception requirements. In FY07, mature advanced thru the wall imaging capabilities consistent with a randomized, distributed array implementation concept.	2528	2711	2681
- Mature Multi Function Radio Frequency System (MFRFS) for use on small ground and air vehicles and future Soldier technologies. Mature 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 munition command guidance for use on small ground and air vehicles. Mature Aluminum-Gallium-Nitride-based semiconductor Ultra Violet (UV) optoelectronics for covert line-of-sight and non-line-of-sight communications and for photo-luminescent detection of bio-threats. Mature models and evaluate networked sensor concepts in support of netted fires to allow dynamic updating of weapons in-flight. In FY05, as part of a risk mitigation strategy, integrated FCS MFRFS prototype antenna. Acquired clutter and target data in evaluating FCS MFRFS antenna performance. Completed data collection for urban clutter environment to support robotic imaging and FCS active protection systems. Investigated enhanced UV emitter efficiency and transitioned this technology into unattended-ground-sensor UV communications experiments and bio-agent detection architecture at Edgewood Chemical and Biological Center(ECBC). In FY06, will implement four channel MFRFS receiver design, and test and demonstrate several FCS waveforms in realistic clutter environment; prototype and demonstrate close in active protection radar; and design RF imaging and collision avoidance radar for robotic perception. Will transition to ECBC, UV emitters with enhanced efficiency into Army bio-sensor R&D programs. In FY07, will develop FCS MFRFS radar model for use in analyzing the radar limitations in adverse environments, and prototype and demonstrate RF imaging and collision avoidance radar for robotic perception. Explore high-brightness active regions for LEDs and lasers operating at wavelengths below 300 nanometers for UV covert communications and bio-agent detection.	2409	2571	2831

- Improve the low echelon commander's situational understanding in complex/urban terrain by maturing infrastructure and validating algorithms, filters and agent technologies to reduce cognitive load by fusing information. In FY05, transitioned web-enabled enhanced service-based tools with integrated organizational capability utilizing autonomous asset management and tactical decision aids that reduce both cognitive load and uncertainty. In FY06, will devise a local fusion node that serves as a host for organic air and ground sensor suites that correlates/fuses the local picture from a suite of highly mobile manned and semi-autonomous sensor nodes within an adhoc networking environment. In FY07, will devise for end-user evaluation an integrated warrior software ensemble that provides multi-media based spot/salute report, semi-autonomous platform control, distributed interaction, video source subscription, capture, annotation, and publication to include GPS/compass based blue force/asset tracking.	2507	2495	2678
Oak Bard	4796	0	0
Total	19662	17462	19457

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
SA2 BIOTECHNOLOGY APPLIED RESEARCH	2638	3599	5669	5546	5796	5911	6029

A. Mission Description and Budget Item Justification: The objective of this project is to support maturing biotechnology, which is being conducted at the Army's Institute for Collaborative Biotechnology (ICB), an University Affiliated Research Center. 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 exploit breakthroughs in biotechnology basic research transitioning from the ICB to enable revolutionary Future Force capabilities in sensors, electronics and photonics. Areas of research include bio-array sensors, biomimetics, proteomics, genomics, DNA research and development, and control of protein and gene expression. Efforts include designing and performing multi-scale dynamic and predictive modeling to understand the biologically-inspired "sense and respond" systems (integrated system of sensor, information processing and response mechanism) and their components. ARL in collaboration with the ICB industry partners will conduct applied research focused on biological sensors and biological power generation. 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 process of transformation requires revolutionary advances in performance of Army weapons systems, including improvements in engineered systems impacting soldier survivability. The ICB will conduct unclassified basic scientific research in: sensors, electronics and information processing, and technical fundamentals enabling development of advanced capabilities in these application areas. 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 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 2005	FY 2006	FY 2007
- Institute for Collaborative Biotechnology - In FY05, identified mature emerging opportunities at the ICB in areas such as bio-molecular based detector arrays for new sensors, biological power sources for reduced logistics demand, and biomimetics and biomimetics processing that led to new electro-optic materials, chemical detectors and multifunctional smart materials. Explored feasibility of microbial fuel cells for low power sensor applications. In FY06, will investigate the use of the biologically-based and inspired sensors and materials to design and fabricate "sense and respond" system components; will devise and experimentally validate a laboratory scale biological sensor, which will be more selective, compact and provide a significantly reduced logistical burden. Evaluate and optimize microbes for use in microbial fuel cells. In FY07, will design breadboards to integrate the components and incorporate biologically-inspired control and networking capability for "sense and respond" systems; will evaluate the biological sensor in a relevant environment and transition to Edgewood Chemical Biological Center and/or Natick Soldier Center. Fabricate laboratory breadboard microbial fuel cells and optimize power output for low power sensor applications.	2638	3599	5669
Total	2638	3599	5669

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
TS1 TACTICAL SPACE RESEARCH	0	0	1550	1600	1650	1700	1750

A. Mission Description and Budget Item Justification: This new project researches and evaluates space-based technologies that will enhance ground capabilities of the Future Force and where feasible, exploit opportunities to enhance the Current Force capabilities. Focus is on space based remote sensor, signal, and information processing technology for space-to-ground applications for advanced intelligence, surveillance and reconnaissance, battle command and communications, target acquisition, position/navigation, threat warning, and space superiority technology for force protection. This space based applied research leverages other DOD space science and technology to support space force enhancement cooperative satellite payload development for advanced technology integration into battlefield operating systems. This includes applied research in persistent intelligence, surveillance and reconnaissance and dedicated communications for in theater high altitude long loiter payload applications. In addition, this project researches and evaluates ground-to-space superiority technologies against remote sensor and communications capabilities, and space object identification and characterization. The cited work is consistent with Strategic Planning Guidance, The Army Science and Technolgy Master Plan (ASTMP), The Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Space and Missile Defense Technical Center in Huntsville, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY07, research and evaluate space-based remote sensing and information processing technologies to conduct space-to-ground intelligence, battle command, and target acquisition applications from small tactical satellites and high altitude long loiter platforms. Evaluate feasibility to leverage other DOD science and technology for space superiority cooperative technology development to counter in theater remote sensing and communications threats.	0	0	1550
Total	0	0	1550

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		47536	39424	32804	33747	34126	34423	34681
47A	AERON & ACFT WPNS TECH	36398	29807	28472	29540	29876	30136	30362
47B	VEH PROP & STRUCT TECH	3904	3999	4332	4207	4250	4287	4319
47C	ROTORCRAFT COMPONENT TECHNOLOGIES (CA)	7234	5618	0	0	0	0	0

A. Mission Description and Budget Item Justification: The Aviation Applied Research Technology program element (PE) conducts research and expands scientific knowledge 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 teaming in 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. These technologies are assessed for their ability to support the long-term sustainability and reduced logistics required of Future Force airframes. Unmanned technologies are directed toward compatibility with the FireScout, the Organic Air Vehicle (OAV), and the Micro Air Vehicle (MAV). 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). Upgrade activities of Department of Defense (DoD) systems such as the AH-64 Apache, UH-60 Black Hawk, CH-47 Chinook; the U.S. Navy SH-60 Seahawk; and U.S. Marine Corps V-22 Osprey, AH-1 Cobra and CH-53 Super Stallion are included in this PE. This PE does not duplicate any efforts within the Military Departments and supports Project Reliance for which the Army is the lead service for the maturation of rotorcraft science and technology. 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 PE is performed by the Aviation and Missile Research, Development and Engineering Center, Redstone Arsenal, AL and the Army Research Laboratory, Adelphi, MD, with facilities located at Fort Eustis, VA; Ames Research Center, Moffett Field, CA; Glenn Research Center, Cleveland, OH; and Langley Research Center, Hampton, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	47780	34295	32370
Current BES/President's Budget (FY 2007)	47536	39424	32804
Total Adjustments	-244	5129	434
Congressional Program Reductions		-174	
Congressional Rescissions		-397	
Congressional Increases		5700	
Reprogrammings	-244		
SBIR/STTR Transfer			
Adjustments to Budget Years			434

Four FY06 Congressional adds totaling $5700 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1200) Aircraft Structural Condition Monitoring (ASCM) for Diagnostics and Prognostics
($2500) Center for Rotorcraft Innovation
($1000) Composite Small Main Rotor Blades
($1000) Mono Tiltrotor Scaled Demonstrator

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
47A	AERON & ACFT WPNS TECH	36398	29807	28472	29540	29876	30136	30362

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 involve technology applicable to all aviation platforms, with a focus on unmanned aerial vehicle (UAV) systems, manned and unmanned teaming, and opportunities for application on manned systems. These system technologies will provide enhanced rotor efficiencies, improved survivability, increased structure and airframe capability, improved engine performance, improved sustainability, improved mission avionics performance, and reduced cost of unmanned and manned aerial vehicles. This project supports the National Rotorcraft Technology Center (NRTC), a partnership of government, industry and academia. The propulsion component technologies investigated in this project will provide improved specific fuel consumption, horsepower to weight ratios, and operation and support (O&S) cost savings for manned and unmanned Future Force systems. These engine component technologies address engine needs for future UAVs with up to a 50% endurance and 30% payload increase over currently available turbine engines. These component technologies will also enable engine demonstrations for manned systems, providing a 33% increase in payload and a 50% reduction in fuel consumption for the CH-47 Chinook; and an 80% payload increase and a 20% combat range increase for future rotorcraft. 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 survivable re-route decision aiding systems. Advanced active controls, aerodynamics, handling qualities, and smart materials (materials that respond to specific stimuli) technologies will 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. This project leverages work accomplished in collaboration with the National Aeronautics and Space Administration (NASA) and is being adjusted to compensate for severe reductions in rotorcraft activities in NASA's Aeronautics program. Technologies researched within this project will transition to advanced technology development programs with application to future, as well as current, Army / DoD rotorcraft systems. 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 Aeroflight Dynamics Directorate of the Aviation and Missile Research, Development and Engineering Center (AMRDEC), located at the NASA Ames Research Center, Moffett Field, CA, the NASA Langley Research Center, Hampton, VA, and the Aviation Applied Technology Directorate, Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
National Rotorcraft Technology Center (NRTC) - In FY05, design and develop, then test component technologies that enable rotorcraft performance improvement, limited authority flight control, damage tolerance, and rotorcraft transmission advances. In FY06, design, develop and test components in the areas of damage tolerance of materials, rotorcraft integrated analysis and design, advanced transmission technologies, health monitoring technology, rotor load prediction analysis, and gear noise reduction technologies. In FY07, will design and develop, then test component technologies that enhance manned and unmanned rotorcraft capabilities using active rotor controls, intelligent flight controls, smart composite structures, advanced manufacturing technologies, and advanced subsystem technologies.	6704	7190	7501

Rotor Technology [Includes the Low Cost Active Rotor (LCAR) program and the Lightweight Active Rotor Concept (LARC) program] - In FY05, integrated selected candidate lightweight rotor and hub concepts for application of on-blade control and began integrated concept subsystem tests. In FY06, start fabrication of Mach-scale model rotor blades and complete model subsystem tests. In FY07, will complete model blades for the LARC rotor and begin evaluation of on-blade primary flight control.	3783	4147	4224
Manned / Unmanned Rotorcraft Enhanced Survivability - In FY05, constructed a database of threat sensors, multi-spectral signatures, and clutter and jammer effects and demonstrated real-time threat lethality predictor, with and without jamming, in 3-dimensional terrain environment. In FY06, integrate intelligent decision aid agent to provide cueing for 'what to do' given threat array and integrate intelligent decision aid agent, along with cooperative/collaborative behaviors, to provide cueing for the manned / unmanned team to respond as a team, and not just as individual platforms. In FY07, will demonstrate the Survivability Planner Associate Re-Router (SPAR) system software on manned and unmanned mission management simulators and will integrate SPAR into existing manned and unmanned air vehicle mission management simulation systems and demonstrated.	3795	4032	4108
Structures and Airframe - In FY05, validated and disseminated improved loads determination tools that are 25% more accurate; conducted bench tests on smart re-configurable airframe and rotors structures; continued efforts to standardize (Joint Service) test methods for durability and damage tolerance certification / qualification of composite structures; demonstrated field and depot level advanced composite airframe inspection and repairs; and evaluated conceptual re-configurable panels, blades and self-healing structures. In FY06, generate and evaluate structures that incorporate ballistic protection and survivability features and evaluate and mature concepts that are self-sensing and self-healing (smart parts). In FY07, will validate Mode III and Mixed-Mode (II & III) fracture mechanics failure modes and test methods to support Durability and Damage Tolerance (D&DT) certification methodology for composite structures and will generate technologies to reduce structural integrity uncertainty for lower load factors on airframes/rotors.	2335	2315	2404
Small Heavy Fuel Engine (SHFE) - In FY05, completed rig-test of 700 horsepower compressor for improved performance; completed fabrication and evaluated advanced foil bearing components for weight and cost reduction; and continued fabrication of 700 horsepower class ceramic turbine hardware for improved performance and reduced weight. In FY06, complete design of advanced ceramic matrix composite power turbine for improved performance with reduced weight; mature advanced foil bearing via rig-test to validate weight and cost reduction; and complete fabrication and conduct rig-test of 700 horsepower class ceramic turbine to validate improved performance and reduced weight. In FY07, will complete fabrication and conduct test of advanced ceramic matrix composite power turbine blades to validate improved performance and reduced weight and will complete design of advanced technology combustors for reduced engine weight and cost.	1431	977	1391
Network Operations and System Integration [Includes the Precision Automated Landing Adaptive Control Experiment (PALACE), Handling Qualities & Flight Controls (HQ&FC) Intelligent Control Concepts, and Advanced Rotary Wing Concepts]. PALACE - In FY05, completed full mission simulation of UAV autonomous landing with computer vision-based guidance and flight-evaluated autonomous site selection, descent, and landing in a cluttered environment, without GPS, on a Yamaha RMAX rotorcraft UAV. HQ&FC Intelligent Control Concepts - In FY06, low-altitude 3D navigation through obstacle field using laser radar and stereo cameras and apply advanced control law analysis tools using the RASCAL in-flight simulator for the UH-60M upgrade program. In FY07, will validate closed-loop individual blade control (IBC) with full-scale wind tunnel test; will complete UH-60 Black Hawk flight test with external load stabilization devices allowing increased speed envelope for aerodynamically active sling loads; and will complete piloted simulation and human factors evaluation of multi-UAV operator interface and control techniques. Advanced Rotary Wing Concepts - In FY05, completed characterization of rotary wing UAV platform vibration environment and data link latency issues in order to address stabilization and other system performance characteristics to achieve precision engagements. In FY06, initiated integration of advanced targeting and stabilization technologies to provide a precision attack capability for rotary wing UAVs. In FY07, will conduct flight test	5895	6319	6555

demonstrations of precision attack capability from test bed UAV under airborne control from a manned aircraft.			
Unmanned Collaborative Operations [Includes Part 1 of the Unmanned Autonomous Collaborative Operations (UACO) program (Part 2 of UACO is under 63003/313) and Digital Situational Awareness Testbed]. UACO - In FY05, developed three competitive preliminary designs for control of vehicle, mission equipment, and flight management architectures of multiple UAVs; initiated maturation of autonomy and collaboration technologies; and worked with other Government agencies to interface behaviors into a synthetic environment for future independent assessment and evaluating/collection of metrics. In FY06, conduct simulation demonstrations at contractor and government facilities, and flight test the best of the three designs for autonomous collaborative UAV behaviors using multiple small UAVs. Digital Situational Awareness Testbed - In FY05, completed piloted simulation and human factors evaluation of control of multiple UAVs from a manned cockpit. In FY06, evaluated candidate controls/displays for control of multiple UAVs with varying mission requirements. In FY07, will develop guidelines for control of multiple UAVs from a single station (either airborne or ground).	12455	4827	2289
Total	36398	29807	28472

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
47B	VEH PROP & STRUCT TECH	3904	3999	4332	4207	4250	4287	4319

A. Mission Description and Budget Item Justification: The Vehicle Propulsion and Structure Technology project investigates engine, drive train and airframe 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. The 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 inability to design for acceptable reliability and durability with current tools, 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. The 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. The structures research is focused on the effects of aerodynamic loads, aeroelastic interactions, integrated composites, structural integrity, low cost manufacturing and crashworthiness that will provide improved rotor and airframe structure subsystems. 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) located at facilities at the NASA Glenn Research Center, Cleveland, OH and the NASA Langley Research Center, Hampton, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Rotor & Structure Technology [Includes the Survivable, Affordable, Repairable Airframe Program (SARAP), and the Lightweight Active Rotor Concept program] - In FY05, validated reliability-based design methods, durability and damage tolerance analysis methods, lightweight crashworthy concepts, and advanced Non-Destructive Evaluation (NDE) methods in support of SARAP and completed wind-tunnel demonstration of a new lightweight and stable heavy lift tiltrotor concept. In FY06, conduct wind-tunnel tests on a Quad-Tiltrotor model; conduct hover experiments on an advanced active-twist rotor system using the AH-64 Apache as baseline; and evaluate reliability, durability and damage tolerance for tailored and multi-functional composite structures. In FY07, will conduct wind-tunnel test in cooperation with Bell Helicopter to evaluate new heavy lift tiltrotor hub design and will develop multi-functional structural concepts and design tools to reduce ballistic vulnerability for airframes applicable to heavy lift rotorcraft.	1946	1581	994
Propulsion & Drive Train Technology [Includes the Rotorcraft Drive System for the 21st Century (RDS21) program and the Small Heavy Fuel Engine (SHFE) program]. RDS21 - In FY05, conducted experiments and computer simulations of active stall control technologies to extend stable engine operation and investigated autonomous propulsion system technology for future Unmanned Aerial Vehicle (UAV) propulsion control and operation. In FY06, demonstrate and validate active stall control technology. In FY07, will define 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. SHFE - In FY05, performed laboratory endurance tests of face gears to evaluate strength and	1958	2418	3338

durability. In FY06, evaluate environmental and thermal barrier coatings for silicon nitride turbine nozzles; complete full-scale rig testing and analysis of the lubrication and thermal behavior of high-speed rotorcraft helical gears to allow operation for 30 minutes after loss-of-lubrication supply; and perform rotor-dynamic tests of an oil-free foil air bearing technology that will reduce engine maintenance costs by 50% and weight by 15%. In FY07, will evaluate heavy-fuel concepts for potential fuel cell applications; will complete performance and endurance tests of innovative non-contacting air-to-air seal technology for military helicopter and UAV class engines; and will demonstrate and test a low conductivity thermal barrier coating system.			
Total	3904	3999	4332

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602270A - EW TECHNOLOGY**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		19694	29305	19218	16539	16635	16782	16911
442	TACTICAL EW TECHNOLOGY	11099	11380	11604	9477	9532	9614	9685
475	ELECTRONIC WARFARE COMPONENT TECHNOLOGIES (CA)	2108	10449	0	0	0	0	0
906	TAC EW TECHNIQUES	6487	7476	7614	7062	7103	7168	7226

A. Mission Description and Budget Item Justification: This Program Element (PE) researches and investigates electronic warfare (EW) technologies that will 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 will be 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 improvised explosive devices (IED's). Project 442 funds efforts related to research, investigation, 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 SA, targeting, and combat identification. Information fusion research will address sensor data reduction 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 0603270 (EW Technology), PE 0602120 (Sensors and Electronic Survivability), PE 0603772 (Advanced Tactical Computer Science and Sensor Technology), PE 0602783 (Computer and Software Technology), and PE 0602784 (Advanced Concepts and Simulation). Project 475 funds Congressional special interest efforts. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is this PE is related to and is fully coordinated with efforts funded in PE 0603270A (EW Technology). Work is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	19703	19129	19075
Current BES/President's Budget (FY 2007)	19694	29305	19218
Total Adjustments	-9	10176	143
Congressional Program Reductions		-129	
Congressional Rescissions		-295	
Congressional Increases		10600	
Reprogrammings	-9		
SBIR/STTR Transfer			
Adjustments to Budget Years			143

Five FY06 Congressional adds totaling $10600 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1400) GLADVID for Force Protection
($4000) Silver Fox UAV
($2800) Silver Fox Unmanned Aerial Vehicle
($2000) Subterranean Target Indentification
($1400) Xenon Light Source for Non Lethal Deterrence from Small UAVs

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602270A - EW TECHNOLOGY**	**442**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
442 TACTICAL EW TECHNOLOGY	11099	11380	11604	9477	9532	9614	9685

A. Mission Description and Budget Item Justification: This project researches, investigates and applies electronic warfare technologies to enhance the survivability capabilities of ground combat vehicles, aircraft and the dismounted soldier. The survivability approach will provide detection avoidance through signature management and hit avoidance using warning receivers and electronic countermeasures. This project will apply recent advances in radio frequency (RF), infrared (IR) and electro-optical (EO) sensor and jamming sources to detect, locate, deceive and jam Improvised Explosive Devices (IEDs), 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 IEDs will be researched 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 will research EO technologies and countermeasures technologies against laser-aided and electro-optically directed gun or missile systems. A substantial amount of work will be accomplished under The Technical Cooperation Program (TTCP) Electronic Warfare Systems (EWS) Panel and cost sharing under project arrangements with the United Kingdom (UK) and Australia. Finally, this project will look at those Electronic Support (ES) technologies used against non-communications signals for targeting and tactical Situation Awareness (SA).

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Electronic Support for the Future Force: This effort researches technologies to collect, identify, locate, and track hard to detect communications emitters on the battlefield that are otherwise unavailable through space, airborne, or other assets. This will provide full spectrum electronic collection and mapping for the Future Force. In FY05, developed and provided advanced simulation capability to refine the operational utility of Unmanned Ground Vehicle (UGV) and Unmanned Aerial Vehicle (UAV) signals intelligence sensors in the Mounted Maneuver Battlespace Lab at Fort Knox and continued sensor, antenna, and receiver design efforts. In FY06, evaluate UAV and UGS electronic support measures in a warfighter operational environment that demonstrates real time collection, identification and location with sensor data fusion.	3300	1000	0
- Reconnaissance and Defeat of Improvised Explosive Devices: In FY05, collaborated with other U.S. and foreign government agencies on threat and countermeasure techniques; conducted deception and jamming technique research; investigated modeling and simulation hardware and software; expanded the investigation and conducted field-testing of countermeasures against RF and IR links for detonation of booby traps; assessed potential for embedding the countermeasure capability in near term systems. In FY07, investigate unique wave forms for detection of remote controlled improvised explosive devices. Work on this effort is also being accomplished under PE/Project: 62270/906; 63270/K16.	4100	0	749
- Suite of Sense Through the Wall Systems (STTW) for the Future Force: This effort will provide users with the ability to detect visibly obscured targets up to the objective stand off distance, operate on the move, accurately geo-locate targets in the presence of clutter with an	2699	3420	3497

intuitive user interface. In FY05, investigated technologies for concealed weapons detection/concealed explosives detection (CWD/CED); developed and refined techniques for detection of stationary personnel through light construction materials; integrated prototypes with emerging network communications architectures to demonstrate transmission of STTW data on a real time basis; evaluated data transmission, dissemination, and software tools; provided STTW performance model for incorporation into Battle Lab and Future Force Warrior (FFW) operational modeling & simulation. In FY06, conduct lab and user testing of STTW prototypes; utilize experiments to develop tactics, techniques, and procedures and characterize through demonstration urban and complex terrain phenomenology. In FY07, will begin development of integrated personnel detection/CWD/CED systems with greater standoff capability and increase probability of detection; will conduct lab testing of individual STTW sensors against multiple wall types, and formulate techniques for detection of stationary personnel through multiple wall types; will demonstrate hand held STTW prototype with the FFW ATD.			
- Fusion Based Knowledge for the Future Force: In FY05, developed scenarios, constructed data sets, and identified metrics, to conduct a pilot experiment for assessing fusion tools needed to answer commander's priority intelligence requirements (PIRs). In FY06, use software technologies to represent knowledge needed to logically link multiple, diverse sources of data to answer the commander's PIRs. In FY07, will complete process of acquiring knowledge from analysts and implementing in fusion reasoning software, and finalize refinements to software for representing knowledge and reasoning for answering PIRs.	1000	1000	3165
- Next Generation Electronic Warfare Technology for Survivability: In FY06, evaluate candidate technologies to provide full dimensional protection from electro-optic/ infra-red (EO/IR) guided man-portable weapons systems for ground and airborne platforms; design, study, and evaluate multiband laser countermeasure; investigate photonic gap multiband optical fibers and multi-wavelength beam switching, beam steering and pointing devices. In FY07, will initiate hardware-in-the-loop EO/IR countermeasure exploitation/evaluation of next generation EO/IR threats; will design and develop photonic gap multiband optical fibers, beam switching, beam steering and pointing devices.	0	2000	2000
- Cueing Sensor: The purpose of this effort is to develop a cost effective, reliable threat warning and cueing sensor to protect ground vehicles from rocket propelled grenades, tank fired kinetic energy and high explosive anti-tank rounds and antitank guided missiles. In FY06, develop and demonstrate software algorithms for hardware implementation of the on-the-move frame registration, clutter suppression, specific threat classification for the active protection system cueing sensor; investigate focal plane arrays with required array uniformity, operability, sensitivity in the desired spectral bands. In FY07, will develop and optimize threat classification algorithms and signal processing for the active protection system cueing sensor. Work on this effort is also being accomplished under PE/Project 62120/H15; 63270/K16; 63772/243.	0	3960	2193
Total	11099	11380	11604

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602270A - EW TECHNOLOGY**	**906**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
906 TAC EW TECHNIQUES	6487	7476	7614	7062	7103	7168	7226

A. Mission Description and Budget Item Justification: This project researches 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 will contribute 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 will enable 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 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 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 2005	FY 2006	FY 2007
- Electronic Support for the Future Force (ESFF) & Networked Sensors for the Future Force (NSfFF): This effort researches and investigates EW sensors and electronics signal processing technologies. In FY05, researched ESM/SIGINT system capabilities that will operate in unmanned networked environments to detect tactical RF transmissions that can support the movements of the Future Combat Systems warfighters; investigated the ability to integrate the unmanned ESM/SIGINT sensor systems with Networked Sensors for the Future Force ATD communications equipment. In FY06, develop ESFF sensor model; integrate ESM/SIGINT algorithms into ground sensor systems; field test ground sensor systems and demonstrate UAV ESM payload prototype in a warfighter operational environment that demonstrates real time collection, ID and location with sensor data fusion.	4123	5184	0
- Information Operations: In FY05, identified and tested network analysis and data recognition techniques for RF emission, geolocation and virtual address locations in a lab environment. In FY06, develop and investigate adaptive/smart antenna processing techniques to enhance baseline information operations system. In FY07, will collect target vulnerability data, working with various members of the intelligence community; will continue development of adaptive array processors for use in a tactical setting, to counter problems associated with multipath, co-channel and co-site interference that plague current systems, and to provide a precise geolocation capability; will leverage broadband antenna work performed under the Tactical SIGINT Technology program. Work on this effort is also being accomplished under PE 63270 Project K15.	2364	700	4903
- Fusion Based Knowledge for the Future Force: In FY06, conduct experiments and demonstrations to show software architectural capabilities to rapidly develop and maintain multiple interpretations and associated confidence levels to answer commander's priority intelligence requirements; identify requirements and construct initial information agents to support intelligence retrieval of information	0	892	1120

from diverse data sources. In FY07, will finalize development activities of software architecture capabilities and assess its utility to more rapidly develop highly plausible interpretations as answers to commanders' priority intelligence requirements.			
- Reconnaissance and Defeat of Improvised Explosive Devices: In FY06, investigate novel Radio Frequency (RF) probing and other techniques for detection, location and selective neutralization of Improvised Explosive Device (IED) triggering devices; conduct transmitter study to determine the feasibility of a common transmitter for both electronic countermeasures and signal detect/geolocation functions; investigate the effects of RF energy on electronic triggers for remotely controlled (RC) and non-RC IEDs and measure the power/modulation required to dud or otherwise neutralize selected devices; survey existing RF transmitters and antenna technology to meet requirements and identify gaps. In FY07, will develop counter IED prototypes, including unique waveforms, antenna, high sensitivity receiver, and high power transmitter for IED detection and neutralization. Work on this effort is also being accomplished under PE/Project: 62270/442; 63270/K16.	0	700	1591
Total	6487	7476	7614

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		79358	90712	59439	54951	43410	39310	37611
214	MISSILE TECHNOLOGY	33339	44185	47849	54951	43410	39310	37611
223	AERO-PROPULSION TECHNOLOGY	28267	11336	0	0	0	0	0
G02	Army Hypersonics Applied Research	8745	13012	11590	0	0	0	0
G04	AIR DEFENSE TECHNOLOGIES (CA)	1342	4830	0	0	0	0	0
G05	MISSILE TECHNOLOGY INITIATIVES (CA)	958	13899	0	0	0	0	0
G06	UNMANNED SYSTEMS TECHNOLOGIES (CA)	6707	3450	0	0	0	0	0

A. Mission Description and Budget Item Justification: This applied research Program Element (PE) researches and investigates advanced technologies for missiles, rockets, and launch systems for use in the Future Modular Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The overall objectives of the PE are to increase the survivability of launch systems; provide greater lethality and effectiveness under adverse battlefield conditions; increase kill probabilities against diverse targets; and provide powerful new simulation and virtual prototyping analysis tools. A major cross-cutting theme is developing missile technology that is 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 research to help solve the insensitive munitions requirements for missiles, hypersonic/hypervelocity missile efforts, and the maturation of a common high-gravitational force (high-g), low cost, Micro Electro-Mechanical System (MEMS) Inertial Measurement Unit (IMU). The goal of the high-g MEMS IMU program is to design and mature affordable, reliable precision guidance components for missiles and guns at a significantly lower unit cost than current systems. In addition, the performance and small packaging goals will enable the components to meet the requirements of 90% of DoD guided munitions and missiles. The performance goal is develop and demonstrate an IMU capable of providing the 1.0 deg/hr gyro bias (drift rate) needed to maintain accurate position reference during a typical tactical missile or gun flight profile without reliance on the Global Positioning System (GPS) and survive the gun-launch environment (20,000g's). A second objective of the high-g, low cost MEMS program is to design a deeply-integrated guidance and navigation unit (DIGNU). The DIGNU effort will develop and demonstrate an IMU or Inertial Sensor Assembly (ISA) with the same requirements of the initial program but with an additional "deeply-integrated" or "deeply-coupled" GPS military receiver. The GPS receiver incorporates a single microprocessor architecture and integrated hardware within a Selective Availability and Anti-Spoofing Module (SAASM) and software anti-jam (AJ) capability. The deliverable DIGNUs will be packaged in a volume of less than four cubic inches and will use a single microprocessor to absorb the mission computer processing functions found in 90% of all DoD guided munitions and missiles. The high-g MEMS IMU program is a joint project between the Armament Research, Development and Engineering Center, and Aviation and Missile Research, Development and Engineering Center. The MEMS IMU effort is funded by a combination of applied research funding, in this PE, and manufacturing technology funding, in PE 0708045A (Industrial Preparedness). Another major thrust in the PE is to research and investigate small, lightweight force protection technologiesy 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 will investigate and develop the interceptor and fire control technologies necessary to provide the Future Force with an active defense against Rockets, Artillery, and Mortars (RAM).. In addition, the Smaller Lighter, Cheaper (SLC) effort focuses technology to reduce the cost and logistics burden of precision munitions. Through innovative application of technology in concert with more efficient production and integration processes, this program's goal is to reduce the cost per kill of precision guided missiles and munitions. The Army Hypersonics Applied Research program explores and matures the critical technologies required for expendable hypersonic/hypervelocity missiles and hypersonic threats. This PE contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan

(ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	82781	62524	65801
Current BES/President's Budget (FY 2007)	79358	90712	59439
Total Adjustments	-3423	28188	-6362
Congressional Program Reductions		-4898	
Congressional Rescissions		-914	
Congressional Increases		34000	
Reprogrammings	-3423		
SBIR/STTR Transfer			
Adjustments to Budget Years			-6362

FY 07 decrease of -6.4 million attributed to realignment of funding to higher priority requirements
Nine FY06 Congressional adds totaling $34000 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1400) Cruise Missile Defense Via Passive RF Detection
($3500) Enhanced Area Protection and Survivability (EAPS)
($2500) LENS X Hypervelocity Ground Testing
($9000) MARIAH II Hypersonic Wind Tunnel Development
($2100) Nanoscience Initiative for Next Generation Missiles
($1500) Near Hermetic Packaging and Interconnection Technology
($2100) Red Rain
($8400) Unique Waveform Based Missile Technologies for Horizontal Integration and IED Detection
($3500) Unmanned Systems Initiative at AMRDEC

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
214 MISSILE TECHNOLOGY	33339	44185	47849	54951	43410	39310	37611

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 the Future Combat Systems (FCS) and 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 in the efforts in this project is developing Smaller, Lighter weight, and Cheaper (SLC) missile technology to reduce the cost and logistics burden of precision munitions. Research objectives are to enhance the survivability of launch systems, provide greater effectiveness under adverse battlefield conditions, increase kill probabilities against diverse targets, and provide powerful new simulation and virtual prototyping analysis tools. The major effort in this project is the high-gravitational force (high-g), low cost Micro Electro-Mechanical Systems (MEMS) Inertial Measurement Unit (IMU) program. The Army is the Service lead in the investigation of low-cost MEMS IMUs capable of supporting precision guidance requirements of DoD's missile and gun launched precision munitions programs. The MEMS IMU effort is funded by a combination of applied research funding, in this PE, and manufacturing technology funding, in PE 0708045A (Industrial Preparedness.) This is a joint program with the Armament Research, Development and Engineering at Picatinny Arsenal. A second objective of the high-g, low cost MEMS program is to develop a deeply-integrated guidance and navigation unit (DIGNU). The DIGNU effort will develop and demonstrate an IMU or Inertial Sensor Assembly (ISA) with the same 1.0 deg/hr, and greater than 20,000 g's survivability requirements of the initial program with an additional "deeply-integrated" or "deeply-coupled" GPS military receiver incorporating a single microprocessor architecture and integrated hardware within a Selective Availability and Anti-Spoofing Module (SAASM) and software anti-jam (AJ) capability. The Smaller Lighter, Cheaper (SLC) effort focuses on technology to reduce the cost and logistics burden of precision munitions. Through innovative application of technology in concert with more efficient production and integration processes, this program's goal is to reduce the cost per kill of precision guided missiles and munitions. Guidance Electronics Miniaturization and Structronics (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 apply structronics technologies to the electronics substrate such that the substrate becomes the chassis, wiring harness, and printed wiring board for the electronics. Each of these elements will be incorporated into a series of Integrated Guidance Units (IGU's) which will consist of a guidance computer and an inertial measurement unit. This project 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 three 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. Also included in this project is the Extended Area Protection and Survivability (EAPS) program, which is an effort to develop the technology necessary to provide the Future Force an active defense capability against rockets, artillery, and mortars (RAM). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- High-G Micro-electromechanical Systems (MEMS) Inertial Measurement Unit (IMU) - High-G MEMS IMU - In FY05, performed test and evaluation on the Phase 2 IMUs. The Phase 2 IMUs have been tested to meet the following parameters: gyro bias less than 20 deg/hr, volume less than four cubic inches, acceleration bias less than four milli-g's, and gun-hardened to 20,000 g's. Laboratory characterization tests have been performed on software selectable spin rates: a four Hz roll rate version required for missiles and a 20 Hz roll-rate version	9235	13961	5000

required for munitions; performed additional electronics miniaturization to reduce the volume of the IMU to four cubic inches; improved digital IMU electronics design; and performed missile flight tests with the Phase 2 IMUs. Evaluated contractor performance and progress and down-selected from two vendors to one. In FY06, use advanced die packaging techniques to support miniaturization of IMUs to less than four cubic inches volume; incorporate out-of-plane gyros and in-plane accelerometers or other novel sensor packaging strategies to get to smallest possible IMU volume; develop die attach methods, develop a new design process for Application-Specific integrated Circuits (ASICs), design a new internal isolator and integrate the gyro, accelerometer, and microprocessor functions in a single IMU to improve signal isolation. Perform test and evaluation on the early Phase 3 IMUs. In addition, redesign the vibration isolation system for the modified mass and diameter to address the 20,000 g. launch environment. This will require a board stiffness redesign with emphasis on high yield and low cost for the IMU. In FY07, will perform test and evaluation on the final Phase 3 IMU deliverables. Increase built-in-test capabilities, iterate IMU design to get improved performance under vibration, iterate gyro and accelerometer design to handle canard shock, improve processes to increase sensor yields and increase automation of test and calibration			
- High-G Micro-electromechanical Systems (MEMS) Deeply Integrated Guidance and Navigation Unit (DIGNU). In FY05, performed test and evaluation of the DIGNU1s developed under FY04 Congressional add. The DIGNU1s have been tested to meet the following parameters: gyro bias less than 75 deg/hr, volume less than 28 cubic inches, acceleration bias less than nine milli-g's and gun-hardened to 10,000 g's. Field tested DIGNUs to evaluate performance in actual live-sky GPS conditions. Ensured GPS data input to the DIGNU and measured IMU hardware synchronization with live sky GPS information to evaluate DIGNU Anti-Jam performance. In FY06, mature the deep integration algorithms. Address performance issues identified during live field tests with redesign to improve performance. Support missile flight tests with the development, laboratory test and evaluation of the Phase 2 DIGNUs. Test DIGNU2s to meet the following parameters: gyro bias less than 20 deg/hr, volume less than 12 cubic inches, acceleration bias less than four milli-g's and gun-hardened to 15,500 g's. Perform field tests on the DIGNU2 to determine GPS/INS/anti-jam capability; mature and further miniaturize internal anti-jam capability; test application platform interface software and finalize commonality requirements between the units from the two contractors; test G-operational requirements and expanded temperature range requirements for the DIGNU2 products. In FY07, will perform field tests and laboratory characterization on DIGNU3s including anti-jam capability; will further miniaturize the anti-jam module, modify and retest any issues identified during testing of DIGNU2 and perform test and evaluation on the DIGNU3s. The DIGNU3s will be tested against the following parameters: gyro bias less than one deg/hr, volume less than five cubic inches, acceleration bias less than one milli-g, greater than 90 db J/S and gun-hardened to 20,000 gs.	4000	5400	4664
- Smaller, Lighter, Cheaper (SLC) Tactical Missiles. - SLC focuses technology to reduce the cost and logistics burden of precision munitions. Through innovative application of technology, this program's goal is to reduce the cost per kill of precision guided missiles. In FY05, performed assessment of current and future precision guided missile capabilities and gaps. Matched innovative component technology and/or new weapon concepts to both reduce the cost per kill for precision weapons and, where needed, to fill gaps with a new capability. In FY06, initiate efforts with industry to design identified components for reduced cost per kill (e.g. seekers, warheads, guidance electronics). Utilize state-of-the-art System-in-a-Package technology to miniaturize seeker electronics by 80%. Facilitate upgrade of existing seeker to improve range performance from 2.5 km to 4.0 km. Complete trade studies, initial warhead design, effects modeling, and lethality assessment for a multi-purpose warhead that effectively defeats armor, fortified structures and personnel, is insensitive munition compliant, and scalable for TOW, Javelin, Hellfire, PAM, and UAW. This warhead will provide the soldier with a one-round-does-it-all capability while reducing ammunition weight, stowage space, logistics burden and supply chain management. In FY07, will finalize the seeker electronics design, fabricate the electronics first article, and test in a hardware-in-the-loop environment. Will complete the warhead design and perform testing against armor, fortification and simulated personnel targets. Will partner with DARPA to develop and evaluation the Close Combat Lethal Recon (CCLR) system, a three 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. Will	500	1500	5900

establish detailed design of the warhead, safe and arm device, and complete development of the handheld viewer software.			
- Missile Guidance Systems and Seeker Technology. - In FY05, matured controlled arrays of MEMS sensors to provide full dynamic performance ranges, designed geometry transformations for rapid retraining of automatic target recognition (ATR) systems, evaluated infrared (IR) counter-counter measures (CCM) guidance algorithms in a seeker; matured concepts for advanced uncooled IR seeker and sensor hardware; designed, matured, and tested advanced optics, signal processing, guidance and control techniques and conducted captive carry tests of prototype uncooled seeker. Built a prototype Integrated Guidance Unit (IGU) based on proven design. In FY06, integrate uncooled IR prototype hardware with advanced guidance and control signal processing techniques; demonstrate RF and optical phase shifters for phased arrays for tactical seekers via laboratory tests. Perform lab test of damaging laser infrared-counter measure (IRCM) threats to optical components. Spiral stackable substrates and chip scale packaging into the Block 1 Integrated Guidance Unit (IGU). Build, test and compare to baseline IGU design. In FY07, will evaluate uncooled IR concepts and demonstrate prototype configurations, fabricate and test a passive phased sub-array from optical phase shifters and initiate transition of the technology. Will integrate damaging IRCM algorithms and optics in a seeker and perform hardware-in-the-loop testing. Will spiral in die stacking and die thinning into the Block 2 IGU and build, test and compare to baseline IGU design.	9640	9045	13269
- 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 FY05, continued development of techniques for modeling target signatures and backgrounds as perceived by laser radar (LADAR) sensors; completed initial software design and implementation for Phase I of real-time improved control of simulation facilities; applied low frequency radar cross-section (RCS) codes to specific ground targets. Characterized aerodynamics for non-cylindrical and non-typical missile configurations. Implemented new power-on base drag methods in simulation. In FY06, apply LADAR target signature modeling to specific targets and backgrounds; complete the design of real-time simulation control software. Extend aerodynamic predictive techniques by validation with detailed measurements. In FY07, will integrate LADAR, passive IR and visible scene generation techniques on personal computer (PC) hardware; will integrate real-time simulation facility software control to all types of facilities. Will refine and assess aerodynamic prediction methods to maximize benefits from advances in computational power and capabilities. Will investigate novel aerodynamic control methods unique to smaller, lighter, more affordable missiles.	2710	1855	4227
- Smart, Stealthy, Smokeless Missile Propulsion, Smart Structures and Enhanced Lethality. - In FY05, completed design, fabrication and demonstration of self-regulating spring assembly and squib actuation in variable-area-nozzle (VAN) brassboard hardware. Performed tandem warhead integration and performance testing of advanced compact shaped charge with fragmenting body design. Tested warhead Insensitive Munitions design features and additional thermobaric fills. Investigated various fragmentation methods, materials and penetration studies against various classes of targets. Developed Lethality Design Tool Set to characterize system effectiveness against various targets. In FY06, design, fabricate and static test integrated spring assembly actuator and VAN concept in a system configuration. Mature integration of compact shaped charge warhead with enhanced fragmentation design features into a tandem system concept. Will demonstrate the addition of thermobaric explosive to enhanced lethality of warhead sub-system. In FY07, will complete testing of VAN and update design concepts. Will complete subsystem integration test in order to demonstrate projected increase in performance and decrease in sensitivity of the motor. Will demonstrate a combined effects compact warhead integrated into a tandem warhead missile system against a target set. Will investigate and evaluate the integration of warhead concepts in missile systems.	4154	4061	6226
- Insensitive Munitions Research - In FY05, completed formulation research and identified and evaluated controlled motor case venting techniques and candidate materials for lightweight barriers. In FY06, conduct ballistic/aging studies on new less shock sensitive minimum smoke formulations and new formulations; evaluate lightweight barrier concepts, and demonstrate motor case venting concept. In FY07, will evaluate existing and new energetic ingredients for insensitive munition beneficial characteristics; will conduct formulations studies	1100	1100	1300

for emerging oxidizers, thermal additives, and nitramine replacements; and will apply emerging materials/concepts to canister/case design.			
- Defense Against Rockets, Artillery and Mortars (RAM) - Interceptor Development. - In FY05, matured interceptor concepts, established interceptor best technical approaches, and developed a draft interceptor specification. In FY06, begin the design and development of critical supporting component interceptor technologies, including lethal mechanism, propulsion and low cost guidance and control mechanisms. In FY07, will begin the component fabrication and bench and field-testing of critical lethality, propulsion, and guidance and control technologies.	1000	4000	4500
- Defense Against Rockets, Artillery and Mortars (RAM) - Fire Control and Systems Architecture - Investigates fire control components and the integration of the fire control and interceptor technologies into a robust system architecture. In FY05, matured fire control sensor, acquisition and tracking concepts; established the best technical approaches; developed a draft fire control specification; developed draft system architectures integrating the fire control and interceptor technologies; and demonstrated the operational utility of the system architectures through constructive and force-on-force simulations. In FY06, begin the development and demonstration of critical supporting component fire control technologies, including acquisition and tracking sensors and decision algorithms. In FY07, will begin fabrication and bench and field test critical acquisition and tracking sensor components and decision algorithm technologies.	1000	3263	2763
Total	33339	44185	47849

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602303A - MISSILE TECHNOLOGY**	**G02**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
G02	Army Hypersonics Applied Research	8745	13012	11590	0	0	0	0

A. Mission Description and Budget Item Justification: This project focuses on the research and investigation of the critical technologies required to mature expendable hypersonic/hypervelocity missiles and to defeat hypersonic threats. Focus areas include: hypersonic/hypervelocity aerodynamic prediction tool development; engine component design; active and passive cooling mechanisms; turbulent mixing enhancement at low Reynolds numbers; computational fluid dynamic code development and validation and high yield, storable fuel grains. Initial efforts will focus on concept maturation of Hypersonic/hypervelocity enabled missiles and guided interceptors to defeat hypersonic threats to enhance Army operational missions. Efforts will be conducted through detailed system and subcomponent simulation, design, maturation and test in laboratory settings. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, completed system and component level trade studies to determine missile system technical requirements addressing stated objectives for future Army systems and to assess the operational enhancement expected from a hypersonic/hypervelocity enabled system. Computational fluid dynamic and high fidelity mathematical simulation analysis was utilized in these analyses. Continued constructive simulation efforts based on preliminary design trades to further explore advantages of the proposed systems in new operational scenarios of interest. In FY06, utilize missile system and subsystem trades studies to assess system operational performance as system and subsystem technology matures and clearly identify technological shortcomings that need to be addressed to weaponize the hypersonic/hypervelocity engine technology. In FY07, will continue assessment of system operational performance. Evolving operational scenarios will be explored using constructive and engineering level simulations to assess advantages of hypersonic/hypervelocity enabled systems.	1450	2000	2000
- In FY06, further evaluate engine component technology and initiate guided interceptor design effort. Assess operational capability of the component designs and validate computational methods. These efforts consist of experimental model design, instrumentation of experimental models, fabrication of test hardware and extensive ground test investigations of selected missile and guided interceptor components. In FY07, will continue experimental design and evaluation of component technology to optimize the component designs as understanding of component designs improves and technologies mature. Will test and evaluate guided interceptor designs. Component technology will be transitioned during FY07 to PE 0603313 Project G03 and Project 550.	7295	11012	9590
Total	8745	13012	11590

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		27121	36233	19430	19492	19826	20638	20362
042	HIGH ENERGY LASER TECHNOLOGY	15141	20363	19430	19492	19826	20638	20362
NA3	MICROELECTRO MECHANICAL SYSTEMS	2637	0	0	0	0	0	0
NA5	Advanced Weapons Components (CA)	9343	15870	0	0	0	0	0

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, and, where feasible, exploits opportunities to enhance Current Force capabilities. This PE also initiated the investigation of new technology concepts in space applications. The major effort under this PE is the development of a multi-hundred kilowatt (kW) Solid State Laser (SSL) laboratory demonstration that can be integrated into a HEL weapon to provide increased ground platform-based lethality. 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, rocket propelled grenades, 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; and 4) Neutralizing mines and other ordnance (especially improvised explosive devices (IEDs)) from a stand-off distance. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. At weapon system power levels of greater than 100kW, SSL technology has the potential to enhance Future Combat Systems (FCS) survivability by addressing the capability gaps identified above. 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. The multi-hundred kilowatt laser and additional HEL technology components will be refined and upgraded to transition into an integrated SSL weapons system that will be developed in PE 0603004A/L96. Projects NA3 and NA5 funds Congressional special interest items. Work in this PE 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) and starting in FY06 to PE 0603004/L96 (Weapons and Munitions Advanced Technology). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed by the US 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 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	24495	21139	21989
Current BES/President's Budget (FY 2007)	27121	36233	19430
Total Adjustments	2626	15094	-2559
Congressional Program Reductions		-636	
Congressional Rescissions		-370	
Congressional Increases		16100	
Reprogrammings	2626		
SBIR/STTR Transfer			
Adjustments to Budget Years			-2559

FY 05 increase of +$2.6 million (after adjustment for Congressional Undistributed Reductions) is attributed to reprogramming of Congressional Add for Microelectromechanical Systems from PE 0602303A for proper execution.
FY 07 decrease of -2.6 million due to realignment of funding to higher priority requirements.
Three FY06 Congressional adds totaling $16100 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($12600) Army Missile and Space Technology Initiative
($1000) Single Crystal Chemical Vapor Deposition (CVD)Diamond Lens Elements for High-energy Lasers
($2500) Solid-State High-Output Diode Arrays

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
042 HIGH ENERGY LASER TECHNOLOGY	15141	20363	19430	19492	19826	20638	20362

A. Mission Description and Budget Item Justification: This applied research project investigates advanced technologies for Future Force High Energy Laser (HEL) weapons technology, and, where feasible, exploits opportunities to enhance Current Force capabilities. This project also initiated the investigation of new technology concepts in space applications. The major effort under this project is the development of a multi-hundred kilowatt (kW) Solid State Laser (SSL) laboratory demonstration that can be integrated into a HEL weapon to provide increased ground platform-based lethality. 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, rocket propelled grenades, 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; and 4) Neutralizing mines and other ordnance (especially improvised explosive devices (IEDs)) from a stand-off distance. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. At weapon system power levels of greater than 100kW, SSL technology has the potential to enhance Future Combat Systems (FCS) survivability by addressing the capability gaps identified above. 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. The multi-hundred kilowatt laser and additional HEL technology components will be refined and upgraded to transition into an integrated SSL weapons system that will be developed in PE 0603004A/L96. 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), and starting in FY06 to PE 0603004/L96 (Weapons and Munitions Advanced Technology). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed by the US Army Space and Missile Defense Command (SMDC), in Huntsville, AL and the High Energy Laser Systems Test Facility, White Sands Missile Range, NM.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Solid State Laser (SSL) Development, Phase 1 and 2 - 25kW: In FY05, assembled a multi-module, diode-pumped Solid State Heat Capacity Laser (SSHCL) breadboard using 10-cm on-edge laser slabs and demonstrated up to 46kW of laser power for approximately 1 sec. Integrated intra-cavity active resonator and conducted laboratory characterization of the SSHCL breadboard. Demonstrated beam quality of less than 2 times diffraction limit. Demonstrated the major aspects of power scaling and beam combining/quality/efficiency. Integrated the sliding laser disk thermal management concept into the SSHCL breadboard design to improve run-time performance. Analyzed results of competitive 25 kW Joint High Power Solid State Laser (JHPSSL) Program laboratory demonstrations and independent Government testing and down-selected best SSL design.	12241	0	0
SSL Subcomponent Development: - Laser crystal development - In FY05, conducted ceramic laser crystals assessment. Procured and tested optical and thermal properties of high quality ceramic slabs as an alternative laser crystal material. Thermal management - Developed and tested advanced resonator concepts to improve beam quality.	1100	0	0
Solid State Laser Effects: - Laser Lethality and Propagation Assessments - In FY05, expanded lethality assessment to include representative threat system components. In FY06, initiate laser propagation and lethality studies in different environments at tactical ranges both at HELSTF and other test facilities using SSLs. In FY07, will conduct lethality assessments on an expanded target set representative of identified capability gaps.- Laser Modeling and Simulation - In FY05, enhanced on-going High Energy Laser Joint	1800	1500	1500

Technology Office efforts in establishing a DoD-wide validated M&S capability for effectively modeling SSL technology. In FY06, initiate the development and validation of performance and propagation models for Solid State Lasers in a tactical environment. In FY07, will begin integration of validated models into approved Army war-gaming models.			
Solid State Laser (SSL) Development, Phase 3 - 100kW: The goal of this JHPSSL Phase 3 Project is to develop and demonstrate alternative 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 FY06, initiate development of 100kW Solid State Laser. Procure long lead items and begin integration of components into subsystems that form the basis of a 100kW laboratory laser device that meets the JHPSSL Program Phase 3 performance goals for power, beam quality, run time, and efficiency. In FY07, will fabricate remaining components; integrate subsystems into a laser breadboard and conduct preliminary performance tests. Begin integration of complete 100kW solid state laser.	0	17313	17930
Space Application Concepts: In FY06, complete Joint Warfighting Space/Tactical Satellite (JWS/TacSat) cooperative Hyperspectral Imagery (HSI) payload development with Air Force Research Laboratory for JWS demonstration to validate Army Space Intelligence and reconnaissance tactical needs. This activity will be transferred to PE 0602120A beginning in FY07.	0	1550	0
Total	15141	20363	19430

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		22710	27416	16181	17083	17462	17941	18308
C90	Advanced Distributed Simulation	9838	10435	10166	10934	11186	11541	11780
D01	PHOTONICS RESEARCH	3354	3351	0	0	0	0	0
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	4631	5350	6015	6149	6276	6400	6528
D14	Advanced Modeling and Simulation Initiatives (CA)	4887	6900	0	0	0	0	0
HB4	IMMERSIVE ENVIRONMENT APPLIED RSCH INITIATIVE (CA)	0	1380	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element funds applied research in modeling and simulation technologies for application to training and evaluation of the Future Combat System (FCS), the Future Force (FF) and the Current Force. It establishes standards, architecture, and interfaces essential to realizing the Army vision of creating a verified, validated, and accredited synthetic "electronic battlefield" environment as an acquisition evaluation, training, and mission planning and rehearsal tool. The creation of this electronic battlefield environment requires advanced distributed simulation technologies, 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, such as immersive training, leadership development, and concept exploration. This environment will help the Army to 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 technologies required for real time interactive linking within and among constructive, virtual, and live simulation and training by maturing technologies for advanced distributed interactive simulation. Project D02 provides applied research in immersive training at the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California, to leverage the entertainment and game industries in advancing the Army's modeling and simulation technology and applications. This program will ensure 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 program element is related to and fully coordinated with efforts in PE 0603015A, Project S28 (Institute for Creative Technologies (ICT) - Advanced Technology Development) and PE 0603015A, Project S29 (Modeling and Simulation - Advanced Technology Development); and PE0601104A, Project J08 (Institute for Creative Technology). This work does not duplicate an effort within the military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). Work 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 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	22721	16013	16858
Current BES/President's Budget (FY 2007)	22710	27416	16181
Total Adjustments	-11	11403	-677
Congressional Program Reductions		-120	
Congressional Rescissions		-277	
Congressional Increases		11800	
Reprogrammings	-11		
SBIR/STTR Transfer			
Adjustments to Budget Years			-677

FY 05 increase of +$2.4 million (after adjustment for Congressional Undistributed Reductions) is attributed to reprogramming of two Congressional Adds. $1.4M for Standoff Hazardous Agent Detection and Evalutation Systems Research and $1.0M for Advanced Laser Electric Program, both from PE 0603627 for proper execution.

Four FY06 Congressional adds totaling $11800 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1000) Automated Man-In-Simulant-Test (MIST)
($1400) Institute for Creative Technologies
($3400) Photonics Center
($6000) Surveillance and Targeting Robot Platform (Red Owl)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
C90	Advanced Distributed Simulation	9838	10435	10166	10934	11186	11541	11780

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 will enhance 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, and complex data modeling. 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 Research Development and Engineering Command (RDECOM), Simulation and Training Technology Center, Orlando, FL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Live, Virtual, Constructive Simulations: In FY05, enhanced modeling of unconventional threats in complex virtual urban environments; reduced size, weight, and power consumption of inertial sensor packaging for use in urban area training exercises and simulated tactical engagement training. Increased constructive simulation realism by maturing single-processor Graphics Processing Unit (GPU) software architecture and coprocessor algorithms to overcome current constructive simulation computational bottlenecks. In FY06, establish a standard flexible framework composed of a toolset for high-resolution urban environment development. Increase interoperability of multi-service virtual simulations networked with live systems in training environments. Demonstrate components with inertial sensor and software optimizing sensor fusion for more robust navigation during training exercises and increase accuracy for simulated tactical engagement training; and develop multiple GPU cluster architecture using algorithms from GPU coprocessor research. In FY07, will extend research of alternative data sources from Corps of Engineers to rapidly create urban environments for training, mission planning and rehearsal to reduce the dependence on training specific databases. Design navigation software for further robustness during GPS outages and continued miniaturization, reduction in power consumption, and early manufacturability analysis of system components. Will prototype large constructive simulations using multiple GPUs to increase the computational output for the simulation of highly complex urban environments.	3750	3717	3567
Modeling and Simulation Training Technologies. In FY05, created a field deployable patient simulator incorporating realistic medical training in simulated combat environments. Developed prototype dismounted soldier training systems for augmented reality and fully-immersive combined arms training environments. Developed models to facilitate the assessment of the effectiveness of mixed teams of humans and autonomous vehicles. In FY06, evaluate patient simulator use during military training exercises and Develop computer based simulation environment to support Combat Casualty Care training. Evaluate a field capable embedded training system integrated with a Future Combat System (FCS) surrogate to evaluate deployable collective training and distributed after-action review technologies for the dismounted Soldiers. Design human wearable augmented reality training technologies; and develop tools to evaluate mixed human-intelligent agent team performance. In FY07, will design new severe trauma simulation capabilities including advances in haptics, 3D visuals, olfactory, fluid, and sensors to simulate soft tissue, orthopedic, and organ casualties. Will evaluate the use of flexible displays and the application of nano-sensors embedded in the Soldiers' clothing and weapon systems for embedded training. Will design intelligent and	3521	3666	3478

adaptive behaviors to represent autonomous systems to enhance the human-intelligent agent team training.			
Collaborative and Immersive Environment Technologies. In FY05, continued to develop new behaviors in the One Semi-Automated Forces Objective System (OOS) constructive simulation baseline and design the linkages between the asymmetric warfare virtual training technology and the OOS. Performed user evaluations with combat units; and expanded our understanding of the student learner model to identify aspects of learning scenarios that facilitate the enhancement of virtual learning environments. In FY06, develop tools required for a trainer to address new types of asymmetric warfare training scenarios. Use the student learner model to evaluate the effectiveness of the single-user training module for immersive training. Research the incorporation and effectiveness of cultural simulation models creating appropriate asymmetric behaviors in immersive environments. In FY07, will research and prototype an immersive asymmetric warfare training environment for Joint, Interagency Multi-National (JIM) distributed training, mission planning and mission rehearsal. Will conduct experiments to validate the metrics, tools, and methods of the single-user framework and extend the single-user framework to accommodate multi-user small team collaborative requirements. Will design an adaptive learning environment using asymmetric behaviors to replicate the complex conditions experienced in the contemporary operating environment.	2567	3052	3121
Total	9838	10435	10166

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	4631	5350	6015	6149	6276	6400	6528

A. Mission Description and Budget Item Justification: This project enables the transfer and maturation of simulation and training research results to the Army from Program Element (PE) 0601104, Project J08 (Institute for Creative Technologies). Goals of this research 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, such as immersive training, leadership development, and concept exploration; by creating a true synthesis of creativity and technology by leveraging the capabilities of industry and the Research and Development (R&D) community; and by conducting research in virtual humans to enable them to embody natural language, speech recognition in noisy environments, gesture, gaze, and conversational speech. Achieving these goals requires research in techniques and methods for integrating different sensory cues into virtual environments to enhance training and leader development; investigating the application of emerging photo-realistic rendering algorithms and 3-dimensional signal processing techniques to advanced experience learning applications; and enhancing the efficiency of 3-dimensional sound techniques in virtual environments that vary from medium sized immersive environment rooms with high-end graphics and computing systems to low-cost, game console applications using commercial off the shelf speakers. 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 Research Development and Engineering Command (RDECOM), Simulation and Training Technology Center, Orlando, FL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Immersive Technology Environments. In FY05, investigated verbal communication techniques for virtual human interactions with soldiers; and examined the concept of an integrated learning environment framework and identified interdependences to increase the realism of immersive environments used for training. In FY06, investigate nonverbal communication techniques for virtual human interactions with soldiers; and integrate the representations of selectable ethnicity and situational impact of emotions into the human to virtual human interaction. In FY07, will integrate enhanced virtual humans into a framework for leader training environments and will design virtual human component technologies utilizing feedback from concept evaluations.	2171	2461	2628
Immersive Technology Techniques. In FY05, developed techniques to create a single-user learning environment using advanced computer generated coaching and mentoring tools (artificial intelligence). Designed prototype tool sets that allow training developers to rapidly create immersive learning scenarios. Developed and evaluated next generation global illumination algorithms. In FY06, extend the tool sets and techniques for maturation of a single-user immersive learning environment; begin usability and effectiveness testing of single-user prototype components and tools. Develop new programming technology that allows a system's performance to be self-documenting by explaining its reasoning and how it works in easily understood English. Integrate captured photo-real images into a real-time simulation. In FY07, will design techniques for creating a multi-user learning environment integrating advanced computer generated coaching and mentoring tools (artificial intelligence) into an immersive simulation environment. Will investigate concepts and begin to design the tool sets that will allow training developers to rapidly create multi-user immersive learning scenarios. Will advance and incorporate explainable artificial intelligence technology in computer coaches that provide advice and corrections to learners as they use training systems. Will design tools for rapid simulation development.	2460	2889	3387
Total	4631	5350	6015

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	110057	92857	59304	56743	50409	51536	53086
C05	ARMOR APPLIED RESEARCH	13217	9766	9513	9507	9593	9999	10078
H77	ADV AUTOMOTIVE TECH	49940	35071	15083	15106	15279	15411	15527
H91	TANK & AUTOMOTIVE TECH	29745	38458	34708	32130	25537	26126	27481
T26	Ground Vehicle Technologies (CA)	17155	9562	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) researches, investigates and applies combat vehicle and automotive component technologies that will improve survivability, mobility, sustainability, and maintainability of Army ground combat and tactical vehicles. As combat vehicle systems become smaller and lighter, 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, including long-range situational awareness, multi-spectral signature reduction, Active Protection (AP) systems and advanced lightweight armor in place of heavy conventional armor. Project C05 focuses on designing an integrated lightweight armor suite for protection against Chemical Energy (CE) and medium Kinetic Energy (KE) threats with less than one fourth the weight burden of conventional heavy armor, in addition to designing and evaluating appliqué armors for tactical vehicles. 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, pursuing automotive-oriented technology programs that have potential benefit to military ground vehicles. Project H91 investigates, evaluates and characterizes unique AP countermeasure concepts for intercepting CE and KE threats before they reach the target vehicle. Project H91 also investigates hybrid electric propulsion and electronic vehicle component technologies, which are key enablers for achieving Future Combat System (FCS), Future Force and enhanced Current Force capabilities. In the near term, FCS and new tactical vehicles will be designed with hybrid electric architectures and advanced high power density engines that will provide power for propulsion, communications and control systems, life support systems, electromagnetic (EM) armor, soldier battery charging, and export to other systems. In the farther term, vehicle energy and power levels will be increased to accommodate advanced electric weapons (such as lasers, high power microwaves and electric guns) and advanced electric-based protection systems. Project H91 also designs and matures 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. It investigates and develops high temperature/power electronics, high energy density energy storage devices, JP-8 reformation and desulphurization as a fuel source for fuel cells, and components of Pulse Forming Networks (PFNs) (batteries, switches, inductors and capacitors) required for electric vehicle mobility and survivability. Project H91 also researches, designs, and evaluates intelligent agents, adaptive automation, and user-friendly interfaces that optimize the soldier's span of control over manned and unmanned assets increasing the warfighter's efficiency in mission performance. It performs applied research in tactical behaviors and human detection and deterrence for Unmanned Ground Vehicles (UGVs) allowing them to act more intelligently during maneuvers involving tactical formations and stealthy operations as well as protecting themselves from intruders. In addition Project H91 addresses sustainability and maintainability, with efforts in advanced military fuels and lubricants; vehicle diagnostics; and on-vehicle water generation and water purification. This project also addresses the systematic assessment and integration of these technologies in lightweight conceptual platforms using advanced virtual prototyping capabilities. Project T26 funds Congressional special interest items. The PE is coordinated with the U.S. Marine Corps through the Naval Surface Warfare Center and with other ground vehicle developers within 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 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 PE is performed by Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI, in collaboration with the Army Research Laboratory (ARL), Adelphi, MD.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	114108	64883	66668
Current BES/President's Budget (FY 2007)	110057	92857	59304
Total Adjustments	-4051	27974	-7364
Congressional Program Reductions		-489	
Congressional Rescissions		-937	
Congressional Increases		29400	
Reprogrammings	-4051		
SBIR/STTR Transfer			
Adjustments to Budget Years			-7364

FY 07 decrease of -7.4 million attributed to realignment of funding to higher priority requirements.

Sixteen FY06 Congressional adds totaling $29400 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($2000) Advanced Affordable JP-8 PEM Fuel Cell Components for Army APU and Ground Vehicle Applications
($2100) Advanced Electric Drive
($500) Liquid Desicant-Based Atmospheric Water Generation
($1000) Nanofluids for Advanced Military Mobility Systems
($2000) Nano-Engineered Multi-Functional Transparent Armor
($2100) Unmanned Vehicle Control Technologies

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
C05 ARMOR APPLIED RESEARCH	13217	9766	9513	9507	9593	9999	10078

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 will provide the last line of defense for the Future Combat System (FCS), Future Force vehicles and Current Force vehicles (where possible as enhancements/upgrades). The effort also provides analysis, modeling, and characterization of advanced armor solutions designed to protect against emerging threats to include collateral damage from residual debris generated by the Active Protection (AP) threat defeat mechanisms. The major focus is on providing 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. Goals are to provide base armor to defeat heavy machine guns and residual fragments from AP 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, initially at 80 lb/sq.ft. (or less) for FCS and Future Force Vehicles (reducing this to 60 lb/sq.ft. (or less) for future FCS insertion/upgrades). The armor technologies designed and fabricated in this project complement innovative non-armor survivability capabilities funded in Project H91. In addition this project investigates low-burden appliqué armor solutions for the protection of Current Force combat and tactical vehicles, focusing on add-on armor for protection from small arms, land mines and counter Improvised Explosive Device (IED) applications. International cooperative research in mine blast characterization and vehicle response is also conducted. 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 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 Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI, in collaboration with the Army Research Laboratory (ARL), Adelphi, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Advanced and Structural Armors: In FY05, evaluated the FCS armor concept in conjunction with the Integrated Survivability Advanced Technology Demonstration (ATD) to determine effectiveness when used with CE AP system; optimized and validated the performance of armor packages for lightweight test platforms in ballistic range tests; demonstrated multi-shot capability with an electromagnetic armor package; validated the structural armor packages for lightweight combat vehicle platforms, including defeat of advanced RPG and future medium cannon KE projectiles; and completed design and fabrication of advanced full scale ballistic structure/platform.	12317	0	0
Countermine: This effort leverages ongoing efforts in Advanced Lightweight Vehicle Armor Protection. In FY05, refined design for conceptual appliqué armor kits to provide desired resistance to mine blast effects at reduced weights for FCS concept vehicles; collected live fire test data from mine strikes and modeled reactions against FCS concepts. In FY06, fabricate an appliqué mine resistance armor kit solution for FCS and experimentally validate M&S blast models. In FY07, will demonstrate a lightweight blast/fragmentation appliqué in live-fire evaluations.	900	500	500
Advanced Lightweight Vehicle Armor Protection: In FY06, fabricate advanced space frame structure and apply armor to the space frame design; demonstrate advanced appliqué armor; explore integration issues among ballistic, signature management, and related survivability technologies considering durability, mounting approaches, performance synergy, manufacturability and compatibility. In FY07, will	0	8766	8376

complete exploration and evaluate performance of FCS armor concepts for ballistic protection, demonstrate candidate armors against objective threats to include small arms, medium KE, and fragment defeat; apply and validate modeling and simulation tools; continue electromagnetic armor evaluations; and conduct experiments to determine the best solutions for integrating ballistic, signature management, and related survivability technologies.			
Tactical Vehicle Survivability: In FY06, perform testing of multiple transparent armor solutions for application to all vehicles; identify a comprehensive current and future threat list for use in evaluating various survivability components. In FY07, will evaluate advanced armor materials for tactical vehicles.	0	500	637
Total	13217	9766	9513

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H77	ADV AUTOMOTIVE TECH	49940	35071	15083	15106	15279	15411	15527

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 technology programs that focus on benefiting military ground vehicle systems. Component technologies being researched and investigated in this project support the Army's current and future combat and tactical vehicle fleets. Improvements in the current fleet are expected to rely heavily on leveraging commercial technologies for advances in operational capabilities and cost. The NAC serves as a catalyst, linking industry, academia and government agencies for the maturation and exchange of automotive design and component technologies. The NAC core program is focused in two primary areas: Advanced Automotive Technology (AAT), and Future Tactical Truck System (FTTS) Advanced Concept Technology Demonstrator (ACTD). A major effort in AAT is Hybrid Electric Drive (HED) for tactical vehicles and light combat vehicles to improve fuel economy and mobility. Another major effort in AAT is fuel cell research, addressing fuel cells and the equipment required to convert battlefield hydrocarbon fuels to hydrogen needed for fuel cell operation. AAT also includes efforts that address fuel efficiency, vehicle modernization, crew safety, maintenance, reliability, diagnostics and prognostics, 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 implements and evaluates a number of advanced automotive technologies, whach the Army and commercial sector have matured over the last decade, into tactical support vehicles for Future Combat System (FCS) and the Future Force. The ACTD provides two variants of demonstrator vehicles for evaluation in a military unit field environment. ACTD test results will validate performance models, refine user requirements for tactical trucks, and reduce risk of insertion of certain advanced technologies into current and future tactical vehicle platforms. Some activities of the NAC are supported by other government agencies via a Memoranda of Agreement (MOA) and Memoranda of Understanding (MOU). 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 Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Advanced Automotive Technology: In FY05, evaluated advanced propulsion systems/Hybrid Electric (HE) for light tactical vehicles; evaluated Hybrid Hydraulic (HH) propulsion system on medium/heavy tactical vehicles; conducted evaluation of subsystems and components comprising hybrid electric propulsion systems in ground vehicles; evaluated HH propulsion demonstrator; evaluated Heavy Expanded Mobility Tactical Truck (HEMTT) A3 Chassis and Independent Active Suspension Test Rig Component; evaluated reliability and performance of Severe Off Road Vehicle (SORV) at the SORV Track; supported Project Manager (PM) Tactical Vehicles in vehicle evaluation for Re-Powered Light Tactical Vehicles (LTV). In FY06, conduct developmental/operational evaluation of Re-Powered LTV; conduct joint military operation and evaluation of SmarTruck tactical vehicle assessment of capabilities for Homeland Defense/Security automotive needs; and continue technology integration and evaluation of hybrid powertrain technologies focusing on the M113 Command Vehicle variant. In FY07, developmental/operational evaluations of the Re-power LTV; implementation of embedded diagnostics; wireless sensor capabilities to provide oil analysis, tire pressure, and battery analysis; increase survivability on Tactical Wheeled Vehicles to support GWOT; implementation of wireless ground vehicle location, cargo weight, and panic detection device; joint military operations/evaluations and an assessment of the SmarTruck Tactical Vehicles capability for Homeland Defense/Security automotive requirements; technological integration/evaluation of the Hybrid Powertrain for the M113 Command Vehicle variants.	11645	14655	14083
Future Tactical Truck System (FTTS) ACTD: In FY05, designed both the Maneuver Support Variant (MSV) and Utility Variant (UV)	8688	1000	1000

vehicles incorporating advanced, integrated survivability technologies, advanced propulsion (i.e., hybrid electric) systems, logistic re-supply equipment, and C4ISR equipment; initiated build of MSV vehicles that will be used for the MSV Military Utility Assessment (MUA). In FY06, initiate build of UV vehicles that will be used for the UV MUA in FY07; continue to conduct the MSV MUA. In FY07, the MSV and UV vehicles will be supported during a residual phase during which further user evaluation will be conducted.			
Advanced Energy & Manufacturing Stored Energy Technology: This one-year Congressional add evaluated the feasibility of incorporating advanced power technologies into military land warfare systems, to include the legacy, interim, and objective force vehicles. No additional funds are required to complete this project.	2116	0	0
SmarTruck: This one-year Congressional add provided various vehicle platforms to integrate and evaluate cutting-edge automotive technologies with military and homeland security/counter terrorism applications. No additional funds are required to complete this project.	4135	0	0
Military Wheeled Vehicle Electronic Architecture Integration: This one-year Congressional add investigated software interfaces for military vehicle situational awareness, maintenance, and logistics reporting. No additional funds are required to complete this project.	2501	0	0
Rapid Prototyping: This one-year Congressional add researched a soldier- friendly re-manufacturing software suite and a metal spray deposition system. No additional funds are required to complete this project.	1443	0	0
CALSTART Defense Advanced Transportation Technology Program: This one-year Congressional add facilitated development of commercial hybrid trucks, supported the Hybrid Truck Users Forum, and assisted in the accelerated development of hybrid electric vehicles. No additional funds are required to complete this project.	962	0	0
Army Trailer Technology Insertion (TTI): This one-year Congressional add investigated and evaluated suspension systems, propulsion alternatives, pintle alternatives, material options and power source methodologies for the Future Tactical Companion Trailer. No additional funds are required to complete this project.	2452	0	0
Center for Tribology and Coatings: This one-year Congressional add investigated new coating technologies to legacy and future vehicle systems. No additional funds are required to complete this project.	1444	0	0
Distributed Transportable Synthetic Fuel Manufacturing Modules: This one-year Congressional add developed conceptual microchannel process technology reactor design for the third step of synthetic fuel manufacturing (hrdrocracking). No additional funds are required to complete this project.	1443	0	0
Flexible JP-8 (Single Battlefield Fuel) Pilot Plant Program: This one-year Congressional add investigated use of synthetic fuels and the feasibility of a modular fuel plant that would produce synthetic fuel in theater using existing stranded natural gas reserves. No additional funds are required to complete this project.	4327	0	0
Future Hybrid Vehicle Systems: This one-year Congressional add developed and modeling and simulation tools and applications that support Future Hybrid Vehicle Systems. No additional funds are required to complete this project.	1443	0	0
Light Utility Vehicles: This one-year Congressional add investigated fuel cells for All Terrain Vehicles. No additional funds are required to complete this project.	2163	0	0
Multipurpose Utility Vehicle-Reconfigurable: This one-year Congressional add investigated a smaller, lighter, more versatile, more maneuverable internally transportable tactical vehicle which could be used in deployments throughout the world. No additional funds are required to complete this project.	1346	0	0
Unmanned Vehicles Surveillance & Sensor System: This one-year Congressional add researched intelligent software solutions that may	962	0	0

facilitate adjustable autonomous robotic control. No additional funds are required to complete this project.			
Wireless Sensors for Vehicle Maintenance: This one-year Congressional add researched wireless sensors that apply to diagnostics/prognostics and logistics functions. No additional funds are required to complete this project.	961	0	0
Advanced Vehicle Life Consumption and Maintenance Prognostic System: This one-year Congressional add collected data and analyzed fatigue life of selected components/subsystems of the Stryker Infantry Combat Vehicle. No additional funds are required to complete this project.	951	0	0
Mobile Thermal Perimeter Surveillance System: This one-year Congressional add developed and tested a high-efficiency, swing rotary engine and advanced composite ballistic panels for integration into a HMMWV perimeter surveillance platform. No additional funds are required to complete this project.	958	0	0
Hydrogen PEM Fuel Cell Heavy Duty: This one-year Congressional add develops a fuel cell bus with exportable power for use in the Army Mobile Microgrid Demonstration. No additional funds are required to complete this project.	0	1971	0
Center for Tribology and Coating: This one-year Congressional add continues research on lubricants to provide increased wear protection for vehicle systems and sub-systems in high-wear environments. No additional funds are required to complete this project.	0	1774	0
Distributed Transportable Synthetic Fuel Manufacturing Modules: This one-year Congressional add continues development of an air-transportable synthetic fuel production system. No additional funds are required to complete this project.	0	986	0
Light Utility Vehicle (LUV): This one-year Congressional add supports FTTS efforts. No additional funds are required to complete this project.	0	3449	0
Defense Transportation Energy Research: This one-year Congressional add supports an Army-university-industry research coalition dedicated to research and technology development on fuels, fuel cells and auxiliary units. No additional funds are required to complete this project.	0	2070	0
Gaming Technology Software Initiative (GTSI): This one-year Congressional add integrates vehicle engineering simulation and advanced interactive visualization to create a multi-functional tool and integration point for next-generation vehicular technology. No additional funds are required to complete this project.	0	986	0
HAMMER (Hydraulic Hybrid, Advanced Materials & Multi-fuel Engine Research): This one-year Congressional add develops infinitely variable transmissions and series hydraulic drive systems for enhanced mobility and fuel economy. No additional funds are required to complete this project.	0	1774	0
Plasma JP-8 Fuel Reformer: This one-year Congressional add develop a plasma reformer to meet the Army's needs for the on-board reformation of transportation fuels. No additional funds are required to complete this project.	0	1577	0
Rapid Product Development and Deployment Portal: This one-year Congressional add focuses on the education and training needs of defense contracting entities and their supply chain, highlighting capabilities of current and emerging technologies for military use. No additional funds are required to complete this project.	0	1478	0
Ultra Light Cargo Vehicle: This one-year Congressional add integrates and demonstrates the Light Utility Mobility Enhancement System (LUMES) with a fuel cell module. No additional funds are required to complete this project.	0	3351	0
Total	49940	35071	15083

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H91	TANK & AUTOMOTIVE TECH	29745	38458	34708	32130	25537	26126	27481

A. Mission Description and Budget Item Justification: This project researches, investigates, and evaluates innovative vehicle concepts, mobility, power, propulsion, survivability, and other component technologies for application to current and future combat and tactical vehicles. The project also addresses water generation, recovery and purification as well as military fuels and lubricants. Hybrid electric and electric vehicle technologies are key enablers for achieving Future Combat System (FCS) and Future Force capabilities and for bringing critical platform enhancements to current platforms through upgrades. Future combat and tactical vehicles are being designed with hybrid electric architectures, providing power for propulsion, communications and control systems, survivability and lethality. The Hybrid Electric/Electric Vehicle effort designs, fabricates and evaluates critical components for energy storage and power distribution and management. Components developed under this effort are often incorporated into the Power & Energy Systems Integration Laboratory (P&E SIL), funded in Program element (PE) 0603005A, Project 441 (Combat Vehicle Mobility), for evaluation and systems maturation. The Pulse Power effort focuses on providing high energy/high power density components and designs of Pulse Forming Networks (PFNs), which are enablers for the advanced electric-based weapon and protection systems. The goal of the Propulsion/Prime Power effort is to design engines and generators and their components with significantly improved performance characteristics, efficiencies, and power densities. In the near term, increasing the power density is a key objective; in the farther term, focus is on achieving even higher power densities and maturing JP-8 reformation and desulphurization to provide hydrogen on which fuel cells can operate. The Warfighter-machine Interface and robotics technology efforts research, design, and evaluate optimal soldier-machine interfaces for maximum span of control of manned and unmanned ground and air vehicles with minimal soldier task loading. It performs applied research in tactical behaviors and intruder detection and reaction determination for Unmanned Ground Vehicles (UGVs) allowing them to act more intelligently during maneuvers such as tactical formations and stealthy movement as well as protecting themselves from human threats. The Real-time Vehicle Mobility and Motion Effects Modeling and Simulation (M&S) effort focuses on enhancing the interactions of the types of terrain and the vehicle mobility components, modeling of hybrid electric power trains, and methods for traversing complex obstacles and urban environments. 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. Work in this project is performed in collaboration with the U.S. Army Engineer Research, Development, and Engineering Center located at Vicksburg, Mississippi. The Vehicle Survivability effort provides component technologies that contribute to layered vehicle survivability approach. This effort includes design and evaluation of active protection and hit-avoidance components, signature reduction materials, tracking/detection components for unmanned systems, laser protection materials, and advanced lightweight structures and base armor. This work complements, but does not duplicate, work performed under the Armor Applied Research Project (C05). 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 platforms to support the individual soldier and/or create distributed modular water production units. The goal is to reduce water distribution requirements through three approaches: 1) innovative purification of traditional water sources, 2) water recovery from exhaust, and 3) advanced water recovery technologies. Activities are closely coordinated the Army Research Laboratory (ARL) and the Defense Advanced Research Projects Agency (DARPA). 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 Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Hybrid Electric/Electric Vehicles: In FY05, evaluated the high temperature performance of silicon carbide (SiC) solid state components	13945	13555	14744

used in high voltage rectifiers, converters, and motor drives in order to produce a more compact hybrid power management system for FCS vehicles; evaluated and validated advanced power/energy density in Lithium Ion (Li-ion) batteries; matured critical technologies to enable system level integration and demonstrations of P&E components; continued to characterize performance and condition of additional state-of-the-art components for transition to and incorporation into the P&E SIL (a technology development effort in PE 63005) and assessed Li-Ion batteries to confirm improved performance after incorporating fire retarding material, power/thermal management, and higher power density into the design. In FY06, enhance SiC switch design and fabricate high voltage rectifiers, converters, and motor drives; increase Li-ion battery power and energy densities; continue to assess battery performance and potential and begin integration into the P&E SIL with multiple configurations to determine the optimal solution. In FY07, will validate significant performance and capability enhancements to SiC components (60% increase for inverters and a 250% increase for DC-DC converts in power density), and special high-power/high-energy Li-ion batteries (20% increase in power density), allowing for integration into a complete, compact hybrid power management system; and conduct experiments determining whether components, sub-systems and systems can operate successfully at 110oC without degradation in vehicle performance - nearly double the 65oC baseline. This is a collaborative TARDEC and ARL effort.			
Pulse Power - In FY05, investigated and evaluated SiC solid state device concepts for improved output switches and for reduced size pulse charger inverter/rectifier circuits; matured high-performance dielectric materials to further increase the energy density of fast-discharge, high-voltage capacitors; developed novel, modular silicon solid-state output switch concepts; investigated and evaluated advanced thermal management approaches for high temperature operation. In FY06, significantly enhance the capabilities of modular SiC solid state switches by refining current sharing techniques; reduce the size of pulse charger inverter/rectifier circuits with transformer cores improvements; enhance energy density of fast-discharge, high-voltage capacitors with the use of diamond-like carbon (DLC) and fill improvements via new chemistries and antioxidants; and design and evaluate advanced ceramic high temperature thermal management techniques. In FY07, will refine component designs, integrate and test 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. This is a collaborative effort between TARDEC and ARL.	5621	5613	7175
Real-time Vehicle Mobility and Motion Effects Modeling and Simulation (M&S): In FY05, enhanced understanding of adverse effects and passive and active mitigation strategies of moving vehicle operations; validated motion simulation capability for moving vehicles; incorporated hybrid electric power train models into real-time mobility models; and started power system integration for war fighter experiment to determine duty cycle and validate with associated field test plan to establish accuracy of newly developed vehicle-terrain interface. In FY06, continue to evolve mobility models, terrain models, and motion effects mitigation techniques, perform experiments validating motion mitigation techniques concepts, model complex obstacles and urban terrain, and execute power duty cycle experiment.	1973	2695	0
Propulsion/Prime Power: In FY05, analyzed results of performance and durability tests conducted on FCS candidate engines to establish whether they achieved the full 6 hp/cu.ft. system power density in a 4-cylinder configuration and began investigation of alternate engine concepts to determine the feasibility of increasing power density to 8 hp/cu.ft. In FY06, complete both Opposed-Piston/Opposed Cylinder (OPOC) and high speed combustion analysis and design. In FY07, will initiate surrogate engine fabrications for both high speed combustion and OPOC engine evaluations.	1500	2070	2425
Vehicle Survivability (Active Protection/Minefield Clearance/Laser Protection/Hit Avoidance): In FY05, evaluated lightweight materials and blast dissipation techniques for scalable design configurations that were capable of withstanding the blast effect of mines; used modeling and simulation to assess feasability; finalized designs that meet the targeting requirements and integration plans for frequency agile laser vision protection; modeled and simulated signature management components. In FY06, complete design and fabricate prototype countermine mission modules, add Global Positioning System to the sensor fusion situational awareness system, add templates for threat detection to alert users to threats, and evaluate low cost signature management techniques. In FY07, will select subsystem	1692	2389	4685

concepts and develop interface/platform baseline requirements for simulation and modeling of advanced survivability technologies for tactical vehicles.			
Mobility for Manned and Unmanned Vehicles - In FY05, investigated and evaluated lightweight, remote controlled automated modular gap defeat technologies, evaluated automated emplacement techniques and gap sensor technology; and matured a concept through scaled physical models and computer simulations. Began preliminary designs for an unmanned ground vehicle tactical behavior architecture and methodology. In FY06, perform scaling studies, identify and estimate preliminary performance characteristics select best concept and fabricate a breadboard prototype to evaluate a gap defeat technology. Complete unmanned ground vehicle tactical behavior architecture designs. In FY07, will continue improvements of breadboard design, and will initiate evaluation of operational safety, improved autonomous navigation, mobility concepts, tactical behaviors for unmanned systems, and improved diagnostics/prognostics in unmanned systems.	1750	2969	845
Water generation, recovery, and purification: In FY05, developed, fabricated, and evaluated performance of two water from exhaust units mounted on High Mobility Multi-Purpose Wheeled Vehicles (HMMWVs) at Aberdeen Proving Grounds to validate maturity, adequacy with respect to amount of water produced, and water quality; evaluated performance of laboratory breadboard system to establish proof of concept for advanced water recovery technologies. In FY06, complete water-from-exhaust HMMWV field experiment, design, fabricate, and demonstrate a water-from-air device mounted on a Heavy Expanded Mobility Tactical Truck to evaluate performance on a moving vehicle and identify the environmental operational envelope. In FY07, will develop fabricate, and conduct analysis of a matured water from air device.	1974	3159	1762
Fuel Cell Power Initiative: In FY05, conducted laboratory assessment of the state of the art in JP-8/diesel reformation to quantify capabilities and limitations for auxiliary combat vehicle power, developed models that can be used to evaluate reformer designs. In FY06, initiate development of key components of the reformation system (JP-8 desulfurizer, reformer, thermal management and control) that meet reformate gas purity requirement for both proton exchange membrane (PEM) and solid oxide fuel cell (SOFC) power generation applications. In FY07, will start initial integration of system components into a functional brass board and test the "best in class" optimized JP-8 reformer equipped with desulfurization, thermal management and system control logic.	1290	5102	1680
Single Engine and Transmission Lubricants products for reduced logistics footprint: In FY06, conduct a study to determine the feasibility of developing a single engine-transmission lubricant that could reduce logistics footprint by reducing the number of grades from eight (8) to one (1). In FY07, will evaluate various lubricants and lubricant additives to determine their ability to meet both engine and transmission requirements using only one grade.	0	906	1392
Total	29745	38458	34708

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		55305	52010	52221	51092	52188	52062	52220
H03	ROBOTICS TECHNOLOGY	16264	14882	16418	16303	16527	16083	15964
H75	ELECTRIC GUN TECHNOLOGY	4944	4733	5237	5349	5442	5488	5530
H80	BALLISTICS TECHNOLOGY	27827	28847	30566	29440	30219	30491	30726
HB1	SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)	6270	3548	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) provides ballistic technologies required for armaments and armor to support the Future Combat Systems (FCS) and the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities to allow 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 of the Future Force. Project H75 focuses on technologies for electric armaments which 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 applied research in ballistics technology to enhance the lethality and survivability of the Future Force. Focus areas include advanced solid propellants, launch and flight dynamics, weapons concepts for light forces, warheads and projectiles, armor and munition/target interactions. Projects H03 and H80 will enable lethality and survivability technologies for the Future Combat Systems (FCS). Work in this PE is related to and fully coordinated with efforts in PE 0602105A (Materials Technology), PE 0602120A (Sensors and Electronic Survivability), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602716A (Human Factors Engineering), PE 0602782A (Command, Control, Communications Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0603005A (Combat Vehicle Advanced Technology). The cited work is consistent with 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).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	54889	49163	52168
Current BES/President's Budget (FY 2007)	55305	52010	52221
Total Adjustments	416	2847	53
Congressional Program Reductions		-228	
Congressional Rescissions		-525	
Congressional Increases		3600	
Reprogrammings	416		
SBIR/STTR Transfer			
Adjustments to Budget Years			53

Two FY06 Congressional adds totaling $3600 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount shown):
($2600) Advanced Tungsten Penetrators and Ballistic Materials
($1000) Gun Barrel Coatings

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H03 ROBOTICS TECHNOLOGY	16264	14882	16418	16303	16527	16083	15964

A. Mission Description and Budget Item Justification: This project advances autonomous mobility technology for the Future Combat Systems (FCS) and the Future Force. It will investigate robotics technology critical to the maturation of future Army systems, including unmanned elements of the FCS, Future Force Warrior (FFW) 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 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, 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 rapid implementation of near-term robotic follower technology in support of PE/Project: 0603005A/515, and subsequent development of both semi-autonomous and near autonomous unmanned ground vehicles (UGVs). 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). 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 2005	FY 2006	FY 2007
- 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 upon new sensor and sensor processing algorithms for rapid detection and classification of objects in the environment enabling 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 FY05, inserted mature perception, control, and HRI technologies onto testbed platforms to promote rapid transition of semi-autonomous capability to Future Force systems, including transfer of LADAR sensor technology to FCS program. In FY06, will conduct research enabling safe operation of semi-autonomous vehicles in populated environments, including movement in dynamic environments, e.g., oncoming traffic and pedestrians, a key barrier to the utilization of unmanned systems in future urban military operations. Research supports collaborative efforts with DARPA focused upon both near-term implementation of technologies, and incorporation of DARPA sponsored research in adaptive perception and control technology. In FY07, will conduct research to permit meaningful collaboration by autonomous vehicles (including mixed air and ground assets) utilizing the scout reconnaissance mission as the focus for technology development.	6859	7197	7477
- Enhance modeling and simulation infrastructure to enable maturation of semi-autonomous UGV's; devise and implement tools to enable rapid maturation of tactical behaviors. In FY05, integrated mechanisms for behavioral adapability into test bed vehicles and evaluated approach through field exercises during which a minimum of two vehicles collaboratively conducted maneuver required for a zone reconnaissance mission while adapting their behavior to reflect environmental changes.	809	0	0

- Mature perception, intelligent control, and man-machine interface technology required for a single Soldier to manage the operation of multiple unmanned ground vehicles maneuvering with high levels of autonomy through the battlefield. In FY05, matured the perception and control technology required to show baseline tactical behaviors by unmanned ground vehicles adapting to dynamic changes in the environment while maneuvering through rolling, vegetated terrain. This transitioned into Tank and Automotive Research, Development and Engineering Center's Armed Robotic Vehicle Program.	4623	0	0
- Mature perception and intelligent control technologies required to meet objective capabilities for the Armed Robotic Vehicle program and transition this technology to advanced development programs being conducted under PE 0603005A (Combat Vehicle Advanced Technology) Project D515 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 FY06 will conduct research in perception and control technologies for autonomous mobility that will permit realistic operational speed for FCS with spirals to Current Force. In FY07, will mature perception and control technology to permit implementation of behaviors to enhance the operational effectiveness of robotic vehicles.	0	4799	3463
Integrate technology on unmanned ground vehicle testbeds and conduct extensive field exercises for experimentation, technology characterization, and to show capability maturation 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 FY05, proved baseline adaptive tactical behaviors through field experimentation designed to demonstrate the ability of unmanned systems to autonomously alter behavior in response to changes in the local environment. In FY06, will incorporate advanced perception and control technology and transition to FCS Autonomous Navigation System prototypes for evaluation in relevant environments. In FY07, will evaluate technologies for collaborative operation of networked air & ground unmanned vehicles managed by a single Soldier.	3973	2886	5478
Total	16264	14882	16418

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H75	ELECTRIC GUN TECHNOLOGY	4944	4733	5237	5349	5442	5488	5530

A. Mission Description and Budget Item Justification: This project funds applied research for the Army Electromagnetic (EM) armaments technology program. To achieve the objectives of the Army Vision, future armored combat vehicles, including the Future Combat Systems (FCS), requires more lethal, yet compact main armament systems capable of defeating protection levels significantly greater than current values. The goal of this project is to evaluate the potential of EM Armaments to field a leap-ahead capability by providing adjustable velocities, including hypervelocity that far exceeds the ability of the conventional cannon. EM armaments potentially can be fully integrated with electric propulsion and electromagnetic armor systems to provide the efficient, highly mobile, and deployable armored force required by the nation. This project focuses on addressing technical barriers associated with an EM armament, in particular with advanced materials for pulsed power and launchers; experimentally validating full-scale hypervelocity utility of novel kinetic energy penetrators (NKEPs) against the range of threat armors; and devising and experimentally validating high energy launch packages. In the area of pulse power, it will mature and prove critical materials for compact pulsed power for EM guns. For the launcher, it will establish and mature technologies for efficient, lightweight EM guns and projectile launch packages to enable revolutionary lethality for Future Force platforms. In the area of launch package (projectiles), it will establish technologies for full-scale hypervelocity novel kinetic energy penetrators. This research is conducted at the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. The applied research program receives the output of basic research conducted under Program Element 0601104A, Project H62 by the Institute for Advanced Technology, UT-Austin, and transitions it to the Army environment. In turn, the applied research is moved directly into the Armament Research, Development and Engineering Center advanced technology demonstration program where it is incorporated by industry into an EM gun system. 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 ARL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Pulsed Power - In FY05, proved through laboratory testing the strength of new, thick composite rotor bandings and validated thermal management components. In FY06, will prove advanced low density, high strength, low resistivity field coil conductors and efficient switch packaging. In FY07, will experimentally validate active cooling of high speed rotor for pulsed power generation.	1875	1871	1991
Launch - In FY05, validated integrity of advanced composite EM launchers by subjecting to 950 kA across the rails; launched a payload intact at 1.9 MJ of energy and a velocity of 2.3 km/s. In FY06, will validate robustness and rail life of composite launcher; and will electromagnetically launch an 8 MJ projectile with monolithic rod. In FY07, will electromagnetically launch an 8 MJ projectile with functioning novel penetrator.	1193	1423	1518
Full-Scale Hypervelocity Lethality - In FY05, evaluated flexible geometry NKEP and down-selected to most promising hypervelocity penetrator approach. In FY06, will mature mechanisms to deploy NKEP in flight. In FY07, will validate performance of functional NKEP against realistic targets in full-scale EM gun.	1876	1439	1728
Total	4944	4733	5237

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H80 BALLISTICS TECHNOLOGY	27827	28847	30566	29440	30219	30491	30726

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 U.S 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 to lighten and protect Future Combat Systems (FCS) and the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The challenge is to ensure combat overmatch and the survivability of the FCS while achieving rapid deployability in a lighter weight platform (less than 20 tons). Specific technology thrusts include: lightweight armors and structures to defeat existing and emerging ballistic threats; Kinetic Energy (KE) 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/munition vulnerability to attack; novel 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); smart projectile technologies for launch, flight, and precision strike; 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. 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 ARL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Optimize advanced lightweight structural, ceramic, and electromagnetic armor technologies for transition to FCS vehicle designers, Current and Future Force Platforms, and Ground Tactical Vehicles. In FY05, optimized armor packaging and transitioned improved hybrid armor technologies to FCS and current vehicle designers; and validated advanced pulse power componentry necessary to enhance FCS survivability. In FY06, will validate the advanced technology for shaped charge defeat and apply the design tools to tactical vehicles to increase their survivability against small arms and improvised explosive devices. In FY07, will experimentally validate integrated and add-on ballistic protection technologies that make tactical combat vehicles more survivable.	5371	6306	7391
- Mature 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 FY05, validated Anti-Tank (AT) mine blast appliqué kit and crew restraint system for FCS; and showed capability of ballistic shock mitigation technologies. In FY06, will advance models and mature first-generation designs for integrated AT mine blast protection structure/crew system. In FY07, will provide design guidance and proven AT mine blast protection structure/crew system to vehicle designers for FCS Spirals and Ground Tactical Vehicles; and will validate technologies to improve flexibility of protection equipment (torso, extremities, neck) for individual Soldier.	1950	2961	3738
- Mature advanced ammunition and lethality technologies. Couple physics-based models describing interior ballistics, launch dynamics, and flight mechanics with system effectiveness models and emerging high G guidance, navigation, and control (GN&C) technologies to enable dynamic retargeting of precision munitions for revolutionary Future Force lethality. In FY05, transitioned fully coupled suite of	4128	4003	4041

models and validated first generation dynamic retargeting technology to munitions development community. In FY06, will experimentally validate new engineering analysis capability which couples interior, exterior, and projectile structures for analysis of smart munitions; and will validate computational fluid dynamics model of advanced actuator divert for medium caliber munitions. In FY07, will experimentally prove dynamic retargeting technologies (in-flight position update) applicable to FCS and Future Force munitions; and will validate closed loop actuator control system technologies required for divert of medium caliber munitions.			
- Mature propulsion and energetics technologies. Evaluate, select, and prove novel/nanostructural insensitive high-energy materials (IHEM) concepts, which exploit managed energy release, and are required for improving the lethality and reducing the vulnerability of FCS/Future Force gun/missile systems and warheads. In FY05, extended and validated modeling tools used for design of managed energy systems; experimentally assessed promising insensitive high-energy materials in notional energy managed configuration; and provided matrix of novel IHEM propellant and explosives candidates for specific Future Force Insensitive Munitions (IM) applications. In FY06, will down-select a weapons system application for validation of novel insensitive energetic material (gun/rocket/ propellant/multi-purpose warhead); and will mature numerical tools for insensitive munitions design. In FY07, will validate selected system using advanced energetic material with tuned energy release (gun/rocket propulsion/ multi-purpose warhead) with increased performance while meeting FCS insensitive munition requirements and will apply emerging numerical tools to novel insensitive munitions.	4505	4073	3889
- Mature Active Protection counter-munition and sensor technologies to effectively defeat all anti-armor munitions including kinetic energy (KE) projectiles, which is critical to enable survivability of FCS and Future Force platforms. In FY05, proved blast-deflect universal countermeasure design against a variety of KE and CE threats, and transitioned to TARDEC Integrated Survivability Advanced Technology Demonstration (IS ATD) program. In FY06, will optimize universal counter-munition performance through improved modeling, materials and experimentation. In FY07, will transition optimized universal counter-munition to the IS ATD program.	2000	1972	2029
- Mature 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 FY05, matured and integrated emerging materials and novel lethal mechanism technologies & conducted full-scale experimental validation of integrated solution for transition to Future Force munitions developers. In FY06, will integrate lethal mechanisms and prove out broad, multi-functional target defeat capabilities. In FY07, will transition Multi-Threat Objective Projectile Technology to ARDEC and AMRDEC and investigate warhead concepts for tailorable and scaleable lethal effects for Military Operations in Urban Terrain.	3456	3201	3088
- Devise state-of-the-art survivability/lethality/vulnerability (SLV) methodologies to dynamically model the interaction of conventional ballistic threats versus FCS and Future Force System of Systems. In FY05, incorporated models for various damage mechanisms such as fuel fire, blast and shock, and penetration into complex armors, into production SLV codes; modeled lethality of structural secondary fragments; developed code architecture and capabilities based metrics to assess survivability in a Systems of Systems context. In FY06, will update SLV modeling framework , as well as methodology for emerging technologies. In FY07, will mature newly emerging technologies; will incorporate models for weapons effects in urban environments, including structural response and structural damage mechanisms; experimentally validate models.	6417	6331	6390
Total	27827	28847	30566

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		9977	10567	2212	2252	2305	2328	2365
552	SMOKE/NOVEL EFFECT MUN	3175	2483	2212	2252	2305	2328	2365
BA1	Protection Technologies (CA)	6802	8084	0	0	0	0	0

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. The 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 will be designed to be effective, safe, and environmentally acceptable. Modeling and Simulation (M&S) tools will be developed and used to analyze the ability of newly developed obscurant materials to increase survivability of soldiers and platforms. In FY06 a portion of the funding in project 552 is realigned to PE 0603004 project L97 to mature promising technology for potential transition to System Development and Demonstration (SDD). Work in this PE is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). This PE contains no duplication with any effort within the Military Departments. 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 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	7585	2519	2573
Current BES/President's Budget (FY 2007)	9977	10567	2212
Total Adjustments	2392	8048	-361
Congressional Program Reductions		-46	
Congressional Rescissions		-106	
Congressional Increases		8200	
Reprogrammings	2392		
SBIR/STTR Transfer			
Adjustments to Budget Years			-361

FY 05 increase of +$2.4 million (after adjustment for Congressional Undistributed Reductions) is attributed to reprogramming of two Congressional Adds. $1.4 million for Standoff Hazardous Agent Detection and Evalution Systems Research and $1.0 million for Advanced Laser Electric Program, both from PE 0603627A for proper execution. FY 07 decrease of -0.4 million attributed reprogramming to offset business re-engineering efficiencies.

Six FY06 Congressional adds totaling $8200 were added to this PE.

FY06 Congressional adds with no R-2As (appropriated amount shown):
($1000) Application of CHP-105 to Class A Biowarfare Agents
($1000) Automated Multiplexed Diagnostic System for Biowarfare Agent Detection
($3000) Battlefield Production of Modified Vaporous Hydrogen Peroxide for Field Decontamination
($1200) Bioaerosol Sampling Systems for US Army Force Protection
($1000) Biotechnology Education Initiative
($1000) Development/Operation of Test Range for Advanced Sensors and Obscurants

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
552 SMOKE/NOVEL EFFECT MUN	3175	2483	2212	2252	2305	2328	2365

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 researches 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, M&S and vehicle protection technology 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 will be investigated to predict performance and analyze strategic use of obscurants on the battlefield. In FY06 a portion of the funding in this project is realigned to PE 0603004 project L97 to mature promising technology for potential transition to SDD. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Area Plan (DTAP). Work in this project is performed by the Army Research, Development and Engineering Command, Edgewood Chemical Biological Center, Edgewood, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Advanced IR Obscurants. In FY05, tested and assessed in a laboratory environment two IR obscurant screening materials that met performance goals for their use as dry powder aerosols; performed simulations that predicted the potential increase of survivability for the soldier due to improved obscurant material performance. In FY06, determine viable methods for smoke dissemination and begin to modify promising high performing materials to maximize dissemination behavior. In FY07, will continue to refine the loading techniques of IR materials into munitions and evaluate these techniques for their effect on smoke dissemination; and evaluate performance of these materials in a laboratory environment.	2350	1331	1322
Obscurant Enabling Technology for other smoke capabilities (non IR obscurants). In FY05, documented field evaluation of long range delivery (5-8 times further than current) and quick response time (<50% of current) concepts for vehicle and dismounted soldier protection. In FY06, perform field demonstration of long range and quick response concepts for vehicle and dismounted soldier protection. In FY07, will investigate novel non-thermal dissemination methods for visual smoke; using modeling and simulation, will assess the impact of contrast reduction on the effectiveness of obscurant materials.	825	1152	890
Total	3175	2483	2212

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		11271	6607	6247	6362	6435	6490	6539
H21	JT SVC SA PROG (JSSAP)	5519	5621	6247	6362	6435	6490	6539
S50	SMALL ARMS APPLIED RESEARCH (CA)	5752	986	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) researches and designs individual and crew-served weapon technologies that will enhance the fighting capabilities and survivability of dismounted battlefield personnel in support of all Services. The technology enhancement efforts of this PE will assure that the next generation of small arms weapons systems will overmatch the evolving threat and address the needs of the Future Combat Systems (FCS) and the Future Force, and, where practical enhance Current Force. Project H21 designs and evaluates component technologies for the Lightweight Machine Gun and Ammunition (LMGA) effort. LMGA, complementing both the Objective Individual Combat Weapon (OICW) and the Objective Crew Served Weapon (OCSW), offers significantly reduced weight over the currently fielded M249 Machine Gun and its associated ammunition. LMGA will lighten the Soldier's load, provide improved battlefield mobility and reduced logistics burden to maximize operational utility and survivability, while maintaining or improving current levels of performance. 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP) and the Defense Technology Area Plan (DTAP). This program is managed by the U.S. 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, USMC PM Infantry Weapons and PEO Special Programs, U.S. Special Operations Command (SOCOM). Project S50 contains Congressional Adds only.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	11273	5703	6024
Current BES/President's Budget (FY 2007)	11271	6607	6247
Total Adjustments	-2	904	223
Congressional program reductions		-29	
Congressional rescissions		-67	
Congressional increases		1000	
Reprogrammings	-2		
SBIR/STTR Transfer			
Adjustments to Budget Years			223

One FY06 Congressional add totaling $1000 was added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount shown):
($1000) Joint Service Small Arms Program Advanced Recoil Reduction

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H21	JT SVC SA PROG (JSSAP)	5519	5621	6247	6362	6435	6490	6539

A. Mission Description and Budget Item Justification: This project researches and designs individual and crew-served weapon technologies that will enhance the fighting capabilities and survivability of dismounted battlefield personnel in support of all the Services. The technology enhancement efforts of this PE will assure that the next generation of small arms weapon systems will continue to overmatch the evolving threat and address the needs of the Future Combat Systems (FCS) and the Future Force, and where practical, enhance Current Force capabilities. The main effort in Project H21 is the Lightweight Small Arms Technologies (LSAT). LSAT will lighten the Soldier's load, and provide improved battlefield mobility and reduced logistics burden to maximize operational utility and survivability, while maintaining or improving current levels of performance. 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP) and the Defense Technology Area Plan (DTAP). This program is managed by the U.S. 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, United States Marine Corps (USMC) PM Infantry Weapons and PEO Special Programs, U.S. Special Operations Command (SOCOM).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Lightweight Small Arms Technologies (LSAT): In FY05, used 3-D models developed previously to continue refining designs for weapon and ammunition components; fabricated limited quantities of the components and evaluated merit on an individual basis for weight and feasibility in a machine gun application. In FY06, conduct component testing to validate models and populate database with actual values for chamber pressure, muzzle velocity, material strength, and functionality; and update models as necessary. In FY07, will complete all necessary subcomponent and lab scale testing; integrate weapon and ammunition component designs into weapon system; integrate subsystem 3-D models into a fully functioning system level model; maximize modularity of components to facilitate future improvements or upgrades; document program processes, models, and simulations to reflect current design status.	5519	5621	6247
Total	5519	5621	6247

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		103533	125267	35344	33361	33918	33346	33957
H18	ARTY & CBT SPT TECH	19996	13377	13519	10451	10275	10742	11213
H19	CLOSE COMBAT WEAPONRY	5151	6954	7937	8866	9557	10255	10244
H1A	WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	52944	87982	0	0	0	0	0
H28	MUNITIONS TECHNOLOGY	25442	16954	13888	14044	14086	12349	12500

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 with a focus on meeting requirements of the Future Combat System (FCS) 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. Projects H18, H19, and H28 support the Mounted Combat System (MCS) and Abrams Ammunition System Technologies (MAAST) effort, which is focused on maturing an improved ammunition suite to meet FCS requirements and reduce the logistics burden for the MCS and M1A2. The Mid-Range Munition (MRM), a focused effort under MAAST, provides the Beyond-Line-Of-Sight (BLOS) capability for MCS. Also, Projects H18, H19 and H28 support 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. Additionally, Projects H18, H19 and H28 support the Fuze and Power for Advanced Munitions efforts, which in tandem enable tailorable warhead effects for increased functionality and also designs and evaluates new on-board munition power systems with increased energy/power densities in order to extend the range and increase the lethality of future munitions. A major effort in Project H18 is the Insensitive Munition (IM) Technologies Initiative, which is focused on reducing unplanned/accidental detonation of munitions. Project H1A funds Congressional special interest items. Project H28 focuses on the design and evaluation of advanced warheads (shaped charge and Explosively Formed Penetrators (EFPs)); modeling and analytic codes for thermal analysis; novel energetics/explosives; and high impetus, low flame temperature propellants to reduce wear on gun tubes. Most products of this program generally transition to PE 0603004A (Weapons and Munitions Advanced Technology) for maturation and demonstration. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). Work is primarily performed by the Army Armaments Research, Development and Engineering Center at Picatinny Arsenal, NJ.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	102442	37824	36764
Current BES/President's Budget (FY 2007)	103533	125267	35344
Total Adjustments	1091	87443	-1420
Congressional Program Reductions		-549	
Congressional Rescissions		-1263	
Congressional Increases		89255	
Reprogrammings	1091		
SBIR/STTR Transfer			
Adjustments to Budget Years			-1420

Thirty-five FY06 Congressional adds totaling $89255 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1700) Acoustic Counter Battery System (ACBS)
($1750) Active Coatings Technology (ACT)
($1800) Advanced Materials and Nanotechnology for Ammunition
($6400) Advanced Materials and Processes for Armament Structure (AMPAS)
($2000) Advance Technology Lightweight Armament System - Rarefaction Wave Gun
($1700) Alloy-Tungsten for Armor Piercing Ammunition
($2800) Armament Systems Engineering - ASEI2
($1400) Armaments Systems Info Assurance
($2000) Armor and Structures Transformation Initiative (ASTI) - Steel to Titanium
($5400) Army Center of Excellence in Acoustics
($1400) Army Syst Engineering and Integration
($1400) Center for Integrated Security Logistics
($2800) Developmental Mission Integration
($3000) Dynamic Pulse Detonation
($1400) Effects Planning and Course of Action Tool (EPCAT)
($3750) Electroconversion of Energetic Materials
($3500) Engineered Surfaces for Weapons Systems Life Extension
($2400) Fatigue Odometer for Vehicle Components and Gun Barrels Project
($2800) Green Armaments/Rangesafe
($5100) Integrated Emergency Operations Capabilities

($2100) Less than Lethal and Scalable Protection
($2000) Micro-Laminate Ceramic Armor
($2100) Micro/Nano Systems Technology Research
($2200) Nanoparticle Development for Energetic Materials and Protective Systems
($3500) Non-nuclear Earth Penetrator Operational Prototype
($1400) Perimeter Defense Technologies
($1000) Polymer Cased 5.56mm Small Arms Ammunition
($2800) Precision Manufacturing Initiative
($2100) Remotely Operated Weapon/Sensor Technology
($3500) Seamless Data Display (SDD)
($3200) SLEUTH Tungsten Heavy Alloy Penetrator and Warhead Development
($5655) Titanium Extraction Mining and Process Engineering Technology
($1000) Toxin Guard Research
($1000) Transition Laser Engineered Net Shaping Technology
($1200) Ultra Wide Band Sensors

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H18	ARTY & CBT SPT TECH	19996	13377	13519	10451	10275	10742	11213

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, cannon fires, and mortar fires in support of Future Combat System (FCS), the Future Force and, where feasible, to enhance Current Force capabilities. Technology challenges include reducing artillery target location errors, providing real time targeting data to fire direction centers, and enhancing functionality of sensor inter-networking to support information dominance strategies for FCS. Improved smart munitions are pursued to enhance FCS Non Line-of-Sight (NLOS) capabilities and area denial capabilities. They 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. For gun propulsion systems, the focus of the IM effort is on designing barrier and venting technologies for existing and future gun propulsion systems and developing high energy, IM gun propellants at the sub-scale level for emerging gun programs. For warheads, this effort investigates venting mechanisms and IM liner technologies for existing and future explosive projectiles. In addition, the effort 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; and 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. In FY07, this project also researches high power microwave technology for use as non-lethal weapons. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). 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 2005	FY 2006	FY 2007
Common Smart Submunition (CSS): In FY05, conducted a lethality effectiveness study, which determined sizing requirements for an Explosively Formed Penetrator (EFP); evaluated options for sensors to meet discrimination performance requirements and considered a variety of launchers by participating in Joint Service working groups; designed components and evaluated performance of the CSS electronics, sensor, signal processing, and other critical sub-systems. In FY06, fabricate hardened breadboard electronic components; conduct tower field experiment and high-g Soft Recovery System (SRS) experiment; develop CSS models for analyzing packaging and integration issues; miniaturize and develop packaging architecture for CSS electronics; and build components/sub-systems into a system small enough for Umanned Aerial Vehicle, missile and/or projectile applications. In FY07, will integrate components into subsystems and evaluate sensor performance, discrimination algorithms and high-g shock and survivability; evaluate warhead penetration performance and effectiveness for smaller-diameter EFP liner.	6203	5567	2936
IM Technologies Initiatives: In FY05, began developing computer models to analyze venting designs and performed experiments with baseline laboratory hardware; modeled effects of bullet and fragment impacts as well as sympathetic detonation; fabricated and evaluated new venting designs on the propelling charge container; assessed potential barrier materials to be evaluated with baseline ammunition; fabricated and characterized new propellants. In FY06, demonstrate venting designs in the laboratory and use data to build venting model;	1850	2119	3100

optimize container venting design; assess potential barrier materials; fabricate and evaluate second iteration of propellants. In FY07, will select most promising venting design and conduct demonstration to assess IM performance; will demonstrate IM model performance using bullet and fragment impact on the NLOS-LS; conduct live bullet and fragment test on NLOS-LS to verify model results; will conduct MIL-STD-2105C IM tests with optimized vented container and barrier materials; will conduct subscale demonstration of improved propellant for ballistic and IM performance.			
Fuze and Power for Advanced Munitions: In FY05, completed the design and modeling of large caliber Micro-Electro Mechanical Systems (MEMS) Safe and Arm (S&A) device components; fabricated multipoint Electronic Safe & Arm Device (ESAD) components and baselined proximity and impact sensor designs. In FY06, conduct laboratory evaluation, and refine design for MEMS S&A components, ESADs and safety sensor designs. In FY07, will integrate MEMS S&As and ESADs with sensors and continue laboratory evaluation of integrated system to validate models.	3050	3439	3400
Future Force Advanced Weaponry and Munitions: In FY05, investigated lighter weight armament systems for the FCS family of ground vehicles and investigated use of nano-materials in fabrication of lighter weapons and munitions. In FY06, identify most promising technology solutions for light weapons and munitions applications; verify, through experimentation, ability to achieve 1 kg/hr deposition rate for nano-aluminum. Investigate wall-breaching technologies that may reduce the minimum safe distance from 300 meters to 100 meters; characterize baseline sensor designs for survivability versus performance and perform gun launch experiments to demonstrate survivability of individual component technologies. Begin development of multi-mode integrated g-hardened sensor packages. Conduct system engineering and tradeoff analysis to identify the best technical approach to provide a remote armament capability for Armed Robotic Vehicle; begin design and analysis of the ammunition handling system, the weapon mount, and control system. In FY07, will refine and demonstrate process design concept for nano-ceramic materials for lighter weight armament systems. Investigate a non-explosive HPM projectile capable of being fired from a NLOS platform and that can cause temporary or permanent electronic disruption; will conduct trade study to establish design parameters; will begin design and evaluation of a HPM source; will design HPM radiator consistent with system parameters. These efforts are coordinated with related efforts in PE/Projects 060624/H19 and H28.	2990	2252	4083
Acoustic Counter Battery System: In FY05, this one year Congressional add conducted a study to evaluate reducing the size, weight and power required for the current vehicle mounted system to transition it to a man-portable ground based system and/or a soldier wearable system. No additional funding is required to complete this effort.	2516	0	0
Army Center of Excellence in Acoustics: In FY05, this one year Congressional add conducted research and maturation of acoustic technology with academic and commercial partners to support a wide spectrum of Army efforts ranging from rapid fielding initiatives to accelerating technology insertion into major programs. No additional funding is required to complete this effort.	3387	0	0
Total	19996	13377	13519

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H19	CLOSE COMBAT WEAPONRY	5151	6954	7937	8866	9557	10255	10244

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 Future Combat System (FCS), the Future Force and, where feasible, to enhance Current Force capabilities. The project conducts research in technologies that will 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 matures advanced multi-mode fuzing components, extended range munitions and alternative mechanisms to defeat advanced armor systems. Fuze and Power for Advanced Munitions refines advanced on-board munition power systems with increased energy/power densities, increased mission time, improved temperature performance and reduced volume and weight for a variety of applications. Countermine/IED Neutralization exploits Laser Induced Plasma Channel (LIPC) to defeat Improvised Explosive Devices (IEDs) and mines. The Armed Robotic Vehicle (ARV) effort designs and evaluates a remote weapon station optimized for high-reliability on an unmanned vehicle. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). 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 2005	FY 2006	FY 2007
Non-Lethal Payloads for Personnel Suppression : In FY06, conduct laboratory and field testing to determine concentration levels of suppression payload to achieve desired effects against personnel; conduct system flight demonstration; conduct dissemination test and initial health and environmental assessment. In FY07, will verify effectiveness of personnel suppression round to deliver NL payload to area target; and will conduct system performance evaluations in relevant environments.	0	1987	2582
Countermine/IED Neutralization & Urban Warfare: In FY05, investigated performance of technologies for mounted and dismounted warfighters in an urban situation including a capability to deliver stand-off lethality and defeat enemy active protection systems. In FY06, conduct modeling & simulation to increase channel length of laser filamentation for LGE; evaluate different Directed Energy waveform types for effective defeat of Improvised Explosive Devices (IEDs) and Mines; conduct laser filamentation testing to determine laser parameters required for integration with high voltage energy or other Directed Energy (DE) waveforms. In FY07, will begin brass board integration of laser with DE system(s) to demonstrate LGE technology; will conduct laboratory testing to verify laser integration parameters and will perform low level target effects testing for countermine/counter IED.	1830	3000	2852
Warfighter Technology for Future Operations: In FY05, assembled component warhead technologies (i.e., Novel Energetics and Combined Effects Warhead) for a breadboard design. Conducted target effects/material interaction tests using selected agile DE source technology; performed initial studies into benefits of integrating high voltage or other Directed Energy (DE) waveforms with Laser Guided Energy (LGE); identified hardware upgrades to laboratory laser to improve experiments with LGE; transitioned information/results to Precision Mine Neutralization & Location ATO to investigate the LGE for countermine/counter IED applications. Also in FY05, began design and evaluation of advanced energy systems based on thermal and liquid reserve batteries with lower volumes, new electrolytes and higher power densities; performed modeling of advanced thermal battery technology. In FY06, conduct laboratory evaluation and initial testing of preliminary designs on new thermal and liquid reserve batteries and hybrid systems as power sources for	3321	1967	711

current and future munitions. In FY07, will integrate component technologies for dynamic warhead tests using novel energetics in the combined effects warhead design. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H18 and H28.			
Armed Robotic Vehicles (ARV): In FY07, will fabricate and assemble breadboard components including the ammo handling system; will conduct laboratory experiments to prove out the basic concept; will continue design and checkout of the control system; will define and validate the interfaces with the ARV through experimentation. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H18 and H28.	0	0	1792
Total	5151	6954	7937

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H28	MUNITIONS TECHNOLOGY	25442	16954	13888	14044	14086	12349	12500

A. Mission Description and Budget Item Justification: This project advances the state of the art for enabling munitions technologies supporting the Future Combat System (FCS), 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 by funding efforts that design and evaluate warheads, multipurpose blast/fragmentation/shaped charge and Explosively Formed Penetrators (EFPs), high energy explosives, large-caliber gun propellants with barrel wear-reducing additives, energetics, and advanced materials/processes for warheads. 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 matured to increase lethality and optimize performance. New improved energetic materials provide numerous transition opportunities for weapon system upgrades and FCS. High-impetus propellant formulations, when coupled with technologies such as electrothermal chemical ignition, offer increased muzzle kinetic energy, precision ignition and repeatability. Efforts under this project support the FCS 120mm Line-of-Sight/Beyond Line-of-Sight (LOS/BLOS) System Advanced Technology Demonstration (completed in FY05) and the Medium Range Munition (MRM), which contribute to providing a lightweight armament and ammunition system for FCS Mounted Combat System (MCS). The MCS and Abrams Armament System Technology (MAAST) continues the work of designing FCS munitions, including an Enhanced MRM, a Line- of-Sight Multi-Purpose (LOS-MP) munition, an Enhanced Kinetic Energy munition. The MAAST effort increases MRM's range and improves performance against various (multiple) targets. Other major efforts in this project include: Novel Energetic Materials for the Future Force, which matures advanced energetic materials with the ability to control energy release for precision munition and counter-munition applications; Hardened Combined Effects Penetrator Warhead Technology, which provides overmatch lethality using a single warhead capable of defeating armor, bunkers, personnel and Unmanned Air Vehicles; Fuze and Power for Advanced Munitions which proposes alternate/hybrid systems and advanced thermal battery for ruggedizing through lab test and evaluation; and multiple-EFP Warheads Technology, which focuses on analysis and maturation of EFP munitions supporting the Army's research and development of vehicle-mounted APSs and other applications. The Common Smart Submunition effort in this project is coordinated with and complementary to the work performed in H19 and is focused on warhead performance. The Future Force Guns, Munitions and Armor effort designs and evaluates technologies for a lightweight, single stage wall breaching system that can create a Soldier-size entry hole in a spectrum of urban walls in 1/3 of the time currently required; matures extended range munitions for 120mm mortar application; and matures nanomaterials for lightweight composite armor applications. Efforts under this project are consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). 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 in support of the Tank Automotive Research, Development and Engineering Center (TARDEC) under Program Element (PE) 0603005A (Combat Vehicle and Advanced Automotive Technology).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
MAAST: In FY05, completed warhead performance tests and evaluation of Line of Sight-Multi Purpose (LOS-MP) munition for airburst capability, concrete wall penetration and anti-armor performance; optimized Electronic Safe & Arm (ESA) subsystem of multi-effects warhead; completed analysis of LOS-MP performance for selection of final design configuration; completed design of advanced propulsion providing precision ignition and hot performance across entire temperature range. In FY06, mature advanced propulsion charge for LOS-MP and mature a robust combustible cartridge case design; statically test MRM multi-mode warhead designs and complete initial	9342	3382	0

design and integration of counter APS for MRM.			
Novel Energetic Materials for the Future Force: In FY05, defined matrix of energetic materials technologies for advanced gun propulsion and advanced explosives for warhead applications; experimentally assessed the potential benefits of energy-managed materials by generating the appropriate comparative experimental data. In FY06, select a system application for demonstration of novel energetic material (gun propulsion/rocket/multi-purpose warhead); verify the predicted performance and multi-purpose benefit based on additional laboratory experiments and simulations as well as subscale and/or test scaled units and select the enabling energetic materials. In FY07, will bound the pressure and temperature characteristics of the gun propellant and new energetic material for warheads through testing and modeling of selected gun propulsion/multi-purpose warhead; will conduct analysis to determine performance/surivability characteristics compared to current systems with conventional energetics; will conduct experiments with best-performing energetic materials in selected systems or subassemblies.	3946	6014	6800
Hardened Combined Effects Penetrator Warhead and Explosively Formed Penetrator (EFP)Technology: In FY05, determined the critical impact parameters associated with penetration of targets such as masonry and reinforced concrete walls; investigated hardening techniques and hardened designs of the penetrator and evaluated candidate multi-purpose energetic materials including energetics structural integrity. Conducted dynamic testing of optimized APS warhead against Kinetic Energy and High Explosive Anti-Tank rounds. In FY06, incorporate enhanced blast explosives and advanced fragmentation designs into hardened shaped charge warheads and conduct in-process testing. In FY07, will evaluate test results and refine and optimize warhead designs accordingly and repeat in-process testing to confirm performance of optimized warhead against selected targets.	7019	5652	4250
Generation 2 Warhead Development, Explosively Formed Penetrator (EFP): In FY05, this one-year Congressional add investigated a warhead design to defeat a surrogate complex armor target; explored improved hit accuracies at 50 meters; and evaluated performance. No additional funding is required to complete this effort.	1059	0	0
Liquidmetal Alloy-Tungsten Alloy Penetrator: In FY05, this one year Congressional add evaluated variations in physical geometry of a tungsten alloy to determine the performance enhancement; investigated manufacturing processes. No additional funding is required to complete this effort.	2021	0	0
Extended Area Protection & Survival (EAPS): In FY07, will analyze and model advanced warhead and fuze designs; and will design, fabricate and test against static targets.	0	0	1326
Warfighter Munitions Technology: In FY05, analyzed breadboard submunition warhead design that showed significant increase in armor penetration over existing designs. Conducted laboratory evaluation and initial testing of munition power source preliminary designs. Also in FY05, investigated light weight materials for application to armament systems. In FY06, improve aerostability and hit accuracy of EFP warhead. Evaluate performance and investigate producibility of a hybrid munition power. Also in FY06, develop most promising lightweight solutions for system specific applications. In FY07, will investigate ways to improve precision mortars with respect to increasing lethality at extended ranges; and will conduct an analysis to determine the optimal approach for defeating incoming threats (rockets, artillery and mortars) including trade-offs for tracking systems, fire control software, and munitions for engaging the incoming threat; will create models for these subsystems. Also in FY07, will experiment with baseline designs of grenade launched sensors to ensure survivability of acoustic and electro-optic sensors when subjected to gun launch environment; will investigate hardening processes; will begin designing a multi-modal sensor suite for a 40mm grenade application.	2055	1906	1512
Total	25442	16954	13888

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		101771	91925	42175	41729	41917	43483	43904
EM4	Electric Component Technologies (CA)	22518	9661	0	0	0	0	0
EM6	HEATING AND COOLING TECHNOLOGIES (CA)	3449	3943	0	0	0	0	0
EM7	POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)	35292	39331	0	0	0	0	0
H11	BATTERY/IND POWER TECH	11872	11993	12336	11769	10241	10347	10439
H17	FLEXIBLE DISPLAY CENTER	0	4895	5151	5113	5115	5163	5175
H94	ELEC & ELECTRONIC DEV	28640	22102	24688	24847	26561	27973	28290

A. Mission Description and Budget Item Justification: This program element provides 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 Future Combat System (FCS) and Future Force Warrior applications. Project H11 researches 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 consists of 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 new 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	102768	39554	41536
Current BES/President's Budget (FY 2007)	101771	91925	42175
Total Adjustments	-997	52371	639
Congressional Program Reductions		-402	
Congressional Rescissions		-927	
Congressional Increases		53700	
Reprogrammings	-997		
SBIR/STTR Transfer			
Adjustments to Budget Years			639

Thirty-three FY06 Congressional adds totaling $53,700 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1000) Advanced Oscillator Technology for Radar and Communications Systems
($1000) Advanced Power Component Technologies
($1000) Bipolar Wafer-cell Lithium-ion Batteries
($1000) Carbon Dioxide Heating and Cooling Technology
($1000) Conformal LI-ION Polymer Belt Battery for Urban 1st Responders
($1000) Development of Clean Sources of Hydrogen for Fuel Cells
($2000) Direct Methanol Fuel Cell Lifetime Improvement Program (DMFC-LIP)
($2000) E-Beam Reticle and Lithography Inspection Tool
($1000) Field-Ruggedized Mid-Range Direct Methanol Fuel Cells
($1000) Flexible Microelectronics in Support of Flexible Display Initiative (FDI)
($2600) Flexible Polymer Multilaminate Packaging
($1000) Future Soldier Hybrid Power Sources for the Battlefield
($1000) Higher Energy Density Rechargeable Batteries Based on Stabilized Lithium Metal Power (SLMP)
($3600) Jet/Diesel-Fueled Military Fuel Cell System
($1000) Liquid Silicone (Large Format Plate Type) Li Rechargeable Battery for the Future Force Warrior
($2200) Lithium Air Metal Battery
($2500) Lithium Carbide Monoflouride Military Battery Packs
($1800) Manufacturing Technology Development of Advanced Components for High Power Solid-State Lasers
($1500) Miniature Tactical Energy Systems Development
($1000) Nanofluidic Electronic BioSensor Technologies for Defense Applications

($1400) Novel Zinc Air Power Sources for Military Applications
($1000) ONAMI Miniature Tactical Energy Systems Development
($1000) PEM Fuel Cell Tactical Quiet Generators
($2000) Portable Power Technology and Manufacture
($1000) Portable Reforming on the Battlefield
($2000) Portable Solid Oxide Fuel Cell SOFC/JP-8 Demonstrator
($2700) Revolutionary 1.5V Alkaline
($1400) Soldier Fuel Cell System
($1500) Soldier Portable Fuel Cell Power Using Solid Fuel Hydrogen Generator
($2000) State of Charge Battery Life Indicator
($2800) Thin Cylindrical Iron Disulfide Primary Battery
($3000) Transcritical Carbon Dioxide (CO2) Environmental Control Unit
($1700) Weapons of Mass Destruction Marking Set

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H11 BATTERY/IND POWER TECH	11872	11993	12336	11769	10241	10347	10439

A. Mission Description and Budget Item Justification: This project conducts 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 researches advancements 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 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 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, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- 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 FY05, investigated system level stand-alone smart charger technology with 2-hour recharge capability for soldier batteries; investigated power management techniques to reduce operating system power draw for soldier systems by 50%. In FY06, develop and evaluate propane fueled small Stirling engine generator components for silent manportable (<10 kilograms) power 160 watts; design and demonstrate a hybrid fuel cell power source with reformed methanol fuel. In FY07, will investigate system-level smart chargers integrated with a quiet power source for stand-alone charging; will design and demonstrate ruggedized soldier hybrid power source for 72 hour mission; will investigate micro-reformer components for logistic fueled manportable power source.	7613	7817	8168
- 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, and tactical power management systems. In FY05, developed components for a 2 kilowatt (kW) fuel processing system operating on low-sulfur fuel (<50 parts per million sulfur). In FY06, investigate fuel cell reformer components for 1-2 kW system for scout vehicle silent watch; investigate and mature logistic fueled Stirling engine generator components for silent mobile (for vehicle/trailer platforms) power >1kW; evaluate integrated 2 kW fuel processing system operating on low-sulfur fuel. In FY07, will evaluate components for 2 kW fuel processing system operating on high sulfur fuel (>300 parts per million sulfur); will demonstrate 1-2 kW Stirling engine generator system on logistic fuel.	4259	4176	4168
Total	11872	11993	12336

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H17 FLEXIBLE DISPLAY CENTER	0	4895	5151	5113	5115	5163	5175

A. Mission Description and Budget Item Justification: This project funds the new Flexible Display Center at Arizona State University. The objective of this project is to conduct applied research in advanced and novel electronic displays. 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: lightweight, low power and rugged flexible 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). 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.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- In FY05, this effort was funded in this PE under Project H94. The Army established a Flexible Display Center at Arizona State University to develop flexible display technology demonstrations for future vehicle and future Soldier applications. In FY06, will design and fabricate larger format reflective and emissive displays (up to 4" diagonal). The research will enable improved integration of display sub-systems. Display drivers will be developed. In FY07, will design and fabricate 4" diagonal Active Matrix reflective and emissive displays with enhanced resolution and functionality. Begin full color design. Display development on the pilot line will begin for improved processes with higher yield. Management and applied research will be conducted by ARL in collaboration with Natick Soldier Center, the Flexible Display Center, industry, and other university partners.	0	4895	5151
Total	0	4895	5151

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H94 ELEC & ELECTRONIC DEV	28640	22102	24688	24847	26561	27973	28290

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, 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 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 ultra-violet (UV)/Infrared (IR) vertical emitters, will be a key enabler for more affordable 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. In FY05, this project also funded the new Flexible Display Center at Arizona State University. As of FY06, the Flexible Display effort will be restructured to Project H17 for increased visibility and management oversight. 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 2005	FY 2006	FY 2007
- Mature high performance antennas and RF front-end architectures to support multifunction radar systems; and design and evaluate electronically scanning antennas for multifunction RF applications. In FY05, prototyped small linear Ka antenna arrays, using ferroelectric and micro electro mechanical system (MEMS) phase shifter technology to assess feasibility of each concept in terms of loss and beam positioning speed. In FY06, will assess Ka-band Electronically Scanned Antenna (ESA) requirements for Army communications. Will design and mature multiple apertures in Joint Service Communications bands integrated into composite armor. Will design high sensitivity single mmW microbolometer detector for radiometry applications. In FY07, will fabricate composite armor antennas consistent with Army directional antenna requirements.	3061	943	1004
- 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	2571	2829	3110

detection, and authentication techniques for the Future Force. In FY05, assessed the performance of E-Beam lithography in patterning nanoscale RF structures for Future Force and future Soldier communications; designed, fabricated, and evaluated phase-locked cavity based stabilized local oscillator (STALO) for RF front ends; and integrated lead zirconium titanate (PZT) MEMS switches in a phased array in an Electronically Scanned Antenna (ESA) structure. In FY06, will develop a full PZT-MEMS switch based ESA for missile seekers. Investigate 1/f noise physics in resonators, and optimize miniature dual mode resonators with low g sensitivity leading to high g smart munitions. In FY07, will develop wafer-level packaging with a MEMS phase shifter process for multifunction RF applications; and will start characterization of stabilized oscillator dual mode crystals with low hysteresis temperature effects.			
- 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 FY05, integrated and characterized VE tube with semiconductor amplifier and power supply in Millimeter Power Modules (MMPMs); completed transmit/receive (T/R) module incorporating wide bandgap Monolithic Microwave Integrated Chip (MMICs) for synthetic aperture radar/moving target indicator (SAR/MTI) radar to support tactical UAVs. In FY06, will fabricate and evaluate high power (60W) Q-band MMPM amplifier; and will investigate reliability of gallium nitride (GaN) devices under high temperature, fabricate 2nd generation devices, and implement packaging concepts with thermal modeling. In FY07, will characterize, analyze, and evaluate high power (80W) Ka-band MMPM; and will design and characterize GaN T/R and power amplifier modules.	2925	2867	3183
- Investigate eye-safe scannerless 3-D imaging laser radar (ladar) and multi-color passive infrared (IR) imaging focal plane arrays (FPAs) and cameras 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 FY05, implemented and characterized a longer-range improved version of the ladar breadboard, and collected data to show functionality for target acquisition. Using the newly constructed tandem test bed, characterized promising nonlinear optical materials in militarily relevant focusing configurations. In FY06, will analyze passive IR target and background signatures and recommend design criteria to the Communications and Electronics Research, Development and Engineering Center (CERDEC) for advanced IR dual-band passive sensors; will evaluate and select a nonlinear limiting material class with large bandwidth and high optical density for extensive characterization in tandem limiter configuration. In FY07, will design and evaluate obscured target detection through 3-D ladar imagery in simulated UAV and ground-to-ground scenarios and transition to CERDEC Mission Equipment Package for Class II UAV program; will address issues associated with encapsulating the selected nonlinear material in a solid host, leading to development of a robust limiting device, which provides technologies to protect against damage at all laser wavelengths across the operating spectrum of the Future Force electro-optic vision systems.	3309	2982	3210
- 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. Will design and fabricate arrays for higher operating temperature. In FY05, achieved growth of LWIR arrays with less than 2% defective pixels. Fabricated 256x256 LWIR FPA from material grown on Si with high sensitivity. In FY06, will fabricate large area arrays with up to 1000X1000 pixels for both MWIR and LWIR with a goal of less than 1% defective pixels; and will fabricate arrays with new detector design for higher operating temperature. In FY07, will continue the growth of high temperature arrays with the goal of achieving operating temperatures of 180 Kelvin for MWIR and 120 Kelvin for LWIR.	2665	2019	2723
- Investigate a broad base of extremely quick, accurate, and novel photonic architectures to enable detection of hazardous substances to enhance soldier survivability. In FY05, characterized the chemical sensing concept using a photoacoustic system on a Micro-	1884	1404	1492

Electromechanical-Systems (MEMS) platform and characterized an antimony-based resonant-cavity vertical-emitting infrared Light Emitting Diode (LED). In FY06, will evaluate MEMS photoacoustic sensor performance for feasibility as a trace-level chemical sensor. In FY07, will explore possible chip-level technologies (Quantum / Interband Cascade Lasers, MEMS microphones and MEMS actuators) for incorporation into MEMS photoacoustic chemical sensing system.			
- 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 FY05, explored designs and fabrication methods for a MEMS based fuel pump, and investigated Aluminum Nitride for a micro-channel cooling system to provide 250 watts / square centimeter (W/cm2) of cooling. In FY06, will fabricate a MEMS based fuel pump and fuel injector devices; design and fabricate reclaimed energy system for small engines, and fabricate micro-cooling systems capable of 250 W/cm2. In FY07, will design and fabricate reclaimed energy systems for small engines; investigate methods to integrate MEMS based fuel/air delivery devices to small engines and fuel cells; and will design and fabricate cooling systems that provide 500 W/cm2.	2500	4435	4564
- Investigate and evaluate prognostics and diagnostics (P&D) algorithms; design, fabricate and evaluate MEMS and other sensors; and design, code, and evaluate database for the integration into decision systems to extend sensor rationalization and minimize downtime via condition-based maintenance. In FY05, fabricated MEMS multi-level acceleration latch/reset switches for no power shock detection and monitoring; and conduct validating experiments on MEMS/nanotechnology sensors. In FY06, will research and evaluate advanced base-sensor suite, processor, and transceiver in distributed multi-node network. In FY07, will evaluate chemical and stress sensors for missile health monitoring.	2815	2780	3442
- Investigate and mature silicon carbide (SiC) power device and packaging technologies to enable high temperature and power density converters for motor drive and pulse power applications for the Future Force (FF). Investigate technology for advanced batteries, fuel reformers and fuel cells to be used in hybrid power sources for FF electromagnetic armor and smart munitions. In FY05, implemented high-temperature controller and DC-DC isolation circuits for high-power converters; investigated high temperature power converters for 10 kilowatt (kW) and 100 kW mobile power applications and implemented high-voltage SiC power rectifier for a survivability application. Provided technology for an advanced high-energy rechargeable battery with enhanced user safety and high temperature charge retention and explored sulfur-removal absorbents for fuel cells. In FY06, will investigate and evaluate high-temperature SiC power converters implemented with current-controlled devices for medium power hybrid-electric vehicle (HEV) power conversion applications; will provide electrode/electrolyte materials technology for enhancing charge/discharge rate of advanced Li-ion batteries and investigate absorbents for removing sulfides in military fuel for fuel cells. In FY07, will mature current controlled SiC power components; investigate/evaluate high-temperature SiC converters implemented with voltage-controlled devices for low power HEV power conversion; and provide improved electrolyte for low temperature Li-ion batteries and sulfur-tolerant catalysts for logistic fuel processing for fuel cells.	1783	1843	1960
- The Army established a Flexible Display Center at Arizona State University to develop flexible display technology demonstrations for future vehicle and future Soldier applications. In FY05, investigated 2.5" diagonal active matrix reflective displays from research line. In FY06, this effort is restructured into PE 0602705A Project H17 for increased visibility and management oversight.	5127	0	0
Total	28640	22102	24688

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		26393	31664	23907	24904	26310	27655	27877
H95	NIGHT VISION & EO TECH	22081	23483	23907	24904	26310	27655	27877
K90	NIGHT VISION COMPONENT TECHNOLOGY (CA)	4312	8181	0	0	0	0	0

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

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	26406	23823	26686
Current BES/President's Budget (FY 2007)	26393	31664	23907
Total Adjustments	-13	7841	-2779
Congressional program reductions		-149	
Congressional rescissions		-310	
Congressional increases		8300	
Reprogrammings	-13		
SBIR/STTR Transfer			
Adjustments to Budget Years			-2779

FY 07 decrease of -2.8 million attributed reprogramming to offset business re-engineering efficiencies.

Six FY06 Congressional adds totaling $8300 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1000) Compact Lightweight Solid State Glass Lasers for Military Applications
($1300) Crystal Materials for Electro-Optic Imaging and Communication
($1000) Diffractive Optics for Advanced Imaging
($1500) Enhanced Micro-Image Display Technology
($1000) Miniaturized Sensors for Small and Tactical Unmanned Aerial Vehicles (UAVs)
($2500) Next Generation Focal Plane Array (FPA)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H95	NIGHT VISION & EO TECH	22081	23483	23907	24904	26310	27655	27877

A. Mission Description and Budget Item Justification: This project funds efforts that research, design, and apply 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 the Future Force, and, where feasible, exploit opportunities to enhance Current Force capabilities. The Soldier Vision System Components effort will determine 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 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. The Distributed Aided Target Recognition (AiTR) effort will research the ability to dramatically reduce the time necessary to acquire targets, and collect intelligence data. The Lightweight Laser Designators effort will provide the capability to incorporate lightweight laser designators on small unmanned aerial vehicle (UAV) and unmanned ground vehicle (UGV) platforms and portable soldier systems. The Low Cost High Resolution Focal Plane Array (FPA) effort researches 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 using the Advanced Sensor Modeling and Simulation effort, and Sensor Modeling and Simulation Technology effort. In addition, this effort 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. The Multifunction Laser effort will assess and evaluate laser materials to produce a covert ladar system. The Modeling, Measurements, and Simulation Applied Research for Sensor Design and Evaluation effort will develop new and evolve current sensor models, simulations, and measurement procedures to address new sensor technologies, new modalities and more robust urban and global war on terrorism threat environments. The High Performance Small Pixel Uncooled Infrared Focal Plane Array effort will demonstrate the feasibility of high performance, smaller pixel, low cost, uncooled technology for short range Future Combat Systems sensors, unmanned aerial vehicles, head mounted thermal imaging, thermal weapon sights, cost effective targeting system, distributed aperture systems, driver vision, and precision attack munition. 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 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 PE is performed by the Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Disposable Sensors. In FY05, fabricated initial imaging and non-imaging data collection systems to collect and analyze multi-sensor modality data; devised and demonstrated initial embedded signal processing and fusion methodologies; investigated novel magnetic devices and signatures relevant to personnel detection in urban environments.	1904	0	0
Soldier Vision System Components (SVSC). In FY05, researched 1280 x 1024 passive video-board low light sensors, miniature pixel fusion processor with advanced system control functions and low power 320 x 240 uncooled FLIR; investigated and evaluated large	5204	5702	4105

format (High Definition TV) low light video sensors for future soldier system efforts; evaluated first low-power, small-pixel, high dynamic range color micro displays. In FY06, complete development, deliver and evaluate final configuration prototype components: low power color micro displays, Micro Channel Plate Complementary Metal Oxide Semiconductor (MCPCMOS) visible near infra-red sensor, variable density dichroic combiner/attenuator, and multi-spectral pixel-fusion processor; design and fabricate SVSC test-bed to conduct system architecture human factors studies; continue multi-spectral fusion data collection for image fusion metric; perform video frame rate selection power/latency trade; select image fusion algorithm. In FY07, will investigate low power high performance large format night imager and pixel fusion processor for multi-spectral fusion on a low power color head mounted display; will provide components with integrated fusion architecture to PEO Soldier including: head mounted opto-mechanical configuration and interface definitions, low power electronic configuration and interface definitions, multi-spectral sensor, color display fusion algorithm implementation, and MCPCMOS/electron bombarded active pixel sensor system level performance comparison study.			
Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence. In FY05, investigated baseline algorithm against difficult targets and urban/clutter environments. In FY06, research multispectral and hyperspectral ATR algorithm against difficult targets and urban/cluttered environments. In FY07, will conduct phenomenology study of fusing multiple sensors against highly cluttered environments.	849	1225	1443
Lightweight Laser Designators. In FY05, built selected brassboard solid-state laser designs and tested in the laboratory to verify energy output, beam quality and operation over temperature. In FY06, conduct laboratory demonstrations with most promising designs, assess performance, harden and refine laser design in order to transition the best laser designs to laser manufacturers for brassboard fabrication. In FY07, will research and develop brassboard compact lasers meeting requirements for lightweight designators.	2401	2256	2380
Low Cost High Resolution Focal Plane Arrays (FPA). In FY05, evaluated multi-band pixel interconnect for making three dimensional readout circuits; demonstrated long wave Mercury Cadmium Telluride (HgCdTe) on silicon growth in a 256X256 format with greater than 90% operability; developed uncooled detector test structures with 8 milli-second (ms) time constant and 70 milli-Kelvin (mK) Noise Equivalent Temperature Difference (NETD). In FY06, demonstrate increased dynamic range readout circuits for the FPA in order to simultaneously observe contents of a dark cave in bright sunlight; demonstrate long-wave HgCdTe growth on silicon in a 640X480 format and greater than 93% operability; demonstrate advanced dual band high resolution HgCdTe FPA in a dual f-number configuration to see wide area field of view and high resolution long range identification in the same system; demonstrate a 640X480 uncooled array with a 5ms time constant and a 50mK NETD. In FY07, will demonstrate long-wave HgCdTe array in a 1280X720 format with greater than 96% operability; will demonstrate a 640X480 uncooled array, with a 5 ms time constant and a 35 mK NETD.	7156	8298	6800
Integrated Modeling and Simulation Applied Research for Sensor Design and Evaluation. In FY05, delivered new sensor and targeting task performance models that replace current models; completed beta version of "spectral" thermal sensor performance model to support 3rd Gen FLIR technology research program; transitioned active laser range gate sensor model for program manager/industry use; validated synthetic thermal target models transitioned to Program Executive Office for Simulation Training and Instrumentation for incorporation into trainers. In FY06, validate and publish human performance model for fused, multi-spectral (MWIR/LWIR or IR/Image Intensifier) imager; publish improved measurement procedures for under-sampled and "super-resolved" imagers. In FY07, will complete development of 3rd GEN FLIR simulation; will update Acquire family of models with metrics for the detection and discrimination of concealed weapons, and more robust detection and discrimination of personnel in urban environments.	4567	4389	4914
Multifunction Lasers. In FY07, will assess and evaluate laser materials to produce multiple wavelength bands and pulse modulation for future covert laser systems.	0	0	1390
High Performance Small Pixel Uncooled Focal Plane Array. In FY06, perform trade studies and do modeling and simulation to demonstrate feasibility of high performance small pixel uncooled focal plane array. In FY07, will design and fabricate pixel structures to	0	1613	2875

verify design parameters; will test and evaluate the pixel structures to verify sensitivity and noise predictions; will do the preliminary design of the read out integrated circuit (ROIC).			
Total	22081	23483	23907

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		26267	29171	22088	21965	21961	22160	22333
H24	COUNTERMINE TECH	17222	16436	19300	19127	19089	19263	19414
H35	CAMOUFLAGE & COUNTER-RECON TECH	2529	2582	2788	2838	2872	2897	2919
HB2	COUNTERMINE COMPONENT TECHNOLOGY (CA)	6516	10153	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) studies and examines applied technologies to improve countermine, signature management and counter sensors capabilities for the Future Force and where feasible, exploits opportunities to enhance Current Force capabilities. Project H24 focuses on concepts and technologies with potential to improve detection and neutralization of mines and improvised explosive devices (IEDs) from a safe distance using ground and air platforms. The goal of this project is to increase mine and improvised explosive device 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 examines countermine phenomenology of surface and buried mines, booby-traps, and improvised explosive devices. 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 and IED detection operations. This PE addresses emerging mine/IED threats in both the conventional and electronically activated categories, 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. Project H35 examines signature management techniques for tactical operation centers and counter sensor techniques to reduce the reconnaissance capabilities of our adversaries. Project HB2 funds Congressional special interest items.

Work in this PE is related to and is fully coordinated with PE 0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermine and Barrier Development), PE 0603710A (Night Vision Advanced Technology), ERDC, and the US Marine Corps. This PE contains no duplication of effort within the Army, other Services, or the Department of Defense. 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 PE will be performed by the Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/ Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, Virginia; the Army Corps of Engineer, R&D Center, Vicksburg, Mississippi; and the Armaments Research, Development, and Engineering Center, Picatinny, New Jersey.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	26279	19293	23037
Current BES/President's Budget (FY 2007)	26267	29171	22088
Total Adjustments	-12	9878	-949
Congressional Program Reductions		-128	
Congressional Rescissions		-294	
Congressional Increases		10300	
Reprogrammings	-12		
SBIR/STTR Transfer			
Adjustments to Budget Years			-949

Five FY06 Congressional adds totaling $10300 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($2800) Biological Detection of Unexploded Ordnance and Land Mines
($1500) Explosive Detonation and Mitigation-INL
($4000) Quantum Research Facility
($1000) Small Synthetic Aperture Radar (SAR) Buried Mine Detection
($1000) Stoichiometric Explosive Detector System

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H24 COUNTERMINE TECH	17222	16436	19300	19127	19089	19263	19414

A. Mission Description and Budget Item Justification: This project examines new countermine technologies using man-portable, ground-vehicular, and airborne platforms for detection, discrimination and neutralization of individual mines, minefields, and improvised explosive devices (IEDs). These technologies support the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. This goal of this project is to detect mines and IEDs with high probability, reduce false alarms, and increase operational tempo by performing data collection to assess the ability of various sensor combinations and signal processing/fusion algorithms. This project sponsors 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. The Wide Area Airborne Minefield Detection effort will characterize a variety of airborne sensor technologies, tested in a variety of environmental conditions, to support wide area minefield detection. The Precision Mine Neutralization and Localization effort will increase the potential for sustained rapid movement of tactical forces using stand-off neutralization technologies. The Off Route Mine Detection and Neutralization effort will provide forward-looking mine and IED detection and neutralization, including side-attack detection, in an off-route environment within required rate-of-advance for Brigade Combat Team minefield reconnaissance missions. The Countermine Phenomenology Studies effort will 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. The Sensors for Explosive Detection effort will provide short range standoff capability to detect explosives (such as IEDs, mines, and car bombs) using chemical sensing methods in urban environments and route clearance scenarios.

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 PE is performed by the Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center (CERDEC)/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, Virginia; the Corps of Engineers RD&E Center, Vicksburg, Mississippi; the Armaments Research, Development, and Engineering Center, Picatinny, New Jersey; and the CERDEC Intelligence and Information Warfare Directorate, Fort Monmouth, New Jersey.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Center of Excellence for Unexploded Ordnance (UXO). In FY05, prepared the annual UXO Research and Development Plan; developed the UXO RDT&E Strategic Road Map; tested various "real-time" explosive specific detection technologies. In FY06, prepare report on "real-time" explosive specific detection technologies with recommendations on technologies for varying environments; coordinate requirements, integrate programs from the mission areas, and leverage the capabilities in other Government agencies, industry, academia, and the international community. In FY07, will continue to establish standards for testing, modeling, and evaluating Counter UXO technologies and ensure that requirements are current and accurate, opportunities for leveraging technologies are identified and exercised, duplicative programs are identified and eliminated, and information on programs and progress is shared.	486	500	500
Wide Area Airborne Minefield Detection. In FY05, collected and analyzed measurements using brassboard sensor, a wide variety of environmental conditions (soil conditions, temperature, humidity, ambient lighting, etc.) and collected extensive clutter data for building, testing and refining mine and IED detection algorithms. In FY06, modify and evaluate the brassboard sensor design on multiple	5078	5670	7547

backgrounds; perform additional data collections with modified sensors; continue maturing optimized mini clutter detection algorithms and modules. In FY07, will complete design and build a multispectral countermine sensor; will test the sensor in a manned flight and collect data over a variety of mines and IEDs in different deployments and in a variety of clutter backgrounds; will apply an automatic target recognition algorithm to the data to assess the technical and operational performance of the sensor and provide recommendations for a sensor design/specification for the subsequent sensor/system prototype; will analyze data from three different data collections for the ground penetrating radar and hyperspectral sensors to determine performance for detecting IEDs.			
Precision Mine Neutralization with Localization. In FY05, designed and built precision neutralization breadboard components and subsystems; performed initial field experiments; conducted analysis on collected data; began building and testing point neutralization breadboard systems based on evaluation and assessment of prior field experiments. In FY06, assemble cross-country acoustic-based mine confirmation and localization sensor data collection system(s); investigate landmine confirmation and localization signal processing and associated target recognition algorithms; conduct joint field data collections with precision mine neutralization breadboard systems and confirmation and localization sensor data collection systems. In FY07, will combine multiple standoff mine localization, and neutralization technologies onto a single, or integrated platform; will conduct field experiments against mines and IEDs in realistic on- and off-route environments; will perform assessment of combined technologies.	3290	4637	4474
Countermine Phenomenology Studies. In FY05, conducted a field study to gather data to feed an environmental model and sensor performance model that will be used to predict and reduce false alarms; completed countermine testbed model including a detailed background environmental model with target mine/IED model. In FY06, conduct site characterization and mine/IED sensing field experiments to determine predictive capabilities of improved geo-environmental models and assemble database of mines in background signatures. In FY07, will conduct blind countermine experiments at well characterized sites to evaluate model performance and clutter rejection improvements.	3554	4266	4732
Sensors for Explosive Detection. In FY05, conducted initial studies on signatures of explosives and their behavior in various environments; transitioned amplified fluorescence quenching polymer based sensor technology to the Joint IED Task Force following extensive data collection. In FY06, investigate field portable explosive detection sensor technology for data collection and focus on spectroscopic sensor development as well as signature studies of roadside and vehicle borne improvised explosive devices. In FY07, will conduct lab and field experiments of new portable sensors and evaluate performance.	960	1363	2047
Off Route Mine Detection and Neutralization. In FY05, continued to examine and conduct evaluations of off route detection capabilities designed to provide increased operational tempo and enhanced vehicle and soldier survivability; conducted a successful field test demonstrating 35 kph rate of advance, 50m detection standoff and < 0.3 m location accuracy with a Pd >85% & FAR of .01/m2 in a complex background.	3854	0	0
Total	17222	16436	19300

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H35	CAMOUFLAGE & COUNTER-RECON TECH	2529	2582	2788	2838	2872	2897	2919

A. Mission Description and Budget Item Justification: This project designs, develops, and investigates 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. The Low Cost Counter Reconnaissance Technology effort will investigate advanced materials and processes for countering visual, infrared (IR), and spectral sensors; optical and electronic techniques for reducing the signatures of uncooled IR sensors used in the Future Force; modeling and simulation of the vulnerability of sensors to laser blinding; and new technologies to exploit or deny the enemy's use of reconnaissance sensors against friendly forces. The Advanced Electronic Deception Techniques effort will investigate spectral characteristics of targets and backgrounds to determine optimum filter bands; spatial resolution requirements; spatial and spectral registration requirements; and sensor noise effects.

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

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Low Cost Counter Reconnaissance Technology. In FY05, continued modifications of experimental focal plane arrays (FPAs) and measurements of these FPAs; demonstrated signature reduction in one prototype infrared lens. In FY06, integrate new focal plane arrays and optics into a prototype uncooled infrared sensor and fabricate advanced paints and patterns incorporating spectral signature reduction, perform field experiments to validate optical augmentation and spectral signature reductions.	2529	2582	0
Low Observable 3rd Gen Sensors. In FY07, will investigate spectral characteristics of targets and backgrounds to determine optimum filter bands, spatial resolution requirements, spatial and spectral registration requirements and sensor noise effects in an effort to enhance concealment of friendly forces.	0	0	2788
Total	2529	2582	2788

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		20746	28420	18858	18312	18450	18614	18956
H70	HUMAN FACT ENG SYS DEV	16721	17232	18858	18312	18450	18614	18956
J21	HUMAN FACTORS APPLIED RESEARCH CA	4025	11188	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program investigates and evaluates aspects of human factors engineering that may limit or improve capabilities of individuals and teams of Soldiers operating in complex, dynamic environments to enable maximizing the effectiveness of Soldiers and their equipment for mission success. Key research areas include sensing, perceptual and cognitive processes, ergonomics, and 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).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).

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	20656	17482	18160
Current BES/President's Budget (FY 2007)	20746	28420	18858
Total Adjustments	90	10938	698
Congressional Program Reductions		-125	
Congressional Rescissions		-287	
Congressional Increases		11350	
Reprogrammings	90		
SBIR/STTR Transfer			
Adjustments to Budget Years			698

Three FY06 Congressional adds totaling $11350 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($3500) 3rd Generation Omni-Directional Treadmill LITE
($3850) MANPRINT
($4000) Team Performance and Optimization in Agent and Human Agent Teams

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H70 HUMAN FACT ENG SYS DEV	16721	17232	18858	18312	18450	18614	18956

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 Warrior (FFW) and Future Combat Systems (FCS) 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 Unit of Action (UA) Maneuver Team 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 Center (NSC); Communications -Electronics Research, Development and Engineering Center (CERDEC); Simulation and Training Technology Center (STTC); Engineer Research and Development Center (ERDC); Army Research Institute (ARI); and Army Materiel Systems Analysis Activity (AMSAA). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- 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. In FY05, determined and transitioned critical performance requirements for prototype information displays; and determined metrics to assess the training effectiveness of interactive simulation technology. In FY06, will refine decision aids to optimize visualization and information sharing requirements in the UA; and will investigate the usability and effectiveness of interactive technology for immersive training scenarios. In FY07, will validate a suite of tools to improve C2 capabilities in uncertain and urban environments; and will conduct cognitive task analysis of multi player training modules.	3442	3700	4391
- Enhance human performance modeling tools to optimize Soldier machine interactions for FFW and FCS. Collect empirical data on human perception (vision and hearing) to support the development and validation of human and system performance models. In FY05, linked vehicle dynamics, biodynamics, and anthropometric modeling capabilities to extend soldier centered design tools; developed architectures for modeling human performance of system of systems (SoS) through linked IMPRINT models and the Modeling	2708	2735	3062

Architecture for Technology and Research Experimentation (MATREX); investigated the relationship between the extent of binocular parallax and the accuracy of terrain -contour evaluation to establish the basis for guidelines for mounted and dismounted off-road mobility. In FY06, will incorporate ability to model human performance in joint operations with IMPRINT 8 (Pro); will establish parameters that improve the detection and recognition of terrain hazards for mounted and dismounted off-road mobility by using multi-regression techniques. In FY07, will identify and apply analysis metrics aimed at distinguishing performance of teams embedded within SoS and joint operations; will create and distribute a protected web-based repository of human performance models used in Manpower and Personnel Integration (MANPRINT) analyses; will model sniper targeting performance using dual band sensors and transition to Army Aeromedical Research Laboratory and special operations communities.			
- 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 FY05, extended motion-based simulation validation with multimodal modeling approaches to provide an integrated approach to analysis of multiple crew station issues. In FY06, will further extend mitigation solutions to a broad cross section of ride problems and integrate with multimodal display and control approaches for a complete solution. In FY07, will consolidate crew station guidelines for designers of future vehicles to provide a basis for next generation enhancements.	2155	2248	2399
Investigate and determine interface design solutions for UA 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 FY05, refined models using newly gathered field data; conducted further experiments for model validation for integration into force-on-force models; provided interface design solutions to FFW; conducted decision cycle time model validation studies. In FY06, will run final experiments using displays that provide information across the Soldiers' sensory modalities, and publish display design guidelines for FCS based upon the experiment and model results. In FY07, will mature physics-based models of human locomotion to research Soldier load and range of motion of future systems; and will evaluate Soldier physical and cognitive performance using prototype FFW Soldier systems.	4526	4649	5096
- Improve human robotic interaction (HRI) in a full mission context. In FY05, modeled cognitive workload and performance in multi-task conditions at the system of system level; examined workload, levels of autonomy, shared situation awareness, and Soldier performance for scalable Operator Control Unit (OCU) concepts; determined requirements for mixed asset control and workload management for mounted and dismounted missions; and investigated Soldier-robot team performance and workload using realistic simulation environments. In FY06, will examine effects of situational uncertainty, user expectancies, task interruption, knowledge representation, and adaptive automaton on HRI using realistic simulations of FCS and FFW missions; will Investigate OCU concepts during field experimentations and transition results to the TARDEC; and will investigate HRI implications of mixed asset teaming concepts in realistic simulation or field experiments. In FY07, will address Soldier-robotics team performance using models and metrics with the goal of identifying optimal systems for particular operational contexts and understanding the implications of each; and will utilize metrics and diagnostics to determine optimal span of control and adaptive automation for mounted and dismounted Future Force missions using aerial and ground unmanned systems.	3890	3900	3910
Total	16721	17232	18858

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		22358	17859	17923	17131	16650	16507	16796
048	IND OPER POLL CTRL TEC	3997	2788	3010	3019	3049	3076	3099
835	MIL MED ENVIRON CRIT	3381	3022	3256	3293	3326	3355	3380
895	POLLUTION PREVENTION	1078	3357	4592	3757	4069	3817	4011
896	BASE FAC ENVIRON QUAL	7939	7016	7065	7062	6206	6259	6306
EM5	ENVIRONMENTAL QUALITY APPLIED RSCH - AMC (CA)	4791	0	0	0	0	0	0
F25	MIL ENV RESTOR TECH	117	0	0	0	0	0	0
F35	Environmental Quality Applied Research (CA)	1055	1676	0	0	0	0	0

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 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 matures 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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 project work.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	22369	16417	17379
Current BES/President's Budget (FY 2007)	22358	17859	17923
Total Adjustments	-11	1442	544
Congressional Program Reductions		-78	
Congressional Rescissions		-180	
Congressional Increases		1700	
Reprogrammings	-11		
SBIR/STTR Transfer			
Adjustments to Budget Years			544

One FY06 Congressional add totaling $1700 was added to this PE.

FY06 Congressional add with no R-2A (appropriated amount shown):
($1700) Chemical Materials and Environmental Modeling Project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
048 IND OPER POLL CTRL TEC	3997	2788	3010	3019	3049	3076	3099

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 effects of legal and regulatory environmental restrictions on installation facilities, training and testing lands, and ranges, as well as to avoid fines and facility shutdowns within the United States and reduce environmental impacts to the warfighter abroad. New and innovative technologies are essential for the effective control and reduction of military unique hazardous and non-hazardous wastes on military installations 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Industrial Compliance and Pollution Prevention Readiness - In FY05, matured physiochemical and biosorbent treatment technologies for wastewater from munitions production allowing cost effective treatment while maintaining mission readiness. Developed program to investigate new industrial contaminant streams resulting from insensitive munitions production, specifically dinitroanisole (DNAN) and N-Methyl-P-Nitroaniline (MNA). Determined optimal processing parameters to produce cellulose by-product. In FY06, will mature bench treatment technologies for perchlorate commingled with explosives. In FY07, will maximize adhesive and agglomerative properties of cellulosic component and will transfer polymer component to reduce barrier/fortification requirements. Will initiate reductive treatment/transformation studies for DNAN and MNA, and use structural activity analysis to predict fate and treatment effectiveness. Will identify environmental risk components of future urban and close battle ranges.	1620	2788	3010
Sustainable Live-Fire Range Design and Maintenance - In FY05, matured application of the range risk assessment evaluation protocol as a web and Geographic Information System based range planning tool.	2377	0	0
Total	3997	2788	3010

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
835 MIL MED ENVIRON CRIT	3381	3022	3256	3293	3326	3355	3380

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 contaminant concentration levels that protect the environment and human health from adverse effects. This research supports the Army Risk Assessment and Modeling System (ARAMS). The ARAMS links models of expected result and transport to the exposure and effects models and databases of explosives and their degradation by-products. New research using toxicogenomics and molecular modeling tools for toxicity and exposure assessment will further reduce 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 levels at Army installations. The Long-Term Monitoring program provides a means of monitoring military unique contaminants during remedial actions and site closure during near-real-time in situ monitoring using miniaturized sensors for use in the field. This will reduce or eliminate the costly and lengthy operation of off-site analyses and enhance overall monitoring capabilities by providing continuous/autonomous detection/analysis. 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). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, and the Center for Health Promotion and Preventive Medicine located at Aberdeen, Maryland, execute the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Land Remediation/Hazard/Risk Assessment Tools for Military Unique Compounds; Long Term Monitoring for Army Ranges; Characterization/Assessment and Remediation of Distributed Source Ordnance Related Compounds (ORCs) on Army Ranges - In FY05, provided screening tools for the development of an in situ, real-time contaminant concentration level monitoring system for long term monitoring for installations and ranges to significantly reduce the need for laboratory testing and the associated sample handling requirements. Continued studies to determine the transport properties and characteristics of military relevant contaminants associated with training and testing ranges. Evaluated new and innovative toxicogenomic and computational biology methods to develop predictive toxicology models that improve ecological risk assessment and range management of ORCs. In FY06, will identify rapid, statistically based sampling and innovative analytical methods and protocols for ORCs assessment on Army ranges. Will identify novel contaminant extraction and field measurement methods for on-site long term monitoring. Will design a computational biology virtual simulation for predictive toxicology analogous to a "Canary in a Coal Mine" for mammalian organisms. In FY07, will identify novel contaminant detection systems and measurement protocols for near-real-time, on-site long term monitoring. Will integrate a distributed source contaminant transport model into the ARAMS. Will continue development of a computational biology virtual simulation for predictive toxicology analogous to a "Canary in a Coal Mine" for mammalian organisms.	3381	3022	3256
Total	3381	3022	3256

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
895 POLLUTION PREVENTION	1078	3357	4592	3757	4069	3817	4011

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 will mature 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 Future Combat System (FCS) 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 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP), and supports the Army Strategy for the Environment. Work in this project is performed by the Research, Development & Engineering Command's (RDECOM) Army Research Laboratory (ARL) 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 2005	FY 2006	FY 2007
Rocket and Missile Propellants - In FY05, identified and modeled environmentally benign rocket and missile propellants and engine concepts. In FY06, conduct small-scale testing of new prototypes. Conventional Ammunition - In FY05, matured environmental performance evaluation method for new high explosives. Identified insensitive, non-toxic high explosives candidates. In FY06, select candidates for evaluation and synthesis. In FY07, will refine synthesis procedures, perform large-scale testing, and evaluate environmental performance of final candidates. Pyrotechnics - In FY05, identified and performed limited laboratory testing on non-toxic pyrotechnic formulations. In FY06 - Refine pyrotechnic formulations and composition processing In FY07 - Perform compatibility and performance testing on final candidates. Manufacturing - In FY05 - Identified and evaluated performance of non-hazardous pyrotechnic binders. In FY06 - Identify and evaluate non-polluting manufacturing processes for pyrotechnic and explosive manufacture. In FY07 - Conduct bench-scale tests to mature novel processes.	1078	3357	4592
Total	1078	3357	4592

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
896 BASE FAC ENVIRON QUAL	7939	7016	7065	7062	6206	6259	6306

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 affect mission support and environmental compliance. The project provides advanced methods and technologies to restore lands damaged during training activities and allow sustained use of installation facilities and training land resources. 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Threatened and Endangered Species (TES) Management to Reduce Operational Constraints - In FY05, analyzed the effects of military training and land management on high priority TES to support the reduction/elimination of training restrictions. In FY06, complete spatial assessment technology for high priority species on Army lands and mature new inventory and monitoring protocols for select species to reduce TES management costs. In FY07, will complete new techniques for preparation of population goals on Army lands to ensure the Army is only responsible for its fair share of species recovery.	3554	4352	3563
Predictive Risk Assessment and Management for Army Ranges and Training Lands - In FY05, prepared an engineering analysis of costs associated with life-cycle operations and maintenance of environmentally compliant range designs to reduce and facilitate maintenance, and produced improved range designs and construction techniques for firing and defilade positions, target berms, range roads and trails, and low water crossings to reduce compliance risk. Completed development of a range security software tool to provide objective determination of security measures for range asset protection, and completed a munitions load and screening model for munitions capacity for live fire training ranges. In FY06, complete integration of munitions carrying capacity model as a component platform consistent with the Installation Training and Maintenance (ITAM) Army Training and Testing Area Carrying Capacity (ATTACC) methodology.	1604	224	0
Reconfigurable and Joint Ranges - In FY05, completed noise dose-response model augmentation and noise mitigation practice development for typical training operations to include nighttime training. Matured technology for field measurement of particulate matter concentrations from Army training activities that enable estimates of impacts of training on local and regional air quality. Matured capability to predict encroachment impacts of proposed regional plans on military installations and their ability to support future training and testing. In FY06, conduct cost benefit analysis for land rehabilitation projects that will improve erosion control practices and prioritization of sites for training land rehabilitation. Identify culturally influenced components for incorporation into Future Force urban ranges. Will mature improved guidance on noise complaint risk associated with training noise levels. In FY07, will mature ATTACC protocols that incorporate non-military land and natural resource stressors.	2781	2440	3502
Total	7939	7016	7065

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		28774	49242	21193	23488	24089	24521	25056
779	C2 & PLAT ELEC TECH	8220	8922	8718	9088	9560	9864	10287
H92	COMMUNICATIONS TECH	10013	12473	12475	14400	14529	14657	14769
TR9	C3 COMPONENT TECHNOLOGY (CA)	10541	27847	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) researches advanced communications technologies and expands scientific knowledge of 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, presentation of information and decision-making. This will be achieved by improving the command, control, and communication systems (e.g. man-machine interface, 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 research on infrastructures that allow timely distribution, display, and use of C2 data on Army platforms. This research also includes enhancements to the Global Positioning System (GPS) user equipment to provide a more robust, anti-jam capability, and improvements to man-machine interfaces and decision aids for increased operation tempo in an On-the-Move (OTM), network-centric battlefield environment. Project H92, Communications Technology, funds research that will provide technologies that allow Current and Future Force field commanders to communicate OTM to/from virtually any location, in a seamless, secure, self-organizing, self-healing, network. Integrated networks of unmanned remote sensors, maneuver and fire support elements, and situational awareness (SA) tools will allow the Future Force to achieve overmatch with agility and versatility. In addition, portions of the research support the Joint Tactical Radio System (JTRS) evolutions. Project TR9 funds Congressional special interest efforts.

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 PE contains no duplication with any effort within the Military Departments and is fully coordinated with 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	27416	21787	22792
Current BES/President's Budget (FY 2007)	28774	49242	21193
Total Adjustments	1358	27455	-1599
Congressional Program Reductions		-297	
Congressional Rescissions		-498	
Congressional Increases		28250	
Reprogrammings	1358		
SBIR/STTR Transfer			
Adjustments to Budget Years			-1599

Fourteen FY06 Congressional adds totaling $28250 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($500) All Digital Transceiver (ADT) Development
($1000) Center for Integrated Systems in Sensing, Imaging and Communications at Michigan Technology University
($2000) Center for Urban Warfare Preparedness and Response
($1000) Digital Alert Display for Army Commanders
($6000) Enhanced Wireless Digital Communications for Urban First Responders
($1000) HEAT - Heterogeneous Agent Teams for FCS Command and Control
($2400) High Mobile Large-Scale C4ISR Command Post Systems, C-130 Compatible Command Trailer
($3400) Improved Bandwidth for Battle Communications
($1750) Integrated Lightweight Electronics Shelter
($4300) Lightweight Inter-theater Transportation Tactical Operations Center
($1500) Portable Flexible Communication Display Device
($1000) Software Defined Radio Interoperability Initiative
($1400) Ultra Wideband Chip Set
($1000) USB Data Acquisition for Voice Recognition/Response

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
779 C2 & PLAT ELEC TECH	8220	8922	8718	9088	9560	9864	10287

A. Mission Description and Budget Item Justification: This project researches 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 will require leaders at all levels to have continuous situational awareness to make informed and rapid critical decisions to "shoot, move and communicate" more quickly than the adversaries. This project does the applied research that will enable commanders at all echelons to have better and more timely information and will allow them to command from anywhere on the battlefield, freed from their command posts and while On-the-Move (OTM). Emphasis is on course of action determination and analysis, 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 advanced high resolution and large screen displays, 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 & 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 designs and develops technologies and decision aids that enable course of action (COA) generation and analysis that enables C2 OTM. The Networked Enabled Battle Command effort investigates and evaluates information search, retrieval, and decision models to enable seamless interoperability between the Future Combat System (FCS) Brigade Combat Team (BCT) and echelons above brigade.

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

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Battle Space Awareness & Positioning: In FY05, began integration of network assisted Global Positioning System (GPS), RF ranging, enhanced dead reckoning, and Micro-Electro Mechanical System (MEMS) Inertial Measurement Units (IMUs) into a complete positioning, navigation and tracking system for dismounted soldiers in complex and urban terrain; performed laboratory evaluation, and prepared for field testing of breadboard system; conducted investigation in performance improvements for MEMS IMUs for integration within the context of an integrated navigation system for dismounted soldier and tactical vehicle applications. In FY06, complete integration, prepare and conduct field test assessments of the integrated dismounted urban position/navigation technology; continue the investigation of performance improvements for MEMS IMUs for dismounted soldier and tactical vehicle applications. In FY07, will investigate advanced positioning/navigation sensor and integration technologies and will conduct trade studies to determine applicability of advanced network algorithms and processes within the context of emerging FCS BCT architectures.	3418	3316	2782
- C2 OTM Enabling Technologies: In FY05, matured selected tactical decision aids transitioned from the Army Research Laboratory; identified requirements for a distributed collaboration environment, and constructed a network-centric software environment for mobile decision tools to support C2 functions in complex and urban terrain; conducted an assessment of intelligent agent technology within CERDEC, National Labs, industry and academia and determined candidate applications for agents in Command, Control,	1802	1537	1406

Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR). In FY06, implement intelligent agent based C4ISR applications and conduct initial technical experiments to quantify performance. In FY07, will mature the intelligent agent based applications and frameworks with the goal to provide a repository for agent technology and its subsequent re-use.			
- Networked Enabled Battle Command: In FY05, investigated software technology for automated retrieval of mission-relevant Battle Command information across heterogeneous Service-Based Architectures. In FY06, design and develop software technology capable of intelligently regulating/prioritizing flow of information between low bandwidth and higher bandwidth networks based on understanding of network status and battle context, such that network performance is maintained while optimizing net-centric information flow across echelons; investigate knowledge acquisition and representation technology to capture experienced/expert commander's battle decision, as a function of situation and mission, in a form that computers can read and process. In FY07, will investigate 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; will investigate automated wargaming tools that allow commanders to project potential effects of decisions and assess sensitivity of alternate options on future battle state.	2000	4069	4530
- Networked Sensors for the Future Force: In FY05, integrated the Battle Command software infrastructure with Battle Command applications and unmanned systems controller and tested in field experimentations with unmanned networked sensors and platforms.	1000	0	0
Total	8220	8922	8718

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H92 COMMUNICATIONS TECH	10013	12473	12475	14400	14529	14657	14769

A. Mission Description and Budget Item Justification: This project researches 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 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 Communications Planner for Operational and Simulation Effects with Realism (COMPOSER) effort develops 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 proven through modeling and simulation. Modeling and Simulation (M&S) for Network Design effort will design and mature 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 will design and develop solutions to address emerging requirements for Joint Force's secure and dynamic high speed communications cryptography requirements. Radio Enabling Technologies and Nextgen Applications (RETNA) 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 investigates low cost, low profile omni directional and directional antennas and antenna components. Tactical Wireless Network Assurance (TWNA) funds research in network protection and wireless intrusion detection technologies for mobile wireless ad hoc networks and provides safeguards against modern network attacks.

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

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Communications Planner for Operational and Simulation Effects with Realism (COMPOSER): In FY05, investigated and designed open system architecture to ensure interoperability with multiple waveforms and systems; performed analysis of technologies for the predictive network planner and dynamic 2D/3D visualization tools to integrate into COMPOSER architecture; developed and demonstrated an open architecture proof of concept communications planner, consisting of network visualization tool and Communications Effects Simulator (CES); evaluated spectrum management technologies to support WIN-T program. In FY06, conduct laboratory testing of COMPOSER technology and evaluate technology in the Training & Doctrine Command (TRADOC) Battle Lab Collaborative Simulation Environment (BLCSE); utilize parallel and distributed computing technologies to analyze network behavior; assess and characterize performance of the higher physical data link and network layers through M&S. In FY07, will perform analysis of available radio models and waveforms and integrate the waveforms to test interoperability with COMPOSER tools; develop Release III Version of COMPOSER, improving CES and enhance network visualization tool; will complete spectrum management architecture and interface document.	1031	2789	1610
- Radio Enabling Technologies and Nextgen Applications (RETNA): In FY05, leveraged traditional and wide bandgap power amplifier technologies to develop an efficient Wideband Power Amplifier (WBPA) for Joint Tactical Radio System (JTRS) ground applications; evaluated the suitability of applying passive graphite foam thermal management technology to JTRS ground radios; initiated design of a high efficiency WBPA for Manpack and embedded JTRS Cluster 5 radio variants. In FY06, begin design of the Cluster 5 WBPA	909	2913	1772

subsystems; plan, develop, and test breadboard layouts of complex RF filter banks, diplexer systems, low-loss power conditioner modules, interface and control electronics, and core wideband power amplification subsystems; begin design of a system-level WBPA breadboard by simulating then physically placing validated subsystems onto breadboard prototype. In FY07, will continue development of Cluster 5 Manpack WBPA form fit prototype; will validate the WBPA's component performance and associated system-level capability.			
- Antenna Technologies: In FY05, investigated technologies for a family of Rotary Wing Aircraft multi-band antennas, lightweight body-wearable antennas (helmet and vest) for Future Force Warrior (FFW), and low profile vehicular antennas to comply with JTRS communications requirements for various ground and air platforms; conducted OTM demonstration of K/Ka band phased array; designed and demonstrated the 3 port Multiband Antenna design, WNW Multiport Antennas and Body Wearable Antenna. In FY06, investigate and develop gallium nitride monolithic microwave integrated circuit technologies used in development of high efficiency power amplifiers (PAs); develop methods of integrating low noise amplifiers, PAs, up and down converters into SATCOM antenna assemblies. In FY07, will develop low cost options for electronic/mechanical scanning antennas; will evaluate and analyze low profile versus performance and affordability of Ku/Ka single beam antenna system and conduct modeling & simulation to validate networking directional antenna parameters/link connectivity.	1268	2344	3032
- Tactical Wireless Network Assurance (TWNA): In FY06, provide intrusion detection algorithms for Future Combat System Brigade Combat Team; evaluate database access control and authentication of mobile data elements that restrict unauthorized modification to mobile code by preventing unauthorized access on a 20 mobile node ad hoc network; test adaptive security alert correlation, visualization and response to tactical wireless network security events in near-real time. In FY07, will investigate and develop advanced information assurance techniques; will expand wireless intrusion detection to detect attacks against mobile hosts and networks.	0	2000	2485
- M&S for Network Designs and programmable encryption technologies: In FY06, perform assessment to address the challenges of mobile wireless, ad hoc communication network performance capabilities related to capacity, connectivity, and scalability; assess and characterize behavior and performance of the network (higher physical, data link and network layers) through M&S; solidify new cryptological embedded chip design requirements and develops a hardware design. In FY07, will evolve analytical and M&S processes and technologies by using a surrogate future force network as a baseline to validate principles and rules that govern the behavior and performance of complex communication network; will complete integration of cryptological embedded chip design and provide testbed verification of the performance specifications.	0	2427	3576
- Dynamic Readdressing and Management for the Army (DRAMA): In FY05, evaluated enhanced automated network management tools for large, tactical, OTM networks to include integration with net management agents, enhanced intelligent agents, and scalability of dynamic readdressing and Internet Protocol (IP) multicast protocols along with network management tools; researched, analyzed, and evaluated conceptual technical architecture/framework, advanced technologies, correlation algorithms, and dynamic database mapping techniques to support the Network Operation concept of an integrated Network Management, Information Assurance, and Information Dissemination Management capability.	4777	0	0
- Free Space Optical/Near-Optical Communications (FOCUS) and Sensors Networking: In FY05, conducted early laboratory experiments to establish performance against program goals and evaluation criteria for ground sensors and conducted laboratory experiments emphasizing subsystem investigation.	2028	0	0
Total	10013	12473	12475

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		5346	4521	3844	3785	3810	3842	3872
Y10	COMPUTER/INFO SCI TECH	5346	3535	3844	3785	3810	3842	3872
Y11	COMPUTER & INFORMATION SCIENCE APPLIED RES CA	0	986	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) researches and applies information and communications technology to enhance the understanding and speed the decision cycle for mounted & dismounted commanders & 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, 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 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 PE is related to and fully coordinated with efforts in PE 0602782A(Command, Control, Communications Technology), PE 0603772A(Advanced Tactical Computer Science and Sensor Technology), and PE 0603008A(Command, Control, Communications Advanced Technology). The cited work is consistent with 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). Project Y11 contains congressional adds only.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	3862	3590	3705
Current BES/President's Budget (FY 2007)	5346	4521	3844
Total Adjustments	1484	931	139
Congressional Program Reductions		-23	
Congressional Rescissions		-46	
Congressional Increases		1000	
Reprogrammings	1484		
SBIR/STTR Transfer			
Adjustments to Budget Years			139

FY 05 increase of $1.5 million was reprogrammed for the Ultra-Large Scale (ULS) Software Systems Study.
FY06 Congressional Adds with no R2A:
($1000) Software Reliability and Security Improvements

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Y10	COMPUTER/INFO SCI TECH	5346	3535	3844	3785	3810	3842	3872

A. Mission Description and Budget Item Justification: This project researches and applies information and communications technology to enhance the understanding and speed the decision cycle for mounted & dismounted commanders & 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, 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 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 PE is related to and fully coordinated with efforts in PE 0602782A(Command, Control, Communications Technology), PE 0603772A(Advanced Tactical Computer Science and Sensor Technology), and PE 0603008A(Command, Control, Communications Advanced Technology). The cited work is consistent with 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 2005	FY 2006	FY 2007
- 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. In FY05, provided user directed fusion techniques that combined with the Communications-Electronics Research, Development and Engineering Center (CERDEC)'s techniques will enable automated fusion techniques to improve the completeness and timeliness of decision-making in C2 operations. The integrated technology will be matured for Distributed Common Ground Station-Army and Future Combat Systems (FCS) assessment. In FY06, will investigate Resource Description Framework (RDF) and Ontology Web Language (OWL) for marking up current Command and Control Information Exchange Data Model and future data-stores to include discovering content through published meta-data. In FY07, mine marked-up RDF and OWL based data-stores for events/associations across disparate data sources.	1139	1012	1113
- Design secure, stealthy, energy-efficient network protocols on a miniature radio to support networked sensors, a key element of the inter-netted Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) in providing situational awareness, and to provide enhanced communications capabilities for unattended sensor arrays, smart munitions, and robotics platforms. In FY05, conducted evaluations of networked sensor systems in real environments performing collaborative sensing, using the miniature radios with enhanced media access control. In FY06, will enhance the radio and protocols to provide higher throughput and lower power consumption, while reducing size, and decreasing cost, for more ubiquitous military use and improved force protection/survivability. In FY07, will optimize sensor and communications integration with optimal energy utilization to extend battery life and thus increase the safety of soldiers during military operations.	514	522	522

- Conduct applied research on tactical information protection technologies for agent-based vulnerability assessment over wireless bandwidth constrained links and security infrastructures for sensor networks. The Future Force will operate in a complex wireless environment where survivability must be maintained in spite of inherent vulnerabilities of standardized protocols and commercial technologies. In FY05, conducted advanced network assurance experiments in a laboratory environment with a view toward increasing the security of critical military data and information. In FY06, will begin validation of advanced network assurance using at least 20 nodes in a relevant environment. In FY07, will complete validation and demonstrate prototype with access control and tactical Public Key Infrastructure (PKI) across warfighter information network to enable interoperability with sustaining base.	493	443	466
- Investigates techniques to enable autonomous local sensing assets to cooperatively share sensed events within a wireless distributed fusion environment in order to inform the force of relevant local events. In FY05, developed an interface between a dismounted interactive semi-automated force (DISAF) simulation and a surrogate sensor simulation server in order to generate the volume activity for low level event detection to include terrain based entity prediction. In FY06, will develop a suite of cooperative distributed low level correlation and tracking agents that tip and cue one another through a end-user directed sequence list of spatial/temporal linked objectives. In FY07, evaluate, using a DISAF simulation, 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.	1159	1054	1213
- 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 FY06, define the underlying framework for document exploitation, indexing and search across archived translated documents. Evaluate current state-of-the-art in two-way speech-to-speech translation technologies to include microphones that can operate in noisy environments. In FY07, enhance the underlying framework to include the ability to extract the metrics required for evaluation of text based machine translation engines. Develop the underlying software framework to integrate the best microphone and two-way speech technologies.	541	504	530
- Documented an initial technology roadmap for Ultra Large-Scale Software (ULS) Systems development and prepared a ULS research program proposed plan.	1500	0	0
Total	5346	3535	3844

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	52477	50318	50098	50302	50811	51262	51663
855	TOPOGRAPHICAL, IMAGE INTEL & SPACE	10817	10936	12344	12403	12538	12647	12741
H71	ATMOSPHERIC INVESTIG	6501	6481	7016	6728	6865	6927	6980
T40	MOB/WPNS EFF TECH	17086	16136	17233	17687	17779	17942	18087
T41	MIL FACILITIES ENG TEC	4852	4834	5276	5238	5292	5335	5378
T42	COLD REGIONS ENGR TECH	4267	4358	4714	4716	4769	4812	4850
T45	ENERGY TEC APL MIL FAC	2822	3630	3515	3530	3568	3599	3627
T48	Center for Geosciences & Atmospheric Research	1727	1676	0	0	0	0	0
T49	UNIVERSITY PARTNERING FOR OPERATIONAL SUPPORT	2491	0	0	0	0	0	0
T52	Stationary Power and Energy Applied Research (CA)	957	1281	0	0	0	0	0
T53	Military Engineering Applied Research (CA)	957	986	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this applied research program element 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 battlespace environments 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, and the Army Research Laboratory located at Aberdeen, Maryland, execute the project work.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	52500	47046	48188
Current BES/President's Budget (FY 2007)	52477	50318	50098
Total Adjustments	-23	3272	1910
Congressional Program Reductions		-220	
Congressional Rescissions		-508	
Congressional Increases		4000	
Reprogrammings	-23		
SBIR/STTR Transfer			
Adjustments to Budget Years			1910

Four FY06 Congressional adds totaling $4000 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount shown):
($500) Center for Geospatial Intelligence and Investigation
($1000) Detonation Suppression System Pilot Program
($1300) Fuel Cell Systems for the War Fighter
($1200) Geosciences Research

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
855	TOPOGRAPHICAL, IMAGE INTEL & SPACE	10817	10936	12344	12403	12538	12647	12741

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 Project H71. 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). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Data Generation - In FY05 matured methods to generate features from multispectral imagery, soils, and collect data from wireless devices in theater; matured prototype capabilities that convert geographic information within intelligence messages or other non-structured data into geospatial data for spatial analyses. In FY06, mature capabilities to geo-encode non-spatial sources to support planning and military decision-making process. In FY07, will mature tactical sensing capabilities to detect and geo-locate chemical and biological agents, and other critical battlespace environment features.	2256	1760	2874
Data Management - In FY05 matured and released tools that automated the fusion of elevation data from various sources and registered imagery from multiple sensors. In FY06, complete end-to-end testing of geospatial data management methods and tools and transition tools to Army systems/services. In FY07, will mature tools to correlate and integrate/fuse geospatial data from various sources (including tactical sensors and other sources) into a common geospatial database that supports multiple applications.	4680	4632	4487
Data Analysis - In FY05, matured and experimented with tactical bandwidth compatible terrain reasoning tools; developed information models and algorithms to solve multi-variable helicopter air maneuver route planning based on terrain, weather, and sensor effectiveness; matured initial spatial-temporal information constructs and terrain analysis capabilities for urban tactical battlespace environment planning. In FY06, mature prototype situation and threat analysis tools that will incorporate time-sensitive course of action (COA) information for Future Force applications addressing unit of action operations; will develop algorithms to solve maneuver route planning for helicopters and unmanned aerial vehicles; will enable rapid situational understanding and decision support in the urban battlespace environment. In FY07, will mature urban terrain reasoning tools that incorporate the effects of natural, man-made features, and human activities into urban COA planning tools.	3881	4544	4983
Total	10817	10936	12344

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H71 ATMOSPHERIC INVESTIG	6501	6481	7016	6728	6865	6927	6980

A. Mission Description and Budget Item Justification: The objective of this project is to perform the applied research for tactical weather and atmospheric effects algorithms, and for the integration of battlefield atmospheric environments simulations. The Army's transformation plan to the Future Force will require capabilities for battlefield commanders to make decisions based on tactical weather technology and impacts. This weather intelligence data will have to be not only 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 Project Director Integrated Meteorological System (PD-IMETS), and in the future to the Program Manager, Distributed Common Ground Station-Army (DCGS-A), 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 and Future Combat Systems (FCS) through future applications and platforms that support echelons at Brigade and below, down to the individual soldier, and Defense Technology Objectives, Weather/Atmospheric Impacts on Sensor Systems, and On-Scene Weather Sensing and Prediction Capability. 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.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Mature a new high resolution, short-range forecasting capability based on integrating new battlefield meteorological data sources (non-conventional meteorological sensors such as Unmanned Aerial Vehicles (UAVs), robotic sensors, etc) into model initialization which will directly impact nowcast/very short-range forecast accuracy over the target area & provide much higher resolutions over the theater of operations. Implement a research version of an operational forecast/meteorological model that can ingest data from met satellites, UAV, and ground-based sensors. Research & verify the capability to host the model on battlefield processors, including battlefield fire support systems, to allow for autonomous generation of artillery meteorological message & production of near real time decision aids. In FY05, evaluated models with the most complete set(s) of modifications for insertion of meteorological data from non-traditional sources that were likely to exist on the future network-centric battlefield. Evaluated the modified research model for operation on processors that simulate those likely to be available to the network-centric future forces. In FY06, implement modifications based on field test results and complete a preliminary version of the research model that can ingest data from non-traditional sources. In FY07, will implement & evaluate a combined set of atmospheric models that can produce analyses & nowcasts at very fine scales for urban & complex terrain regions and are capable of assimilating non-traditional data.	2251	2365	2638
Investigate critical value thresholds for weather impacts on friendly & threat systems for the rule-based Integrated Weather Effects Decision Aids & develop physics-based atmospheric effects models for operational combat mission planning, simulations & war games, and for sensor/weapon development. Mature the Acoustic Battlefield Aid (ABFA) and tri-service Target Area Weapons Software as key acoustic & Electro-Optic decision aids. Integrate distributed client applications on mobile devices for "first in" decision aids & for "over	1930	2072	2179

watch" of lower echelons. Devise access to weather on embedded soldier & system processors. Integrate vegetation & terrain effects and infrasonic frequencies into ABFA to support intelligence analysis. In FY05, created a 3D acoustic propagation model for handling dynamic atmospheric inputs & complex ground surfaces to produce high-fidelity simulated signals & realistic environmental impacts for acoustic sensors. Devised optical turbulence blur/feature distortion effects model to simulate performance differences & tradeoffs in sensor optics, detector spectral responses & signal processing methods. In FY06, integrate acoustic & seismic decision aid into a library of analysis modules tailored for user applications. Integrate a polarized radiative transport module in Weather & Atmospheric Visualization Effects for Simulation (WAVES). In FY07, will integrate route planning decision aids based on effects of winds, terrain, & weather hazards on platform performance.			
Integrate high resolution boundary layer meteorological measurements with models to improve quantifying combat conditions in urban/complex terrains. Enable the continuous assimilation of real time, 3D Light Detection And Ranging (LIDAR) remotely sensed wind data into micro-scale urban wind models for near real time, 3D picture of the current atmosphere over urban/complex terrain. Devise weather satellites' data applications to improve battlefield sensing. Apply new data compression standards to demonstrate 25:1 or greater compression of 2D, 3D and 4D meteorological databases to reduce bandwidth requirements. Quantify the value added of additional battlefield surface observations & vertical profiles to improve objective analysis, short-term forecasts and decision aids. Devise/verify algorithms for optimum meteorological sensor placement. Perform detailed measurements of the urban meteorological environment for model development/verification. In FY05, improved remote laser-based techniques for aerosol detection/classification using LIDAR technology. Investigated pattern classification techniques of background aerosols for class differentiation. Showed the fusion of LIDAR urban wind measurements with a 3D urban wind model. In FY06, show urban aerosol characterization using remote sensing for identification/verification with in situ collected data. Measure, characterize & analyze meteorological data over urban/complex terrain. Investigate automation techniques for sorting aerosol particles by optical signatures to identify threat agents. In FY07, will show a prototype automated MetSpaces information service with agents to collect/manage battlefield meteorological data & distribute model based products between echelons. Will investigate the use of super-continuum LIDAR for remote spectral identification of chem/bio threat agents.	2320	2044	2199
Total	6501	6481	7016

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T40 MOB/WPNS EFF TECH	17086	16136	17233	17687	17779	17942	18087

A. Mission Description and Budget Item Justification: The objective of this applied research project is to provide technologies for rapid upgrading, construction, and repair of in-theater airfields; for overcoming battlespace gaps 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 Combat Systems (FCS) and 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 will mature technologies that will 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Force Protection - In FY05, increased the number of structural types that can be rapidly assessed from 13 to 20 structural types; produced protection upgrades for a variety of forward operating bases. In FY06, deliver algorithms for assessing the effectiveness of blast/fragment protection upgrades to structures in contingency environments that will increase the resistance of structures by 90% to 200% above current minimal protection. In FY07, will develop algorithms for survivability design and assessment tools, will produce 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.	5098	4961	5242
Weapons Effects and Structural Response - In FY05, produced algorithms for predicting penetration of a 155mm projectile into urban materials ; defined mechanical properties of urban construction materials; estimated weapon and fragment penetration for range of urban target structures using existing weapons effects prediction methods; and conducted experiments and High Performance Computing calculations to define airblast propagation in the multi-building (9 buildings) urban environment.	1481	0	0
Enable Theater Access /Joint Rapid Airfield Construction - In FY05, determined engineering properties of stabilized soils. In FY06, select rapid repair materials for paved airfield surfaces. In FY07, will select shear-resistant stabilizers and dust control additives for semi-prepared C-17 airfield surfaces. Rapid Port Enhancement - In FY05, integrated the Small Port Throughput Simulation Model into larger-scaled modeling systems and applications; conducted successful intermediate-scale experiments for the Lightweight Modular Causeway System (LMCS). In FY06, finalize design of LMCS and complete the Small Port Throughput Simulation Model and support Joint Enable Theater Access initiatives. In FY07, will conduct full-scale LMCS component testing and support demonstration.	4484	4568	4758
Maneuver Support/Gap Defeat - In FY05, evaluated emerging sensor technologies for characterizing small terrain gaps, evaluated concepts for defeating gaps less than four meters wide through simulation and analyses; determined mobility performance attributes for advanced vehicle platforms such as small unmanned ground vehicles; created hydrologic decision analysis capability for wet gaps to provide rapid in-theater maneuver assessment for the warfighter. In FY06, integrate reconnaissance technologies for characterizing critical features of terrain gaps less than 4 meters wide and conduct evaluations of gap crossing technologies in simulated environments; create a force response element that represents the soil/snow for any motion system operating in real time simulated environments. Future Force Breaching - In FY05, conducted experiments that defined breaching effectiveness for hand-placed and standoff demolitions against structures; measured secondary debris and airblast produced by contact demolition charges; and produced the capability to predict damage	4137	4566	3204

to concrete walls. Hardened Combined Effects Penetrator Warheads - In FY07, will finalize analytical procedures for predicting projectile/target performance. UGV Autonomous Maneuver - In FY07, will begin to create capabilities to interpret local terrain characteristics from on-board sensors for autonomous maneuvers while keeping pace with manned counterparts.			
Battlespace Environment Support - In FY05, produced procedures to correlate and modify data structures between Battlespace Terrain Reasoning and Awareness (BTRA) and OneSAF Objective System (OOS) or other Modeling and Simulation (M&S) for point-to-point insertions. Extended BTRA routes to networks into OOS or other M&S using XML and ontological technologies. Developed a data model schema and structure with broader community applicability for simulation to C4ISR interoperability. Experimented with unique scaling and adaptive algorithms for entity and aggregate level maneuver networks; matured advanced throughput models for intelligent maneuver decisions including bypass options, route planning, resourcing, and management tools; determined combined effects of static and dynamic obstacles on maneuver planning tools; determined combined effects of static and dynamic obstacles on maneuver planning tools; provided functional components to create a common integrated obstacle overlay capability; and advanced tactical analyses of urban terrain and population as they pertain to the spectrum of military operations. In FY06, develop capability for transferring additional high-priority BTRA maneuver-related information products to OOS and other applications, will introduce extensions for computer-generated forces behaviors supporting training and course of action development and analysis. In FY07, will produce and refine products/procedures for interoperability; will expand scaling as required based on set of BTRA information products; will incorporate additional behaviors and related components as necessary to support training and course of action development and analysis.	1886	1683	1698
Remote Assessment/Rapid Analysis - In FY06, determine feasibility of interpreting sensor data to characterize critical infrastructure. In FY07, conduct road, bridge, and building experiments, and begin analysis.	0	358	2331
Total	17086	16136	17233

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T41 MIL FACILITIES ENG TEC	4852	4834	5276	5238	5292	5335	5378

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 CONUS facilities and forward bases, models predicting airborne dispersed chemical, biological, and radiological (CBR) 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Facility Engineering - In FY05, completed initial beta version of model to depict CBR airborne dispersion rates in military facilities, and established performance related requirements for building envelopes, and completed forward facility planning tools. In FY06, establish performance related requirements for building envelopes for airborne CBR protection. In FY07, will complete 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 chemical and biological agents.	2513	1849	2098
Facility Modeling and Simulation/Fort Future - In FY05, validated prediction and optimization algorithms for installation capability to support Army Installation Transformation; and extended force projection algorithms to cover multiple, regional installations. Urban Reasoning and Battlespace Analysis - In FY06 define framework for incorporating facility use and cultural factors for tactical decision aids. In FY07, will model buildings and cultural aspects of urban terrain in computationally efficient form.	2339	2985	3178
Total	4852	4834	5276

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T42 COLD REGIONS ENGR TECH	4267	4358	4714	4716	4769	4812	4850

A. Mission Description and Budget Item Justification: The objective of this applied research project is to provide warfighters with an accurate and timely understanding of the battlespace 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Terrain State - In FY05, developed models and tactical decision aids for incorporating weather impacts on terrain into the Future Combat Systems commander's mobility analysis and course-of-action decision tools; established initial suite of remote site assessment, evaluation and selection decision aids for Joint Rapid Airfield Construction; matured and transitioned to the U.S. Army Tank Automotive Research, Development and Engineering Center vehicle simulator, high resolution 3-dimensional vehicle-terrain interaction algorithms for simulating terrain surfaces of snow, semi-frozen and thawing soils at the Ethan Allen Firing Range test track in Vermont. In FY06, complete formulation for all-season, all-terrain, 3-dimensional soil modeling for input to ground platform and terrain mechanics simulations; will complete model parameterization for vegetation and ground surface processes for tactical terrain analysis. In FY07, will formulate new model of energy and mass exchange for exterior urban surfaces to support target surveillance and reconnaissance; will validate models of radiant temperatures of urban exterior surfaces.	3407	3304	3455
Signature Physics - In FY05, completed high-fidelity acoustic propagation simulation and dynamic acoustic vehicle signature model and mature algorithms to self adapt unattended ground sensors for local geologic effects in support of Networked Sensors for the Future Force (NSfFF); developed query and subscription based incorporation of signature physics tool set (e.g., weather induced terrain state) with the Command and Control in Complex and Urban Terrain program collaboration tools. In FY06, complete wide area infrared targeting template based on terrain-weather phenomena for wide range of targets and backgrounds. In FY07, will formulate new approaches to multi-sensor fusion (e.g., acoustic and seismic) and optimization based on characteristics of a complex battlespace environment.	860	1054	1259
Total	4267	4358	4714

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T45 ENERGY TEC APL MIL FAC	2822	3630	3515	3530	3568	3599	3627

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 threats such as chemical, biological, and radiological (CBR) attacks. 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Energy and Utility Systems Response to Threats - In FY05, matured indoor performance analysis tools for building mechanical systems consistent with chemical and biological protection needs, and completed initial beta version of model to depict chemical and biological water borne dispersion rates in water systems. In FY06, validate CBR analysis tools in a controlled test facility. In FY07, will compare tool analyses to an instrumented Army facility using simulated chemical and biological agents.	1702	1400	1762
Installation Modeling and Simulation/Fort Future - In FY05, matured integrated tools for judging suitability of energy infrastructure to support power projection, readiness, threat assessment, and sustainability requirements. In FY06, extend simulations for power, water, and fuel infrastructure analysis to forward staging areas. Urban Reasoning and Battlespace Analysis - In FY06, mature methodology to infer utility system topology. In FY07, will extend methodology to work with incomplete data sets. Future Forces Ranges - In FY07, will identify critical infrastructure signatures to support urban training simulations.	1120	2230	1753
Total	2822	3630	3515

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
790	Personnel Performance & Training Technology	14839	14990	16200	15834	15987	16072	16226

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 nonmaterial solutions to improve human performance and 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 who will perform well today, and be ready and relevant as the future unfolds. The research, where feasible, exploits opportunities to enhance Current Force capabilities. The behavioral and social science applied research conducted in this program element will provide knowledge products, methods, techniques, and tools that will enable the Army to: select Soldiers who are predicted to perform well in future jobs and assign them to 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 the uncertain, rapidly changing missions they are facing today and missions that are predicted to be even more complex in the future; leverage the potential of embedded training technologies for training: (1) complex battle command skills for network-enabled environments, (2) dismounted squad leadership and team maneuver with ground Soldier systems technologies, and (3)command and control (C2) in digital, distributed networks. 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 that will provide a more synergistic training and educational process (e.g., automated and improved diagnostics, coaching and mentoring, performance measures, and feedback methods). This program leverages and coordinates with work at a number of other Laboratories and RD&E Centers including, the Simulation and Training Technology Center (STTC), Natick Soldier Center, Army Research Laboratory (ARL) and the Communications Electronics Command (CECOM). 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). This project is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Personnel Selection and Assignment: In FY05, assessed the extent to which promising, but currently unmeasured, Soldier attributes predict future-oriented enlisted job performance; validated new certification measures to ensure Soldiers qualify on the skills necessary for effective job performance; developed a set of alternative methods that can improve enlisted attrition management. In FY06, develop guidelines and recommendations for a more flexible enlisted selection and classification system that can keep pace with changing job requirements; develop a conceptual framework of Army career continuance that identifies the critical factors that influence Soldier retention in today's volatile global-war-on-terrorism environment; identify interventions to enhance retention; and develop or adapt Soldier selection measures for their use in job classification to improve performance and job satisfaction of entry-level Soldiers. In FY07, will refine and test model of Army career continuance, assess potential interventions, and provide preliminary input to the DCS G-1 and TRADOC HQ on interventions that show a high potential to improve retention of Soldiers and leaders; and will conduct preliminary assessment of prototype job classification measures for enhancing entry-level performance and job satisfaction.	4090	4647	4536
Training: In FY05, developed methods for training selected C2 skills for FCS Brigade Combat Team leaders and staffs; formulated principles of effective performance measurement in future digital C4ISR environments; conducted assessments of modified digital After Action Review (AAR) systems in terms of ability to support FCS C4ISR training; and assessed the effectiveness of embedded/augmented/virtual reality approaches for small unit leader training (in collaboration with STTC). In FY06, develop exemplar training package for improving dismounted small unit decision making capabilities and information utilization skills; provide lessons	7414	7495	8262

learned from virtual and augmented reality approaches to train future land warrior capabilities; identify cognitive behaviors underlying expert performance for critical individual and team battle command activities in network-enabled environments; create a laboratory environment to assess the impact of alerts on the AAR process in network-enabled systems; and analyze the impact of changes in robotic operator control unit design on training efficiency. In FY07, will develop exemplar training packages for commanders performing battle command in networked-enabled environments; will assess the impact of alerts on training requirements and the AAR process for a network-enabled force; will identify the collaboration/communication requirements needed between dismounted Soldiers and robotic operators for effective employment of robotic platforms in platoon-level exercises; will establish preliminary skill retention curves for critical digital skills; and will identify training and human dimension challenges of joint and coalition operations.			
Leader Development: In FY05, developed preliminary computer-based coaching techniques for expanding leader skills through experiential learning; developed and evaluated a prototype training system for leaders of multinational teams; developed self assessment techniques to increase leader self awareness. In FY06, assess an on-line self-assessment and feedback module for increasing self awareness and improving attention to learning materials; develop experiential growth model of leadership skills; design training strategies to improve critical thinking, interpersonal skills, and self-awareness using principles of experiential learning; develop preliminary model of how self-awareness influences the growth of leadership skills; and identify skills (cognitive, interpersonal), knowledge and attitudes that leaders need to perform in future joint and combined headquarters operations. In FY07, will validate effectiveness of protocols to collect and analyze data from Soldiers in the field on leadership vignettes; will evaluate online assessment tools for improving leadership growth and development; will evaluate alternate strategies to improve critical thinking and interpersonal skills; will design instruments for assessing the leader skills and attitudes needed for effective performance in high-stress, joint operations; and will identify critical cultural factors for leading multicultural teams.	3335	2848	3402
Total	14839	14990	16200

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	14846	15207	16006
Current BES/President's Budget (FY 2007)	14839	14990	16200
Total Adjustments	-7	-217	194
Congressional Program Reductions		-66	
Congressional Rescissions		-151	
Congressional Increases			
Reprogrammings	-7		
SBIR/STTR Transfer			
Adjustments to Budget Years			194

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602786A - LOGISTICS TECHNOLOGY**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		54385	47667	25436	22078	19827	19991	20132
283	AIRDROP ADV TECH	2483	2168	2352	2348	2370	2391	2408
C60	AC60	3503	1631	3699	0	0	0	0
E01	Warfighter Technology Initiatives (CA)	34343	26270	0	0	0	0	0
H98	CLOTHING & EQUIPM TECH	9037	12785	14334	14462	12131	12230	12313
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	5019	4813	5051	5268	5326	5370	5411

A. Mission Description and Budget Item Justification: This applied research Program Element (PE) investigates technologies to improve soldier survivability and performance for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The PE addresses technologies for: the air delivery of personnel and cargo, combat clothing and personal equipment, and combat rations and combat feeding equipment. The Airdrop Advanced Technology Program (project 283) supports all Services' requirements for air dropping larger combat and logistics loads while improving delivery accuracy, minimizing vulnerability of aircraft, and reducing life cycle costs. Investigation of technologies for safer, more combat efficient personnel parachutes addresses a critical capability for rapid deployment force projection, particularly into hostile environments. The Clothing and Equipment Technology Program (project H98) funds cutting edge research and technologies that will enhance warfighter survivability from both combat threats (e.g., ballistics, flame, directed energy) and the field environment (e.g., cold, heat, wet); enhance signature management; provide wearable, conducting materials to augment data and power transmission; provide cooling to the Soldier to reduce risk of heat stress; and lighten the soldier's load. Human science is incorporated into modeling and analysis tools that will enable technologists and military users to trade-off potential warrior system capabilities and mature a human-centered warrior system design. The Joint Services Combat Feeding Technology Program (project H99) supports all Military Services, the Special Operations Command, and the Defense Logistics Agency with research conducted on high payoff technologies for performance enhancing combat rations, ration packaging, and combat feeding equipment/systems. Research will enhance nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; minimize physical, chemical and nutritional degradation of combat rations during storage; meet the needs of individual soldiers in highly mobile battlefield situations; and provide 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, the last with oversight and coordination by the Department of Defense (DoD) Combat Feeding Research & Engineering Board. Project E01 funds Congressional special interest items. Efforts are related to and fully coordinated with those in PE 0603001A (Warfighter Advanced Technology). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this PE is performed by the U.S. Army Natick Soldier Center, Natick, MA.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	54051	21707	24778
Current BES/President's Budget (FY 2007)	54385	47667	25436
Total Adjustments	334	25960	658
Congressional Program Reductions		-209	
Congressional Rescissions		-481	
Congressional Increases		26650	
Reprogrammings	334		
SBIR/STTR Transfer			
Adjustments to Budget Years			658

Fifteen FY06 Congressional adds totaling $26650 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount shown):
($1750) Advanced Warfighter Sustainment Systems for the 21st Century (AWSS-21)
($1000) Army Combat Uniform Advanced Fabric Treatment Technology Demonstration
($2600) Biosecurity Research for Soldier Food Safety
($1700) Center for Geosciences Phase IV
($1800) Development of Long-shelf Life Fruits and Vegetables for Military Rations
($1000) Electro-Textile
($3400) GPS-Guided Parasail System
($500) Improved Self Sintered Silicon Carbide to Meet Body Armor Protection
($2800) Integrated, Unbreakable, Flexible Visible Infrared Lighting Surfaces for Shelters
($1000) Mosiac Flexible Armor
($4300) NBC Integrated Protection Membrane Shelters
($1000) Research on Structures and Composites in Construction for Force Protection
($1000) Smart Apparel for Warriors (SAW), Next Generation ACU
($1000) Soldier System Center 6.3
($1800) Ultra Lightweight Flexible Photovoltiacs for the Individual Warrior

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - LOGISTICS TECHNOLOGY**	**283**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
283 AIRDROP ADV TECH	2483	2168	2352	2348	2370	2391	2408

A. Mission Description and Budget Item Justification: This project researches technologies to enhance cargo and personnel airdrop capabilities. These enabling technologies support the goals of the 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 will 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 Strategic Planning Guidance, the Army Science and Technology Master Plan, and the Army Modernization Plan. Work in this project is performed and managed by the US Army Natick Soldier Center, Natick, MA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Advanced Air Cargo Delivery - In FY05, evaluated sub-scale concept models for Precision Airdrop - Medium (30,000 lb payload); identified fundamental physical and numerical instabilities inherent in modeling large canopies necessary for advanced cargo airdrop applications with up to 30,000 lb payload and incorporated new modeling techniques, to address physical and numerical instabilities, into a suite of high fidelity modeling tools available for simulating cargo airdrop applications.	2483	0	0
Advanced Sensor Technology Development - In FY06, explore technology (when no commercial solution exists) for advanced pressure, stress/strain, and shape measurement prototype devices suitable as instruments in providing the dynamic response of flexible aerodynamic decelerator systems. In FY07, apply sensor technology to realistic flowfields related to airdrop applications.	0	700	852
Modeling and Simulation for Tactical Parachute System Performance Enhancement - In FY06, develop experimental methodologies providing high level of detail of parachute physics for use with both personnel and cargo parachutes; and use High Performance Computing (HPC) modeling and simulation to investigate fully open parachutist control and rate of descent aspects of ATPS. In FY07, will utilize experimental methodologies to develop detailed knowledge of baseline parachute physics; will complete investigation of fully open parachutist control and rate of descent issues; and will investigate parachute opening phenomena.	0	1468	1500
Total	2483	2168	2352

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - LOGISTICS TECHNOLOGY**	**H98**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H98 CLOTHING & EQUIPM TECH	9037	12785	14334	14462	12131	12230	12313

A. Mission Description and Budget Item Justification: This project researches and investigates technologies to improve Soldier survivability and performance. Research focuses on lightweight materials for personal protection and survivability from both combat threats (e.g., improved ballistic, flame, and directed energy) and the field environment (e.g., cold, heat, wet); enhanced signature management; modeling and analysis tools for optimizing Soldier system clothing and equipment; and advances in emerging technology (e.g. nanotechnology, electrotextiles) to improve the performance, multi-functionality, and fightability of Soldier clothing and equipment. The goal of the ballistic protection work is to research and apply advances in materials technology to improve the protection and performance of warrior armor systems against conventional and emerging ballistic threats. The supporting biomechanical tools effort will provide a capability to identify promising candidate 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. The objective of the novel blast protection effort is to characterize blast profiles, determine the hazard, and demonstrate improved protection concepts. The goal of Infantry Warrior Simulation is to build essential analytic tools needed to assess the combat worth of next generation warrior systems, with a focus on network centric warfare technologies. Nanotechnology is being applied to several soldier clothing and equipment areas, and potentially could revolutionize the performance of various Soldier-worn components. The major nanotechnology effort focuses research on conducting, flexible, wearable materials for lightweight power generating and storage devices to augment power sources for Soldier-worn computers and equipment. The purpose of the microclimate cooling effort is to provide a capability that mitigates the effects of heat stress encountered by dismounted infantry exposed to hot environments and encumbered in protective clothing. The goal of the directed energy protection effort is to apply recent developments in nano-materials research to provide the dismounted soldier with eye protection against tunable-laser threats occurring on the battlefield and to provide improved ballistic fragmentation protection for the eyes, face and neck, and scratch resistance for the lenses. This project leverages work performed by the Institute for Soldier Nanotechnologies supported by Program Element (PE) 0601104A (University and Industry Research Centers) and PE0 602105A (Materials Technology). The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this project is performed by the U.S. Army Natick Soldier Center, Natick, MA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Ballistic Protection for the Individual Warrior - In FY05, enhanced fiber mechanical properties through processing/post-processing techniques and evaluated their ability to meet performance requirements; began research on material system(s) architecture incorporating advanced fibers into flexible materials and composite technology. In FY06, mature material(s) system(s) architecture for both flexible and composite technology to include resins system, adhesion modifiers, and fiber architecture. In FY07, will demonstrate technology with a 30% reduction in weight (over the level achieved in FY03) with equivalent fragmentation protection in flexible and composite configurations; and will transition composite technologies to ballistic protective garments to reduce weight and/or increase multiple-hit capability.	2930	2464	2021
Novel Blast Protection - In FY05, defined and developed initial protective material system concepts for fielded Interceptor Vest ("add-on" blast protection) and conducted preliminary evaluations on material system concept(s). In FY06, define and develop initial protective material system concepts for Future Force Warrior (FFW), continue development of test device for blast protective concepts, and refine concept for Interceptor Vest and transfer technology to PM-Clothing & Individual Equipment. In FY07, will develop an integrated	2930	2464	1723

concept for blast protection for the future warrior, validate performance and transition to Program Executive Office (PEO) Soldier development program.			
Infantry Warrior Simulation (IWARS) - In FY05, explored alternative representations of intra-small unit information transfer, identified and developed optimal software approaches for integration of the Army Materiel Systems Analysis Activity's target detection, target engagement, and weapons effects algorithms for inclusion in IWARS. Released IWARS version 1.0. In FY06, complete information centric capability for intra-platoon operations and release IWARS version 2.0. In FY07, will develop initial small unit battle command module to support small unit information transfer impacts, and release the High Level Architecture compliant version 3.0 IWARS.	2059	1853	2240
Electrotextiles: Self Powered, Conductive and Smart - In FY05, conducted research to create photovoltaic (PV) fibers and identified promising near-term conductive textile-based technologies; continued investigating technology for prototype portable PV mats and PV integrated shelters to recharge batteries used to power soldier-borne items. In FY06, develop prototype PV battery rechargers, PV shelters and new stealthy camouflage pattern photovoltaics; and develop near-term technologies for conductive fiber-based compositions, while identifying advanced materials with high payoff potential. In FY07, will transition PV prototypes to PEO Soldier, Special Operations Command, and FFW; explore power generation and electrical conductivity in unique fiber-based compositions; and investigate new power generating and electrically conductive textile-based compositions compatible with warrior systems.	1118	1479	2027
Soldier Borne Microclimate Cooling - In FY06, investigate alternate material and design approaches for reducing the weight and power consumption of cooling technologies by focusing on the maturation of desiccant-assisted evaporative cooling technology and on new technologies for vapor compression cooling (e.g., carbon foam and micro-channel heat exchangers, optimized fan designs, soft packing, and biofeedback for power management). In FY07, will downselect material and design approaches, and begin the integration of technological elements and components into a breadboard system.	0	887	1470
Soldier Integrated Tunable (Frequency Agile) Laser/Ballistic Eye Protection - This effort addresses the emerging threat of frequency agile lasers on the battlefield and provides increased ballistic fragmentation protection. In FY06, evaluate laser protection schemes, research optical limiting concepts that do not require an intermediate focal plane, and improve the performance of ballistic protective materials within the weight limit of the currently fielded system. Establish experimental protocols to evaluate lens abrasion due to blown sand and define baselines for subsequent experimental abrasion measurements. In FY07, will mature lighter weight ballistic materials while maintaining the improved level of performance; will identify and evaluate abrasion resistant coatings and coating application procedures; and will research optical limiting concepts that meet system design response time requirements.	0	2702	3243
Biomechanical Tools for Individual Soldier Extremity Protection - In FY06, define Soldier performance output measures for extremity worn body armor and equipment, initiate human experiments to collect energy expenditure data and construct an initial principles-based biomechanical model for the effect of extremity loading on the defined output measures. In FY07, will complete a principles-based biomechanical model that predicts Soldier performance when encumbered with body armor, define performance thresholds for the biomechanical variables and develop empirically based fatigue model for integration with the principles-based biomechanical model.	0	936	1610
Total	9037	12785	14334

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - LOGISTICS TECHNOLOGY**	**H99**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	5019	4813	5051	5268	5326	5370	5411

A. Mission Description and Budget Item Justification: The Joint Services Combat Feeding Technology project researches and applies combat ration and field food service equipment technologies to revolutionize the manner in which we sustain and support the Armed Forces, ensuring optimal nutritional intake. 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% (i.e., weight, cube, fuel and water) and labor requirements by 50%, while improving the quality of food service. Thrust areas include: combat rations, ration packaging, and combat feeding equipment/systems. Near-term goals are to: enhance nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; reduce ration weight/volume and food packaging waste to minimize the logistics footprint; tailor rations to the combat situation and provide an "eat on the move" capability, thereby improving mobility; reduce replenishment demand by extending shelf-life, permitting more extensive prepositioning of stocks, while maintaining initial quality; and provide equipment and energy technologies to reduce the logistics footprint and to enhance operational efficiency of field feeding while improving the quality of food service. The work in this project supports all military Services, the Army's Future Force, Special Operations Command, and the Defense Logistics Agency. The Army has Executive Agency responsibility for this Department of Defense (DoD) program, with oversight and coordination provided by the DoD Combat Feeding Research & Engineering Board. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this project is performed by the US Army Natick Soldier Center, Natick, MA, and this project has collaborative efforts with the U.S. Army Research Institute for Environmental Medicine.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Equipment and Energy Technologies - In FY05, completed materials research and developed concept for individual beverage chiller; transitioned a prototype Capillary Force Vaporizer stove that weighs 50% less and consumes 50% less fuel than commercial stoves; developed process for applying quasicrystalline coatings on aluminum cookwear that provides nonstick properties similar to fluorocarbons and hardness similar to steel; explored self-powered and solar-powered refrigerated container technology; developed technology to flamelessly combust methanol as a preliminary step to JP8; developed a proof-of-concept thermoelectric self-powered tray ration heater; and explored an alkaline fuel cell concept to control hydrogen emissions for group ration chemical heaters. In FY06, integrate and test water chiller subsystems for Soldier hydration; complete and transition self-powered tray ration heater; complete prototype design for a solar powered refrigerated container; and down select four competing designs for Waste to Energy Converters. In FY07, will complete prototype development of JP8 fueled flameless catalytic sheet materials and integrate into a safe heating system with potential to consume less fuel than chemical or open-flame heaters; and fabricate a prototype Solar Powered Refrigerated Container.	2277	2177	2281
Ration Stabilization, Packaging, Food Safety & Novel Nutrient Delivery Technologies - In FY05, researched pathogen probe technology and transitioned to diagnostics platforms to advance biosensor effectiveness for food pathogen detection; researched self-hydrating membrane pouch forward osmosis technology for safe/effective re-hydration of dried beverages/rations by non-potable water sources; investigated Radio Frequency Identification (RFID) technologies applicable to ration logistics, integrated into tamper evident concept; validated barrier results which met oxygen transmittal rates for MRE packaging; investigated technology to predict combat ration quality via RFID; investigated performance enhancing ration component technology and encapsulated micronutrients to enhance mobility and reduce weight/volume; investigated oral mucosal (buccal) absorption; and researched novel delivery systems. In FY06, tailor food	2742	2636	2770

sampling extraction procedures using immunoassays; investigate electrospun arrays for capture from complex matrices and validate array technologies to identify multiple pathogens; and evaluate self-hydrating pouch forward osmosis technology. Analyze RFID-based storage temperature data and document recommendations for shelf-life management to provide to Defense Supply Center Philadelphia and the Services. Develop methods for buccal delivery of anti-inflammatory micronutrients to extend onset of muscle fatigue. Optimize barrier coating technology and producibility. In FY07, will continue modification and evaluation of food sampling procedures used for biosensor systems to improve their accuracy and sensitivity to pathogenic organisms; will validate buccal delivery systems and optimize nutrient delivery/absorption; and will verify/evaluate percent loss of performance enhancers in ration over time and focus on enhancers requiring protection.			
Total	5019	4813	5051

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	186959	279780	75407	73951	72517	70577	71275
845	BONE DISEASE RESEARCH PROGRAM	957	986	0	0	0	0	0
863	BTLFLD SURGICAL REPLAC	3833	986	0	0	0	0	0
865	CENTER FOR MILITARY BIOMATERIALS RESEARCH	2396	1971	0	0	0	0	0
866	CLINICAL TRIAL PLEZOELECTRIC DRY POWDER INHALATION	3833	3351	0	0	0	0	0
867	DIAGNOSTICS IN TRAUMATIC BRAIN INJURY BLOOD BASED	2875	986	0	0	0	0	0
869	T-MED/ADVANCED TECHNOLOGY	2991	2797	3011	3075	3160	3029	3057
870	DOD MED DEF AG INF DIS	13764	14744	14932	14909	15191	15349	15493
873	HIV EXPLORATORY RSCH	9527	10815	11432	11407	11476	10780	10849
874	CBT CASUALTY CARE TECH	7567	15402	13682	11806	8999	9077	9144
878	HLTH HAZ MIL MATERIEL	10774	12556	13871	14126	14528	13931	14083
879	MED FACT ENH SOLD EFF	9731	9681	10077	10099	10345	9894	9968
881	Performance Enhancement and Injury Prevention	1650	0	0	0	0	0	0
953	DISASTER RELIEF & EMERGENCY MEDICAL SVC (DREAMS)	10542	5618	0	0	0	0	0
968	SYNCH BASED HI ENERGY RADIATION BEAM CANCER DETECT	8144	8379	0	0	0	0	0
96C	DIGITAL IMAGING AND CATHERIZATION EQUIPMENT	0	986	0	0	0	0	0
96E	HEMORRHAGE CONTROL DRESSING	3354	0	0	0	0	0	0
96F	PORTABLE BIOCHIP ANALYSIS SYSTEM	957	0	0	0	0	0	0
96I	REMOTE ACOUSTIC HEMOSTASIS	0	1380	0	0	0	0	0
977	EMERGING INFECTIOUS DISEASES	0	6950	0	0	0	0	0
FH2	FORCE HEALTH PROTECTION - APPLIED RESEARCH	0	7634	8402	8529	8818	8517	8681
MA2	DIABETES PROJECT	5749	3351	0	0	0	0	0

MA3	MEDICAL AREA NETWORK FOR VIRTUAL TECHNOLOGY	4887	5027	0	0	0	0	0
MA5	CENTER FOR INTERNATIONAL REHABILITATION	4791	0	0	0	0	0	0
MA6	DERMAL PHASE METER	957	0	0	0	0	0	0
NA8	IMPROVING SOLDIER PERFORMANCE (CA)	1727	0	0	0	0	0	0
OA3	CENTER FOR ADV SURGICAL & INTERVENTIONAL TECH (CA)	957	6703	0	0	0	0	0
OA5	COMPUTATION PROTEOMICS (CA)	2491	986	0	0	0	0	0
OA7	ELGEN GENE DELIVERY TECHNOLOGY (CA)	957	0	0	0	0	0	0
OA8	ENHANCED RES IN TRAUMA PREVENTION/TREATMENT/REHAB	1916	986	0	0	0	0	0
OA9	GENETIC ACUTE ENHANCED BIOWARFARE THERAPY PROG (CA	0	986	0	0	0	0	0
PA4	WOUND HEALING PROJECT (CA)	0	986	0	0	0	0	0
PA5	NANOFABRICATED BIOARTIFICIAL KIDNEY (CA)	1869	1577	0	0	0	0	0
PA7	NON-INVASIVE MEDICAL SENSORS (CA)	957	0	0	0	0	0	0
PA9	PROSTHETIC DEVICE CLIN EVAL AT WRAIR AMPUTEE CTR	0	5421	0	0	0	0	0
RA1	SLEEP DEPRIVATION RESEARCH AT WRAMC (CA)	3354	0	0	0	0	0	0
RA2	TARGETED NANOTHERAPEUTICS FOR CANCER (CA)	957	986	0	0	0	0	0
RA4	TRANSPORTABLE PATHOGEN REDUCT AND BLOOD SAFETY SYS	1916	1233	0	0	0	0	0
RA5	USAMRIID ANTHRAX RESEARCH (CA)	2155	0	0	0	0	0	0
RA6	VERSA HSDI (CA)	4120	5914	0	0	0	0	0
TA1	AUTO MEDICAL EMERGENCY INTRAVASCULAR ACCESS (CA)	957	1479	0	0	0	0	0
TA2	ANTI-MICROBIAL COATINGS FOR MEDICAL DEVICES (CA)	1342	0	0	0	0	0	0

TA3	BIOACTIVE PRODUCTS PROGRAM FOR BREAST CANCER (CA)	957	0	0	0	0	0	0
TA4	HEALTH EFFECTS OF IONIZING RADIATION (CA)	957	0	0	0	0	0	0
TA5	CHRONIC WOUNDS (NON-HEALING) RESEARCH (CA)	957	0	0	0	0	0	0
TA6	COLLABORATIVE PROGRAM IN REHAB & ENGINEER RSH (CA)	957	0	0	0	0	0	0
TA7	COMBAT CASUALTY CARE FOR BATTLEFIELD WOUNDS (CA)	2684	2760	0	0	0	0	0
TA8	COMPREHENSIVE BIOACTIVE PROD PRG FOR BREAST CANCER	957	0	0	0	0	0	0
TA9	COMPREHENSIVE REPRODUCTIVE SYS CARE PROGRAM (CA)	11402	0	0	0	0	0	0
UA1	GYNECOLOGICAL CANCER CENTER (CA)	2012	0	0	0	0	0	0
UA2	HIGH-SPEED MEMS ELECTROMAGNETIC CELL SORTER (CA)	1437	2957	0	0	0	0	0
UA4	INTEGRATIVE CARDIAC HEALTH PROGRAM (CA)	4887	0	0	0	0	0	0
UA5	NEUTRON THERAPY (CA)	862	1774	0	0	0	0	0
UA6	PREDICTIVE TOOLS FOR PTSD (CA)	957	1479	0	0	0	0	0
UA7	PREVENTIVE MEDICINE RESEARCH INSTITUTE (CA)	1437	1380	0	0	0	0	0
UA8	PROTEIN HYDROGEL (CA)	957	986	0	0	0	0	0
UA9	MEDICAL SKILLS READINESS TRNG FOR RESERVISTS (CA)	1437	0	0	0	0	0	0
VA1	SHOCK TRAUMA RESEARCH (CA)	2012	0	0	0	0	0	0
VA2	SPINAL MUSCULAR ATROPHY RESEARCH PROGRAM (CA)	2155	0	0	0	0	0	0
VA3	VETERINARY MANPOWER DEVELOPMENT (CA)	288	0	0	0	0	0	0
VB3	MEDICAL TECHNOLOGY INITIATIVES (CA)	0	125024	0	0	0	0	0
X05	MOLECULAR GENETICS &	11324	0	0	0	0	0	0

	MUSCULOSKELETAL RESEARCH(CA)							
X06	HIBERNATION GENOMICS	3369	2563	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) supports applied research for healthy, medically protected Soldiers and funds research consistent with the Medical, Survivability, and Future Warrior technology areas of the Future Force. The primary goal of medical research and development is to sustain medical information and technology (drugs, vaccines and devices) to effectively protect and improve the survivability of U.S. Forces in a variety of settings including, but not limited to, conventional/asymmetric battlefields, areas of low-intensity conflict, and military operations other than war. All medical research is conducted in compliance with U.S. Food and Drug Administration (FDA) regulations. The FDA requires thorough testing in animals (referred to as preclinical testing) to assure safety and efficacy prior to approving controlled clinical testing of experimental (previously unproven in humans) 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, including an increasing number of people in each subsequent phase. All test results are submitted to the FDA for evaluation to obtain approval for routine medical use. 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. The Military Relevant Infectious Diseases effort focuses on designing and developing medical protection against naturally occurring diseases of military importance. Methods identified and matured for prevention and treatment of infectious diseases include candidate vaccines, prophylactic 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 U.S., which are problematic in military deployments and joint operations with coalition forces. Main efforts include preclinical development of candidate vaccines, improved diagnosis, and improved prognostic assessment and disease management. The Combat Casualty Care effort conducts research associated with the care of trauma and burns due to battlefield injuries. Work involves identification and evaluation of drugs, biologics, and diagnostics for resuscitation and life support, as well as trauma care systems for use by forward medics and surgeons. This effort also includes Combat Dentistry research with a focus on prevention of cavities and dental disease and combat maxillofacial (face/neck) injuries on the battlefield. 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 examines technologies, such as body armor and biomonitors, to protect Soldiers from injuries from exposure to hazardous environments and materials. Identifying and developing methods to prevent degradation of health and performance in military environments is another important objective of MOM research. 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. Additionally, findings from research and treatment of Gulf War Illness are used to better understand military health issues and protect Service members against health threats in military deployments. Work is related to, and fully coordinated with, work funded in PE's 0603002A and 0603105A.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 PE is performed by the Walter Reed Army Institute of Research, Silver Spring, MD; U.S. Army Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, MD; U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, MD; U.S. Army Research Institute of Environmental Medicine, Natick, MA; U.S. Army Institute of Surgical Research, Fort Sam Houston, TX; U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL; and the Naval Medical Research Center, Silver Spring, MD.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	183102	74694	74804
Current BES/President's Budget (FY 2007)	186959	279780	75407
Total Adjustments	3857	205086	603
Congressional Program Reductions		-1233	
Congressional Rescissions		-2831	
Congressional Increases		209150	
Reprogrammings	3857		
SBIR/STTR Transfer			
Adjustments to Budget Years			603

Eighty-eight FY06 Congressional adds totaling $209150 were added to this PE.

FY06 Congressional adds with no R-2A:
($2800) Adult Stem Cells for Wound Healing & Immune Reconstruction
($1000) Advanced Proteomics for Clinical Applications
($1000) Antidotes Against Combat Injuries
($5500) Applied & Clinical Prosthetic Research at Walter Reed Amputee Ctr
($1500) Automated Medical Emergency Intravascular Access
($2000) Basic Clinical Translational Genetics
($1300) Bio-foam Bleeding Sealant for Battlefield Trauma
($2300) Biological & Immunological Infectious Agent & Cancer Vaccine
($2200) Biomarkers: Evaluating & Testing Acute & Chronic TBI
($1800) Biomedical Sciences & Technology
($1000) Blood Based Therapy for Traumatic Brain Injury
($1000) Bone Health & Military Medical Readiness
($1000) Broad Spectrum Anti-Viral Host Oriented Therapeutics
($1000) Cancer Prevention through Remote Biological Detection
($6800) Center for Advanced Surgical & Interventional Tech
($1000) Center for Diagnosis of Pathogens
($1000) Center for Traumatic Amputee Rehabilitation & Research
($3400) Clinical Trials Using Piezoelectric Dry Powder Inhalation Device
($4200) Colorimetric PDA-Based Sensor for Rapid Pathogen Detection
($2800) Combat Casualty Care-Battlefield Wounds

($1700) Combat Stress Intervention
($1000) Computational Proteomics
($2500) Control of Inflammation & Tissue Repair
($1000) Copper Air Quality
($3000) CRF Spinal Chord Injury Clinical Trials
($1000) Development of a Continuous Monitor for Sensing Glucose & Lactate
($1000) Development of Biomedical Assistive Technologies for Disabled Service Members
($1000) Digital Imaging & Catheterization Equip
($500) Early & Rapid Analyzer for Heart Attack Diagnosis
($1100) Evaluation of p75 protein for Non-surgical Treatment of Central Nervous System Trauma
($1000) Genetic Reassortment by Mismatched Repair Biowarfare Therapy
($2600) Hibernation Genomics (UAF)
($6000) HSDI
($2100) IC4 Program (Integrated Medicine, Communications, Compassion, Chronic, Care Program)
($500) ImPACT Battlefield Head Injury Diagnosis & Triage
($1800) Improving Soldier Recovery from Catastrophic Bone Injuries
($2600) Infrastructure Support for Clinical Trials of Orphan Retinal Degenerative Diseases
($2500) Integrative Healing Practices for Veterans (VET-HEAL)
($1000) Invitro Surrogate Lung Test Bed
($500) Life Science Research Initiative
($1000) MCIS Portable Clinical Information Initiative
($5100) Medical Area Network for Virtual Tech
($2000) Medical Image Database Holographic Archiving Library System
($2800) Medical Resource Conservation Tech System
($5000) MIL-CAM (Complementary and Alternative Medicine Research for Military Operations and Healthcare)
($2000) Military Biomaterials Research
($21300) Military Molecular Medicine Initiative (M3I)
($2000) Military Nutrition Research: Personnel Readiness and Warfighter Performance
($1000) Mobile Electronic Health Records Initiative
($2100) Molecular Switching Vaccines for Biodefense
($1600) Nanofabricated Bioartificial Kidney
($2500) National Eye Evaluation and Research Network
($1700) Neural Controlled Prosthetic Device for Amputees
($1800) Neutron Therapy
($2100) Non-Electric Disposable IV Infusion Pump
($3300) Northern California Institute for Research and Education
($1000) Online Health Services Optimization

($7500) Orthopedic Extremity Trauma Research
($1000) Orthopedic Implant Design and Manufactures for Traumatic Injury
($1000) Orthopedic Trauma Research Center
($11900) Pain and Neuroscience Center Research
($1000) Personal Medical Record
($1750) Plasma Discharge Medical Devise Sterilization Technology
($1000) Post Traumatic Stress Disorder Research
($500) Post-Traumatic Stress Syndrome Center
($1000) Prevention of Compartment Syndrome
($1400) Preventive Medicine Research Inst.
($1000) Protein Hydrogel
($1000) Rapid Wound Healing Technology Development
($1000) Rare Blood Program
($1400) Remote Acoustic Hemostasis/Image Guide HIFU Therapy
($1850) Respiratory Biodefense Research
($500) Scleroderma Research
($1200) Silver Foam Technologies Healing
($8500) Synchrotron-based Scanning
($1000) Targeted Nano-Therapeutic for Advanced Breast & Prostate Cancer
($1000) TEDCO-MRASC Applied Research Demonstration Project
($1200) Telemedicine & Surgical Innovation Research
($5700) TexSHIELD (Texas Science, Humanitarian Intervention, Education and Leadership for Disasters)
($1000) Tissue Replacement/Repair for Battlefield Injuries
($1250) Transportable Pathogen Reduction & Blood Safety
($1000) Trauma Prevention, Treatment and Rehabilitation, Ryder Trauma Center, University of Miami
($3400) Type 1 Diabetes Regeneration
($3000) Ultra High-Speed MEMS Electromagnetic Cell Sorter
($1000) USP Laser Scalpel
($1000) Vaccine Research in Biodefense & Emerging Infections
($2800) Vaccines & Therapeutics to Counter Biological Threats
($4000) Vigilance Surgical Safety System

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
869 T-MED/ADVANCED TECHNOLOGY	2991	2797	3011	3075	3160	3029	3057

A. Mission Description and Budget Item Justification: This project funds applied research in casualty avoidance, casualty detection, and evacuation and treatment of casualties through application of physiological status monitoring technologies, including biophysical and biochemical sensors, and the fusion of information from these sensors. Focus is on developing a wearable, integrated system that can monitor Soldier physiological status and provide information that will enable personnel to quickly and accurately determine that a Soldier is fully functional, impaired but still capable of functioning, or in need of medical attention. Work includes identification and initial development of parallel and supporting technologies including medical informatics, medical artificial intelligence, and data mining tools that develop predictors of detrimental physiologic changes. Work is performed in coordination with Natick Soldier Center. 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 Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; and U.S. Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
High Altitude Performance/Life Sign Monitoring - In FY05, demonstrated the ability to noninvasively monitor Soldier alertness in real-time operational settings, measure blood pressure, and incorporate this information into remote triage algorithms for the Future Force Warrior (FFW) medic; began human prospective trials of a fieldable acoustic collapsed lung detector; began investigation of markers that will detect the onset of cardiovascular collapse and algorithms to predict the early stages of shock. In FY06, complete integration of the sensor suite and algorithms (heart rate, respiration, body posture and activity, ballistic wound detector, fluid intake, sleep status) with the Personal Area Network and demonstrate performance with the FFW soldier ensemble; complete integration of the initial capability with FFW Advanced Technology Demonstration; conduct evaluation of relationships among variables that signal cardiovascular collapse and indicate a need to apply a Life Saving Intervention. In FY07, will conduct several series of studies to evaluate multiple physiological signals for use in refining algorithms for prediction of cardiovascular collapse due to lower body negative pressure.	2991	2797	3011
Total	2991	2797	3011

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
870 DOD MED DEF AG INF DIS	13764	14744	14932	14909	15191	15349	15493

A. Mission Description and Budget Item Justification: This project researches and investigates medical countermeasures to naturally occurring infectious diseases that pose a significant threat to the operational effectiveness of forces deployed outside the United States. Countermeasures will 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 the parasitic disease malaria, bacterial diseases responsible for diarrhea (i.e., caused by Shigella, enterotoxigenic Escherichia coli (ETEC), and Campylobacter), and viral diseases (e.g., dengue fever and hantavirus). Research also explores improved materiel to control arthropod vectors of disease transmission (insects, ticks, etc.) to reduce incidence of these diseases and addresses a variety of other threats to mobilizing forces, including meningitis, viral encephalitis, scrub typhus, and hemorrhagic fevers. Improved diagnostic capabilities are pursued to enable rapid battlefield identification and treatment or management of militarily important diseases for which there is no current method of protection. Goals include developing DNA (gene-based) vaccines; incorporating new technologies to enhance effectiveness, safety, and duration of vaccines; integrating cutting-edge genomic and proteomic (protein-based) technologies into vaccine and drug discovery; and developing broad spectrum vaccines that can protect against multiple disease strains and drugs to prevent or treat malaria. Work is managed by the U.S. Army Medical Research and Materiel Command. The Army is lead service for infectious disease research within the DOD 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 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 Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, MD; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Malaria Vaccines - In FY05, matured and assessed the role of additional/improved vaccine antigens - including recombinant proteins, adjuvants (aids in enhancing vaccine potency), nucleic acids, and recombinant viruses - in the administration, schedule, and dosage requirement needed to induce protective immune responses; completed preclinical testing required for FDA approval of human clinical testing of DNA and protein vaccine candidates for inclusion in a multicomponent malaria vaccine; demonstrated that the protective immune response generated by the RTS,S vaccine (hybrid protein consisting of a piece of malaria protein fused with hepatitis B vaccine protein that is directed toward the liver stage of the parasite) could be enhanced significantly by a subsequent immunization with a vaccine made of a non-disease-causing form of adenovirus that expresses the same malaria protein; completed and documented pre-clinical test results (safety and efficacy in animals) to support application to the FDA for human administration of a blood-stage protein vaccine because the liver and blood stage vaccines do not cross protect against one another. In FY06, perform testing needed to submit application to FDA for additional blood and liver stage proteins. Results from clinical testing in Project 810 will be used to select and reformulate those additional vaccine components to add to the RTS,S vaccine to increase liver stage protection and to meet DOD product requirements, and additionally, to expand protection to malaria blood stage disease. Continue preclinical development of improved vaccines and submit FDA applications for these products because the FDA considers such modifications to be new products. In FY07, will improve the current clinical efficacy of leading vaccine candidates by applying and evaluating new technologies such as the adenovirus vaccine together with the protein vaccines and adjuvant combinations; and assess new vaccine delivery methods on humans for pote	2828	2509	2866

Antidiarrheal Vaccines - In FY05, conducted preclinical testing including safety testing in animals, assay development, manufacturing process development/testing of the Shigella Invaplex vaccine. This advanced vaccine candidate is composed of bacterial surface material shed from the cells and to which most antibody binding would occur resulting in protection against Shigella dysentery; validated the ETEC model for future vaccine efficacy testing of the current vaccine candidate which is directed against the bacterial cell components that allow bacteria to adhere to the intestine. In FY06, complete preclinical testing of ETEC adhesin-based vaccines; assess more effective delivery methods for vaccines against diarrheal pathogens such as biological adjuvants; and assess non-vaccine approaches to protect against diarrhea such as oral immunoglobulin (animal protein with known antibody activity) supplements. Assess additional proteins in animal studies to add to current Campylobacter dysentery vaccine to improve/provide a high degree of protection. Continue to assess the feasibility of a combined diarrhea vaccine incorporating ETEC components into a Shigella bacteria strain. In FY07, will continue preclinical studies of new Campylobacter vaccine approach directed towards newly discovered bacterial surface capsule and will assess a combined vaccine approach for a broad spectrum antidiarrheal vaccine that incorporates the Shigella Invaplex vaccine combined with surface proteins from Campylobacter and ETEC bacteria.	3267	2754	2076
Insect Control - In FY05, completed laboratory testing of a dengue vector control system and initiated field testing. Initiated sand fly control research to reduce incidence of leishmaniasis, a significant health problem for currently deployed troops (e.g. Baghdad Boil). Initiated cooperative effort with a commercial partner to test a new, military standard insect repellent. In FY06, enhance traditional identification aids for mosquitoes of medical importance for use by Preventive Medicine Units (PMU) in the field; assess sand fly control materials which include new field sand fly identification system, test for identifying presence of leishmania in sand fly, test new attractants and traps and assess best practices for controlling sand flies using laboratory or field testing; and start to compile components for integrated sand fly control system for use by PMU. In FY07, will mature field expedient vector-based pathogen detection kits (currently in development for Leishmaniasis, dengue virus, Japanese encephalitis virus, and Rift Valley fever virus) for transition to advanced development or commercial development; and will continue to assess sand fly preventive medicine materials.	686	408	543
Scrub Typhus Vaccine and Infectious Disease Diagnostics - In FY05, conducted preclinical testing of scrub typhus vaccine required for FDA clinical safety trials of candidate vaccine, and matured approaches to supplement infectious disease diagnostics; matured a one-step process to expand and identify dengue fever virus using Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) that will simplify the deployment of dengue RT-PCR assay to the field. In FY06, evaluate multistrain scrub typhus vaccine candidates in a mouse model, and complete maturity of a new diagnostic for dengue virus and continue to work with commercial partners on Point of Care (POC) assays (for use by physicians in clinics) for dengue fever, cutaneous leishmaniasis and scrub typhus; conduct DoD efforts regarding clinical laboratory based diagnostics (primarily DNA/PCR based assays) for cutaneous leishmaniasis, rickettsial (a type of organism) diseases, malaria, dengue virus, diarrheal agents and hemorrhagic fever viruses. In FY07, will evaluate selected scrub typhus vaccine candidate for safety and immunogenicity in FDA required preclinical animal and laboratory studies; will prepare and submit an FDA application for rickettsial disease diagnostic; and will continue the development of POC and PCR-based diagnostic sets for malaria and diarrheal diseases.	1465	2804	2794
Vaccines against Dengue Fever, Meningitis and Hemorrhagic Fevers - In FY05, completed proof of concept for using a gene from a second hantaviral strain to provide broad protection against the 4 known viruses causing hemorrhagic fevers with renal syndrome (HFRS) (e.g., Korean Hemorrhagic fever), enabling subsequent improvement in the DNA vaccine construct of this gene to increase immune response in humans. In FY06, test new component for an improved meningitis vaccine that will be used to broaden the protection of the vaccine to include additional meningococcus strain; and evaluate alternative methods (DNA, inactivated, designed mutant, vectored and/or new adjuvants (substance that enhances reaction of body)) for making more effective second-generation dengue vaccines against the four viral types that cause disease. Develop high throughput assays for antibody and cellular immune responses needed for assessing clinical trial samples. In FY07, will conduct preclinical testing of additional vaccine strain of the purified inactivated dengue virus vaccine to expand final vaccine to include all four subtypes against which protection is required, and two additional meningitis vaccine subtypes	1846	3688	2703

needed to provide a more broadly protective vaccine; will study a new combined DNA vaccine against multiple lethal viruses including Rift Valley fever, Lassa fever and Crimean Congo hemorrhagic fever viruses.			
Malaria Drug Candidates - In FY05, continued to test novel compounds identified in target-directed functional screening coupled with drug design technologies for suitability and further optimization; performed structural modeling on 125 compounds to assess possible antimalarial properties; performed metabolic stability on 73 compounds from 7 different drug classes using subcellular liver components to assess how stable drugs may be in the presence of liver enzyme systems and their suitability as new antimalarial drugs. In FY06, continue early drug discovery screening of new drug candidates and preclinical testing of biguanid class compound which has the potential to be both a prophylactic drug and curative (to replace primaquine which can cause red cell destruction), assess and modify additional candidate drug classes coming from drug discovery program to improve their effectiveness and safety; provide support as needed to complete FDA required preclinical data package for Artesunate, a promising malaria drug; work with corporate partners in developing new drugs and compounds to take to clinical testing. In FY07, will conduct live testing of potential antimalarial drugs in an animal model; will perform preclinical studies of new drug candidates to assess whether they would be appropriate for clinical testing; will provide support for clinical trials of Artesunate, and provide FDA required preclinical testing support for drugs entering or in clinical trials as needed to submit FDA required preclinical data packages.	3672	2581	3950
Total	13764	14744	14932

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
873 HIV EXPLORATORY RSCH	9527	10815	11432	11407	11476	10780	10849

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, surveillance, and epidemiology, and candidate vaccines for prevention and treatment of Human Immunodeficiency Virus (HIV). This program is jointly managed through an Interagency Agreement between the U.S. Army Medical Research and Materiel Command (USAMRMC) and the National Institute of Allergy and Infectious Diseases. Main efforts include construction and preclinical development of candidate vaccines, such as small animal and nonhuman primate studies, initial clinical development in humans, improved diagnosis of HIV infection, and improved prognostic assessment and disease management of HIV-infected individuals. 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 PE 0603105. 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 Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories. Most work is conducted under a cooperative agreement with the Henry M. Jackson Foundation (HMJF), Rockville, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, performed preclinical testing of candidate vaccines; identified approaches exploiting passive immunity and/or drugs to protect the military from HIV in mass casualty situations; performed genetic analysis of HIV subtypes isolated in Africa for integration into vaccine candidates for this region; identified appropriate populations for field efficacy testing in Kenya, Uganda, and prepared Cameroon site for field trials; maintained global surveillance network for HIV-1 infections; and maintained U.S Military Clinical Intervention Network (MCIN) operated through Military Treatment Facilities to study the frequency and impact of HIV/AIDS in/on military populations. In FY06, continue preclinical testing of candidate vaccines; perform genetic analysis of new HIV subtypes emerging in Africa for integration into vaccine candidates for this region; maintain field trials site development in Tanzania and other regions most appropriate for clinical trial testing; maintain global surveillance network for HIV-1 infections to assess the changing threat to U.S. Forces; continue U.S. MCIN operations to study the frequency and impact of HIV/AIDS in/on military populations; and continue technical watch for new antiretroviral drugs. In FY07, will continue efforts in new candidate vaccine development and testing based on prime-boost vaccine strategy to induce strong and long-term protective immune response; will continue to develop methods to evaluate animal and human physiological parameters that correlate with disease protection and which can be used to assess the potential effectiveness of vaccines in humans; will continue to develop novel strategies to deliver recombinant protein antigens to elicit effective antiviral immune response; will perform genetic and epidemiological analyses of the emerging HIV problems faced by the military; and will continue to support vaccine trials by maintaining appropriate clinical trial sites in Africa.	9527	10815	11432
Total	9527	10815	11432

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
874 CBT CASUALTY CARE TECH	7567	15402	13682	11806	8999	9077	9144

A. Mission Description and Budget Item Justification: This project investigates potential treatments for trauma and shock caused by severe blood loss on the battlefield that could be implemented in the pre-hospital setting prior to and continuing in the progressively more definitive levels of medical care. This project funds the core technology base to develop concepts, techniques, and materiel for the treatment and return-to-duty of warfighters wounded in combat and to military operations other than war. The primary goal is to provide technologies that save lives far-forward and maintain critical care at all levels of the battlefield. Major efforts include hemorrhage control, blood and resuscitative fluids; combat trauma therapies; far-forward medical systems; and combat casualty bioinformatics and simulation. Applied research in combat casualty care focuses on the evaluation of concept feasibility for drugs, biologics, and diagnostics for resuscitation and life support as well as designing trauma care systems for advanced monitoring and testing, emphasizing products for forward medic and surgeon use. Major efforts center on resuscitation and life support to include blood products; resuscitation fluids; drugs and devices to control severe bleeding; methods to minimize, repair, and prevent injury; diagnostic and predictive indicators for remote triage and computerized, autonomous patient care; casualty data gathering and mining; and development of training simulators. Selected technologies are integrated into the Medical Mission Packages incrementally to provide comprehensive far-forward treatment to meet Future Force requirements. Project also funds research to reduce evacuations due to dental disease and reduce the medical logistics footprint on the battlefield. 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 U.S. Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX, U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA, and Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Hemorrhage Control, Blood, and Resuscitative Fluids - including materials and systems for minimizing the effects of traumatic blood loss, preserving blood and blood products, and trauma resuscitation. In FY05, continued animal studies of drugs to evaluate their potential to restore clotting function in casualties with trauma induced chemical imbalances in blood (acidity, lack of fibrin and thrombin) sufficient to prepare an Investigational New Drug (IND) application to the U.S. Food and Drug Administration (FDA) for the most promising candidate; conducted testing to assess efficacy of freeze-dried plasma in animals; completed the evaluation of clotting factor activity stability; searched for best method for rapid inactivation of blood-borne pathogens but discovered only immature technologies; completed studies of low-volume fluid resuscitation; and identified new candidate additives for fluids to improve resuscitation. In FY06, complete animal studies and sample analyses in blood coagulation studies; complete determination of freeze-dried plasma production techniques; conclude comparative studies of next-generation resuscitation fluids; test inhibitors of complement activation (an undesirable natural physiologic consequence of trauma leading to inflammation of tissue and organ failure) in animals to determine their safety; and refine model for assessing resuscitation requirements that have high potential to save lives on the battlefield. In FY07, will scale up production of freeze-dried plasma; will complete stability studies necessary to submit application to the FDA as a prerequisite to beginning human trials; will select best technology for pathogen inactivation; will begin efforts to engineer a new, nonperishable resuscitation fluid to mimic fresh whole blood; will recommend best new fluid for resuscitation; and will select the most promising complement activation inhibitor.	2970	7743	6392
Combat Trauma Therapies - including discovery and development of drugs, biologicals, and medical procedures to minimize the immediate and long-term effects from battlefield injuries. In FY05, downselected and conducted clinical testing of an advanced prototype wound protective barrier device; conducted neuroprotection drug studies in the penetrating head injury (PHI) model to identify a drug to	1435	2095	3283

improve survival and residual brain function in casualties with brain injury. In FY06, evaluate wound cleaning/rapid debridement and tissue viability assessment devices in animal models; select best material for repair of bone fractures and defects; and use the PHI model in further studies to evaluate the body's response mechanisms to a PHI. In FY07, will conduct studies to establish antimicrobial activity profiles in animals; will conduct studies varying initiation and duration of wound cleaning times after injury for reduction of microbial populations; will compile and analyze data and finalize biomedically validated guidelines for resuscitation and evacuation of head-injured patients; and will evaluate neuroprotective drugs in comparative studies.			
Far-Forward Medical Systems - including diagnostic and therapeutic medical devices and associated algorithms, software and data processing systems for resuscitation, stabilization, life-support, surgical support, and dental care. Work is coordinated with and complements effort in Project 869. In FY05, began design of algorithms and sensors for closed loop life support; fabricated and completed developmental testing of a prototype collapsed lung detector; completed multiple initial Warfighter Physiological Monitoring System (WPSM) sensor suite algorithms; and established efficacy of antimicrobial agents against pre-existing dental biofilm. In FY06, complete integrated design for closed loop system host platform; integrate initial sensor suite and algorithms into Personal Area Network (PAN); demonstrate performance with the Future Force Warrior ensemble; continue conducting experiments to provide additional data for identification of markers of impending shock and development of algorithms; evaluate relationships among variables that signal cardiovascular collapse and indicate the need to apply a Life Saving Intervention (LSI). In FY07, will complete analysis of data to develop algorithms for prediction of cardiovascular collapse and indicate the need to apply a LSI; and will establish antimicrobial activity profiles against dental caries through testing in animals.	2500	5084	3231
Combat Casualty Bioinformatics and Simulation - including a far-forward-compatible system for creation and management of patient records and theater regulation of patient flow, and development of casualty simulations and durable, realistic simulators for initial and reinforcement training of care providers. In FY05, designed an internet based system that allows medical researchers to store, manipulate, and analyze human trauma physiology time-series data; began work on an improved training system for far-forward providers. In FY06, incorporate features to allow warehousing of data from additional studies and deliver a fully deployable system; and test medic training system with Special Forces and Army medics. In FY07, will mature an improved deployable, untethered, robust, self-correcting, self-assessing medical simulation training system for far-forward care providers.	662	480	776
Total	7567	15402	13682

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
878 HLTH HAZ MIL MATERIEL	10774	12556	13871	14126	14528	13931	14083

A. Mission Description and Budget Item Justification: This project supports the Medical and Survivability technology areas of the Future Force with focused research for the Soldier on protection from health hazards associated with materiel and operational environments. Emphasis is on identification of health hazards inherent to the engineering design and operational use of equipment, systems, and materiel used in Army combat operations and training. Major efforts include Laser Protection Research, Injury Protection, Soft Body Armor and Environmental Extreme Protection, and Biomonitor System/Dehydration Research. Specific hazards addressed include repeated impact/jolt in combat vehicles and aircraft, blast overpressure and impulse noise generated by weapons systems, toxic chemical hazards associated with deployment into environments contaminated with industrial and agricultural chemicals, nonionizing radiation-directed energy sources (laser), and environmental stressors (heat, cold, and terrestrial altitude). Specific research tasks include characterizing the extent of exposure to potential hazards; delineating exposure thresholds for illness or injury; identifying exposure thresholds for 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 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 Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; United States Army Center for Environmental Health Research (USACEHR), Fort Detrick, MD; and U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Laser Protection Research - In FY05, demonstrated the treatment efficacy of modified commercial off the shelf technologies for advanced diagnostic procedures and retinal imaging for laser-induced injury; completed the Report on the State of the Art for Biomedical Implications of Military Laser Exposure. In FY06, transition laboratory developed and refined triage, treatment and protection strategies from an animal model based upon the classification of the laser-induced retinal injury; assess the efficacy of photodynamic therapy in minimizing secondary effects to laser-induced retinal trauma inherent to military lasers. In FY07, will conduct advanced neuroprotection studies for the prevention of retinal and brain cell injury; will evaluate and assess improved drug delivery systems for treatment of laser-induced retinal injury; and will enhance rapid, field expedient color vision based diagnostics for laser-induced or other eye injury.	3680	3403	3683
Injury Protection (tactical vehicles, face/eye) - In FY05, conducted epidemiological review of blunt and penetrating face and eye injury. In FY06, mature and verify face and eye computational models and injury dose-response models. In FY07, will use laboratory tests and epidemiological data to validate computational and physical models of the face and eye and propose injury-based protection criteria.	914	2732	3275
Soft Body Armor and Environmental Extreme Protection - In FY05, conducted animal studies with a Hard Body Armor impactor; used a finite element model to scale animal injury model to human injury model; and matured body armor blunt trauma injury prediction software. In FY06, validate anthropomorphic test module with animal test data and transition valid body armor testing method with human injury prediction software to the Research, Development and Engineering Command/Natick Soldier Center; conduct small animal cognitive performance tests (i.e., combined fire gas exposure), integrate results, and release interim Toxic Gas Assessment Software - Performance Evaluator (TGAS-PE) results to the Army Research Laboratory, Survivability/Lethality Analysis Directorate. Combined fire gas exposure is a critical element pertaining to live-fire test and evaluation. This model will allow prediction of operational deficiencies of crew in fire scenarios. In FY07, will conduct large animal physical performance tests and will validate the TGAS-PE against large animal	3277	3253	3537

physical performance data.			
Biomonitor System/Dehydration Research - In FY05, conducted comprehensive testing of twelve environmental toxicity sensors, with each sensor assessment involving blind sample analysis using fifteen unique chemicals; down-selected environmental sentinel biomonitor components, utilizing these test analyses as evaluation criteria for the rapid identification of toxic hazards in water and to produce health risk information. In FY06, evaluate and select environmental sentinel biomonitor components that rapidly detect toxic hazards in water and produce health risk information which will provide field commanders a real-time toxicity assessment of water quality for deployed soldiers; and determine dehydration consequences on soldier performance during cold and high mountain missions. In FY07, will complete development of environmental sentinel biomonitor platform and expert system that can quickly process and interpret toxicity data to produce meaningful health risk information for decision-makers on toxic hazards in water; and will mature and verify models to predict water needs for a broad spectrum of modern missions in environmental extremes.	2903	3168	3376
Total	10774	12556	13871

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
879 MED FACT ENH SOLD EFF	9731	9681	10077	10099	10345	9894	9968

A. Mission Description and Budget Item Justification: This project supports the Medical and Survivability technology areas of the Future Force with research for the Soldier focused on preventing health and performance degradation in the military environment. Emphasis is on identification of baseline physiological performance and assessment of degradations produced by operational stressors. This database and collection of rules and algorithms for performance degradation in multistressor environments form the basis for the development of behavioral, training, pharmacological, nutritional interventions, and psychological debriefing to prevent decrements 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; desynchronization of biological rhythms during deployments across multiple time zones and night operations; and thermal and altitude stress. 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 Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; and U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Nutritional and High Altitude Research - In FY05, identified and evaluated performance-enhancing nutritional supplements for incorporation into altitude rations. In FY06, mature pre-deployment doctrine to time-compress altitude acclimatization by conducting extensive physical and cognitive performance studies with human volunteers in an environmentally controlled altitude chamber. In FY07, will refine predictive models of altitude acclimatization, illness incidence, and work performance through laboratory experimentation in preparation for future field studies using soldier volunteers.	2339	2343	2443
Fatigue/Sleep Research - In FY05, determined and modeled the effects of escalating doses of fatigue countermeasures. In FY06, develop an initial laboratory version of the Fatigue Intervention and Recovery Model (FIRM) that predicts recovery, variability, and countermeasures effects. In FY07, will conduct field studies to validate the FIRM predictions for militarily relevant performance.	2056	1986	2069
Mental Health Research - In FY05, proposed effective methods for psychological health screening in deployed troops using extensive data from psychological surveys administered in theatre to more than 4000 Soldiers deployed to Iraq, Afghanistan, and Kuwait. In FY06, field test strategies such as psychological debriefing (following traumatic events) to reduce psychiatric illness in Soldiers. In FY07, will mature criteria for identifying training and operational environments where Soldiers are most susceptible to psychiatric illness by performing extensive analyses of pre- and post-deployment psychological screening data.	3329	3346	3476
Vision and Auditory Research - In FY05, defined human visual performance and image interpretation measurements for advanced displays, sensors, and optical materials under conditions of environmental and physiological stress. In FY06, summarize through a series of laboratory-based human trial experiments, the ability of hearing-impaired Soldiers to use virtual auditory displays for speech and non-speech signals, and produce external peer-reviewed, medically based auditory display design guidelines for Army warfighters regardless of hearing profile. In FY07, will determine tolerance of human visual system to unique aspects of operational Soldier performance in realistic field conditions (mounted, dismounted and aviation).	2007	2006	2089
Total	9731	9681	10077

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
FH2	FORCE HEALTH PROTECTION - APPLIED RESEARCH	0	7634	8402	8529	8818	8517	8681

A. Mission Description and Budget Item Justification: This project researches and investigates technologies associated with Force Health Protection (FHP) and seeks to enhance protection of Service members against health threats in military deployments both by increasing our understanding of military health issues through applied research and by applying findings from a decade of research on the etiology (cause and origin of disease) and treatment of Gulf War Illnesses (GWI). FHP research is conducted in close coordination with the Department of Veterans Affairs. It includes five thrust areas: (1) global health monitoring, (2) health behavior interventions, (3) health risk communication, (4) health risk assessment methods, and (5) medical materiel safety. These thrust areas are addressed by three focused efforts. The goals of the Health Research effort are to identify and mitigate specific illness and injury associated with military service through studies and the collection of Soldier data. The goals of the Health Behavior/Weight Control effort are to evaluate the effectiveness of specific health behavior training such as training to prevent unintended pregnancy and to prevent sexual violence, and to determine the effectiveness of training associated with the treatment of overweight Soldiers. The goals of the Weight Control/Physical Training effort focuses on developing a comprehensive weight management program for overweight soldiers and the evaluation of guidelines to reduce the incidence of physical training injuries. Starting in FY06 this program transferred management from the Office of the Secretary of Defense to the U.S. Army. This project contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; the Naval Health Research Center (NHRC), San Diego, CA; and the U.S. Army Center for Environmental Health Research (USACEHR), Fort Detrick, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Health Research - In FY06, demonstrate preliminary associations between military service and specific illness and injury consequences resulting from occupational, demographic, and health habit related factors, which adversely impact Soldier readiness. In FY07, will conduct major data collection for the Millennium Cohort Study by recruiting a new cohort of 20,000 Service members, administering comprehensive health surveys, and performing extensive data analyses to evaluate the long-term health of people who served in the military. The primary objective for this study is to compare change in health status between deployed and nondeployed personnel and the adjusted incidence rates of chronic disease between cohorts. Secondary objectives include comparing the adjusted change in health between the cohorts based on self-assessed physical and mental well-being, mental health diagnoses from the Patient Health Questionnaire diagnostic assessment, and the post-traumatic stress disorder assessment. This study will serve as a foundation upon which other routinely captured medical and deployment data may be added to answer future questions regarding the health risks of military deployment, military occupations, and general military service.	0	3156	3411
Health Behavior/Weight Control - In FY06, evaluate the effectiveness of health behaviors training program (sexually transmitted diseases, unintended pregnancy, and sexual violence prevention), comparing co-ed training in Army initial entry training (IET), with single gender training in Marine IET. In FY07, will recruit approximately 200 active soldiers on the Army Weight Control Program to study the effect that anti-obesity drugs have on preventing obesity-related illnesses such as hypertension.	0	1991	2406
Weight Control/Physical Training - In FY06, determine the effectiveness of a comprehensive weight management program for overweight Soldiers by collecting and analyzing extensive physiological data from more than 1400 Soldiers enrolled in the Army Weight Control	0	2487	2585

Program. In FY07, will demonstrate the effectiveness of guidelines to reduce the incidence of physical training injuries by evaluating injury rates and fitness levels in 140 Soldier volunteers during a 24-week study comparing an innovative physical training program to the Army Standardized Physical Training program. Follow-up research of study participants will be conducted by the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM).			
Total	0	7634	8402

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**	**VB3**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
VB3	MEDICAL TECHNOLOGY INITIATIVES (CA)	0	125024	0	0	0	0	0

A. Mission Description and Budget Item Justification: Not applicable for this item.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	78821	77434	45666	48280	47989	43706	45554
242	AIRDROP EQUIPMENT	7006	3786	4096	4186	3827	3860	3890
543	AMMUNITION LOGISTICS	1487	1429	1310	1338	1283	1369	1378
C07	JOINT SERVICE COMBAT FEEDING TECH DEMO	2365	2395	2010	1805	2268	2289	2305
J50	FUTURE WARRIOR TECHNOLOGY INTEGRATION	49121	49321	38250	40951	40611	36188	37981
J52	WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)	18842	20503	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates technologies to enhance dismounted Soldier system capabilities while reducing the logistics burden on the battlefield; decreasing operation and sustainment costs; and improving ammunition logistics system performance. This PE contains projects that address technologies for use in the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. The major effort in the Future Warrior Technology Integration project (J50) is the Future Force Warrior (FFW) program that utilizes technology integration and multi-functionality to provide combat overmatch capabilities for the individual Soldier and small combat unit while reducing Soldier load. Per FY05 congressional direction, the FFW program has been consolidated with the Land Warrior (LW) program (managed by Program Executive Office (PEO) Soldier) to focus on Future Combat Systems (FCS) compatibility and realize benefits from the combined effort. The FFW Science and Technology program will demonstrate technologies to provide a lightweight, full spectrum protective combat ensemble, modularly integrated with multi-functional sensors, weapons and medical monitoring capabilities. The program will also mature and integrate technologies for connectivity to other dismounted personnel, FCS, and robotic air/ground platforms for improved situational understanding and effects. 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 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. 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. The objective is to increase both the survivability of aircraft and crews, and the probability that payloads delivered will land in a usable condition. The Joint Precision Airdrop System, an Advanced Concept Technology Demonstration (ACTD) begun in FY04 in partnership with the US Air Force, will demonstrate a 5-ton payload, high altitude precision airdrop system with an on-board mission planning capability. Another major effect within this project is to demonstrate a 15-ton precision airdrop capability that interfaces with the Joint-Modular Intermodal Platform (J-MIP) Joint Capability Technology Demonstration. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. The projects in this PE adhere to Tri-Service Reliance 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), PE0603004 (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 Natick Soldier 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 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	77022	63754	48143
Current BES/President's Budget (FY 2007)	78821	77434	45666
Total Adjustments	1799	13680	-2477
Congressional Program Reductions		-6340	
Congressional Rescissions		-780	
Congressional Increases		20800	
Reprogrammings	1799		
SBIR/STTR Transfer			
Adjustments to Budget Years			-2477

Nine FY06 Congressional adds totaling $20800 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1500) Antimicrobial/Medical Base Layer Garment Technology
($1300) Joint Precision Airdrop Systems (JPADS) - 2k lb Resupply Requirement & Support
($2600) Multifunctional Protective Packaging Technology
($3000) Multi-Layer Coextrusion for High Performance Packaging Film
($2800) Precision Airdrop System for Special Operations Forces
($4700) Ration Packaging Materials and Systems for Meals-Ready-To-Eat
($1400) Self-Decontaminating Selectively Permeable Membranes for Chem-Bio Protection
($200) Small Business Development and Transition
($1500) Technology and Human Systems Integration Testing

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
242 AIRDROP EQUIPMENT	7006	3786	4096	4186	3827	3860	3890

A. Mission Description and Budget Item Justification: This project focuses on the maturation and demonstration of 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 ft) with large offset distances and to deliver payloads with improved accuracy, which enhances cargo, crew, and aircraft survivability. This project provides technology development for the Joint Precision Airdrop System Advanced Concept Technology Demonstration (ACTD) which will demonstrate a 10,000 lb precision delivery capability from up to 20 miles offset with 100 meter Circular Error Probable (CEP) accuracy. A second major effort to increase the payload weight to 30,000 lb began in FY04. The efforts in this project support the Army Transformation goals in the area of rapid deployment. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this project is performed and managed by the Natick Soldier Center, Natick, MA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Aerial Delivery of Cargo - In FY05, completed system integration; conducted technical testing and user training; and demonstrated a high altitude (25,000 ft. Mean Sea Level) deployable, autonomous, offset airdrop capability with the option to deliver separate and distinct payloads (up to 10,000 lbs total) to multiple locations. Matured sensing technology for a parachute cargo release to replace legacy releases.	2355	0	0
Medium Precision Airdrop (capability for payloads up to 30,000 lb) - In FY05, conducted full-scale component prototyping; continued scale-model evaluations of two concepts; completed Guidance, Navigation & Control (GN&C) systems design integration and bench testing; began component level modeling; and evaluated advanced textile materials to improve performance and reduce cost. In FY06, perform component and GN&C evaluations; begin full-scale system design; complete component level modeling and begin system modeling; complete evaluation of advanced textile materials; and integrate intermodal platform. In FY07, will complete all component-level evaluations, system design, and system modeling; will integrate components into airdrop system; and will begin system evaluation and system control logic validation.	4651	3786	4096
Total	7006	3786	4096

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February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
543 AMMUNITION LOGISTICS	1487	1429	1310	1338	1283	1369	1378

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), which is a key component of the JMIP Joint Capability Technology Demonstration (JCTD) and leverages work funded in Defense-wide PE 0603750D. The effort facilitates logistics through its compatibility with the Theatre Support Vessel; 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%, and allow more efficient loading of aircraft (reducing number of aircraft missions required). Technology will transition to weapons and munitions development programs for weapons, munitions, MHE, and tactical vehicles. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. This project is managed by the U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Smart Distribution - Modular Inter-modal Platform (MIP) - In FY05, fabricated components and conducted hardware and interface evaluations on component subsystems.	1487	0	0
Component of the Joint Modular Intermodal Distribution System (JMIDS) Joint Capability Technology Demonstration (JCTD) - In FY06, complete design, fabricate prototypes and conduct engineering testing of a Joint Modular Intermodal Platform (JMIP) as part of an integrated set of technologies (JMIP, the Joint Modular Intermodal Container (JMIC), and an Automatic Identification Technology (AIT) tag) that will facilitate the efficient, rapid, and continuously visible movement and handling of supplies across all transportation modes through the Defense Transportation System and on to forward combat forces. In FY07, modify design and test demonstration quantities of JMIPs with integrated AIT. Will conduct Limited Military Utility Assessments (LMUA) and a full-scale MUA as part of the JCTD.	0	1429	1310
Total	1487	1429	1310

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
C07	JOINT SERVICE COMBAT FEEDING TECH DEMO	2365	2395	2010	1805	2268	2289	2305

A. Mission Description and Budget Item Justification: This project matures and demonstrates nutritionally advanced rations; biosensor technologies for ration contamination/ wholesomeness assessment; and logistically streamlined combat feeding systems with enhanced fuel efficiencies to decrease the combat feeding logistics tail. The project is a Department of Defense (DoD) program for which the Army has Executive Agent responsibility. The project demonstrates advances in combat ration technology, materials, energy utilization, and heating technologies to provide efficient and effective field feeding with reduced resupply burden. It exploits advances in ration formulation and quality, packaging, preservation, and nutritional content to improve morale, extend endurance, and sharpen mental acuity. It also demonstrates predictive modeling and simulation to assist in ration design, mission planning, and Class I (subsistence) distribution and tracking. This 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. The work in this project is performed and managed by the U.S. Army Natick Soldier Center, Natick, MA with oversight from the DoD Combat Feeding Research and Engineering Board. This project has collaborative efforts with the U.S. Army Research Institute for Environmental Medicine. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Equipment and Energy Technologies - In FY05, completed design and fabrication of a thermoelectric water heater chiller for Future Combat Systems (FCS) crew sustainment that weighs less than half of the current Mounted Water Ration Heater and provides hot (140F) and chilled (72F) water in 20 minutes. In FY06, demonstrate and transition thermoelectric water heater chiller to Program Manager Force Sustainment Systems. Demonstrate Capillary Force Vaporizer (vaporizer with no moving parts and constructed of layered ceramics) stove and associated equipment, and transition through Army and Marine Rapid Fielding Initiatives. Demonstrate and transition improved cookware with an applied high hardness, nonstick coating. Conduct proof-of-principle demonstrations of waste to energy conversion technologies. In FY07, will demonstrate and transition thermoelectric self-powered tray ration heater for Army, US Marine Corps and Air Force kitchens; will integrate and demonstrate a prototype beverage chiller with a standard hydration bladder.	613	614	250
Ration Stabilization, Packaging, and Novel Nutrient Delivery Technologies - In FY05, validated and optimized diagnostic techniques to detect chemical/biological agents and/or naturally occurring food pathogens in food matrices and incorporated into biosensor detection systems. Demonstrated and transitioned a surface scanning biosensor. Evaluated advanced prototype film produced using nanocomposites and enhanced barrier coating in ration packaging. Determined stability of encapsulated proteins appropriate for thermally processed components. Developed tests for supplements and conducted limited field evaluation. Finalized and transitioned First Strike Ration (FSR) component/menu/ packaging. In FY06, obtain commercial or prototype array diagnostic systems and validate for four food pathogens from different complex food matrices. Investigate technologies and optimize tamper evident devices to ensure DoD and commercial interoperability, and transition pending Defense Logistics Agency concurrence. Develop model for designing rations to contain optimal levels of macronutrients. In FY07, will demonstrate effectiveness of protein encapsulation in thermally and non-thermally processed FSR components; will complete optimization and final product evaluation of FSR supplements.	1752	1781	1760
Total	2365	2395	2010

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
J50	FUTURE WARRIOR TECHNOLOGY INTEGRATION	49121	49321	38250	40951	40611	36188	37981

A. Mission Description and Budget Item Justification: This project matures and integrates high-payoff technologies and systems for the Future Force Soldier, and develops the basic Soldier System of Systems(SoS) architecture that directly supports the Army Training and Doctrine Command's Soldier as a System (SaaS) concept. Near term focus (through FY07) emphasizes Ground Soldier and Small Combat Unit (SCU) variants, and develops and integrates high payoff technologies in Soldier system areas that will transition to Program Executive Office (PEO) Soldier for fielding to the Future Force. The longer-term goal (FY08 and beyond) is continued technology development and integration that will exploit the SaaS concept for the Mounted Soldier, Air Soldier, and improved Ground Soldier variants. Longer term technology maturation and integration will focus on Soldier borne computing, communications, and networking; Soldier protection and mobility; enhanced situational awareness; and Soldier power. The major effort in FY06 and FY07 is the Future Force Warrior (FFW) System of Systems (SoS). The FFW program utilizes technology integration and multi-functionality to enhance warfighting capability for the individual Soldier and Small Combat Unit (SCU) while reducing Soldier load and power demand. The FFW program develops technology to provide dismounted warfighters in the SCU with enhanced capability in the areas of survivability, networked communications/collaborative situational awareness, individual Soldier and small team lethality/cooperative engagement, and agility while enabling them to operate for extended periods under arduous combat conditions, with reduced loss in physical capabilities from fatigue, stress, and hardship. Per FY05 congressional direction, the FFW program has been consolidated with the Land Warrior (LW) program (managed by PEO Soldier) to focus on Future Combat Systems (FCS) compatibility and realize benefits from the combined effort. Consolidation activities with PEO Soldier included migration of FFW technology development to the same contractor as LW and the establishment of a combined organizational structure. As part of the consolidated Soldier modernization strategy, the FFW program is providing technology with potential to result in the initial fielding of an integrated modular Ground Soldier System (GSS) that is fully compatible with FCS. The FFW SoS utilizes open system architectures and integrated technologies to provide a lightweight system-engineered protective combat ensemble, employing modular plug and play components such as multi-function sensors, networked communications, enhanced positioning navigation, networked fire control, embedded training, medical status monitoring capabilities, and links with man-portable air and ground sensor platforms. This FFW SoS will have connectivity to other dismounted personnel and Current/Future Force platforms including FCS to form adaptive, distributed sensor networks for better situational understanding of local environments and threats. Demonstrations and experimentation will include FY06 participation in the C4ISR On The Move (OTM) experiment, and FY07 participation in the C4ISR OTM and Air Assault Expeditionary Force (AAEF) Spiral D experimentation venues. Key performance goals are to demonstrate a Soldier borne system with fighting load of no more than 70 lbs for the rifleman ; the ability to operate for 24 hrs autonomously at the individual level and 72 hrs at the Brigade Combat Team level; integration of the Soldier Radio Waveform (SRW); and compatibility with FCS. The FFW program works closely with the Army's FCS and Squad Level Integrated Communications Environment (SLICE (developing SRW)) programs, as well as other Army Science & Technology (S&T) and DoD programs, in order to ensure interoperability, prevent possible duplication of efforts, and maximize return on investment to the Army. As part of the FFW/LW consolidation effort, FFW is working directly with PEO Soldier to identify and transition early maturing technologies into ongoing PEO Soldier acquisition programs. The cited work in this project is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. The project matures and integrates Soldier technologies transitioned from Program Elements (PEs) 0602786A, 0602105A, 0602308A, 0602623A, 0602705A, 0602782A, 0602785A, 0602787A, 0603002A, 0603008A, and 0603607A. The Natick Soldier Center, Natick, MA manages this project.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007

FFW/LW Consolidation - In FY05, executed the consolidation of the FFW and LW programs per Congressional direction. Transitioned FFW Lead Technology Integrator (LTI) role from General Dynamics Robotics Systems to LW prime contractor (General Dynamics C4 Systems (GDC4S)). With PEO Soldier, GDC4S and TRADOC System Manager Soldier, developed a Ground Soldier System (GSS) modernization roadmap to achieve GSS requirements that is aligned with ongoing PEO-Soldier and FCS acquisition programs. Redefined FFW government/LTI team structures, and matrixed PEO Soldier personnel into FFW team structure. Re-established program technical baseline based upon consolidated effort and initiated FFW Systems Engineering Synchronization Phase. Reassessed technical performance metrics for GSS and Small Combat Unit (SCU) to meet size/weight/power requirements. Completed prioritization of capability requirements.	3086	0	0
FFW Technology Development - In FY05, continued Soldier SoS M&S, concept and subsystem development including: Headgear - fabricated breadboard sensors (fused visual/infrared) and assessed lightweight ballistic materials; Communications - conducted lab and limited field tests with prototype hardware to evaluate Soldier Radio Waveform for dismounted voice/data comms and modeled FFW network; Soldier Borne System (SBS) - fabricated six prototypes and performed technical evaluations and field assessments with soldiers to obtain feedback; Lethality - defined interfaces between SBS and weapon fire control; modified XM104 fire control to add Non Line of Sight capability; Processing and Power - developed proof-of-concept Soldier borne computer system, developed mission profiles and power duty cycles, and received prototype battery cells for lab evaluation; Personal Area Network (PAN) - defined body borne antennae interfaces and initiated integration of Warfighter Physiological Status Monitoring (WPSM) components into PAN; Software - initiated algorithm development for weapon target pairing, power management and graphical user interface; Soldier/platform interfaces - conducted demonstration of Soldier control of robotic platform; developed initial interface specifications for unmanned and manned vehicles. Augmented Cognition- assessed the capability of real-time assessment of cognitive state of Soldiers in the field, including data collection of WPSM. Systems Engineering - as part of LW/FFW consolidation, stabilized FFW architecture after assessing both LW and initial FFW systems; refined comms, lethality, security, software and physical architectures; validated trade studies and conducted new trades; analyzed distribution and resulting effectiveness of capabilities across the SCU; initiated Interface Control Documents and DOD compliant architecture documentation; initiated analysis of FCS SoS Common Operating Environment products for FFW re-use.	46035	0	0
Body Borne System: Activities are focused on integrating technology in a lightweight, low power, ergonomically designed, integrated modular package to meet overall 70 lb weight threshold (rifleman) and 24 hr autonomous mission. Included are systems engineering tasks to include development of architecture, metrics, requirements allocation, interoperability and supportability. In FY06, complete design and development of Soldier-borne hardware architecture for all Military Operational Specialty (MOS) specific configurations within the SCU. Integrate hardware subsystems into the FFW Soldier Protection and Individual Equipment System. These subsystems include: stand off ballistic protection and load carriage chassis, signature management, semi-permeable membrane (chemical-biological protective) over-garment, laser detectors for Tactical Engagement Sensor (TES), antennas, power sources, communications, computer, position/navigation, fire control, Warfighter Physiological Status Monitoring-Initial Capability, and PAN. Explore requirements for future integration of flexible panel display technology. Develop FCS-compatible interface(s) in areas of power and data (to share Situational Awareness/Common Operating Picture from higher echelons), as well as size/cube compatibility for Ground Soldier vehicle compartments. Fabricate and test 12 integrated body borne systems. Develop engineering projections for fielded GSS and build 1 leader and 1 Soldier mockup. In FY07, will complete final system development and integration, including addition of chem/bio protection using semi-permeable membrane and integration of PAN enhancements. Will retrofit existing 12 systems and fabricate and test 10 additional integrated body borne systems to support up to platoon level size field experiments and demonstrations.	0	6540	4526
Headgear: In FY06, complete design and development of basic helmet configuration integrating leveraged lightweight ballistic shell and liner materials. Complete development of modular add-on hardware for leader/MOS specific capabilities, including initial implementation of TES/laser sensors, microphone, visual and infrared dual aperture sensor fusion and integrated high resolution color helmet mounted	0	11490	7191

display. Perform systems engineering tasks to refine architecture, metrics, and requirements allocation. Develop backwards-compatible interfaces for Advanced Combat Helmet. Continue exploration/development and integration of active noise reduction. Fabricate, integrate and test 12 headgear systems. In FY07, will complete integration into FFW electronic components of vision enhancement, sensor fusion, and TES functionality, and XM50 chem/bio mask interface. Will modify existing 12 systems and fabricate, integrate and test 10 additional headgear systems to support field experiments and demonstrations. Will perform systems engineering tasks to support integration, interoperability and supportability.			
Soldier Computer and Software: In FY06, execute incremental development of Soldier computer system and employing System on a Chip (SoC) technology, leveraging the LW computer system. Continue service based software development and testing of Operating System and information management, power management, WPSM interface, netted fires/cooperative engagement, memory joggers, embedded training and TES, situational awareness, mapping image capture and transmittal, user interfaces and System Voice Control, and Unmanned Aerial Vehicle (UAV) data feed. UAV and UAV controller will be leveraged. Develop basic system processor to support increased functionality for distributed capabilities for Soldier MOSs that don't require a full-up computer. Develop a Soldier Radio Waveform (SRW)-based Application Programming Interface compatible with future radios to result in effective integration of the Soldier in the FCS network. Develop basic compatibility with FCS (SoS Common Operating Environment, Battle Command/Network Management Services) and Army Battle Command System. Explore development of enhancements to handheld planning device/tool. Conduct testing of FFW systems with leveraged LW computers and initial software applications described above. Evaluate Army and FCS information assurance/cross domain security developments for future incorporation into GSS. Conduct modifications to WPSM data processing algorithms to reduce signal artifacts and improve data quality for augmented cognition In FY07, will complete software functionality development to include applications described above and after action review, limited built in test, and code optimization for a power constrained computing environment. Will conduct field experiments and demonstrations with FFW Soldier computer hardware and software. Will develop plan for information assurance/cross domain security for GSS. Will perform systems engineering to support integration, interoperability and supportability.	0	11850	6713
Personal Area Network (PAN): In FY06, develop PAN components for distribution of power and data across the FFW electronic components, leveraging LW cables/connectors and novel electronic textile cables. Perform systems engineering to refine architecture, metrics, requirements allocation, and interface controls. In FY07, will refine PAN, and fabricate, integrate and test PAN to support field experiments and demonstrations. Will perform systems engineering tasks to support integration, interoperability and supportability.	0	1019	705
Power Sources: In FY06, continue development of advanced novel Lithium Polymer (24 hr, rechargeable and conformal for ergonomics/comfort) and Zinc Air (mission extender for missions beyond 24 hrs) power sources. In FY07, will fabricate power sources to support field experiments and demos. Will demonstrate power and energy technologies developed in PE 0602705 and integrate into Soldier systems, with particular emphasis on the GSS. Will evaluate prototype hybrid fuel cell power systems for technical performance and mission capability in Soldier tactical environments for 72 hr mission. Will demonstrate prototype modular quiet man-portable (<10 kg without fuel) battery chargers to support off-vehicle battery recharging.	0	1005	4813
Network/Communications/ Antennas: In FY06, develop communications and network interface Hardware/Software (HW/SW) functionality leveraging Soldier Radio Waveform (SRW) and develop backwards compatibility to Current Force. Implement FFW communications architecture for the SCU and integrate it with the Squad Level Integrated Communications Environment SRW-based network. Conduct network modeling and simulation. Develop network gateway for Soldier connectivity to unmanned ground systems, UAVs and legacy systems. Optimize communications architecture for compatibility with FCS while ensuring robust peer-to-peer communications, situational awareness and synchronization of fires while away from supporting platforms. Develop hardware interface for leveraged handheld radios. Integrate advanced body mounted antennae concepts to support robust communications in restricted	0	4495	3871

positions and environments. Fabricate and integrate components for 12 systems to support FY06 experimentation. In FY07, will refine network based on FY06 experimentation and M&S. Will fabricate 10 additional communication subsystems to support field experiments and demonstrations. Will perform systems engineering tasks to support integration, interoperability and supportability.			
Small Combat Unit Lethality and Fire Control: In FY06, develop distribution of lethality capabilities across the SCU. Complete modification of two XM104 prototype fire control systems for day/night non-line-of-sight cooperative engagement and integrate with LW weapon user interface and FFW body borne system. Develop XM104 hardware interfaces including black box, Weapon User Interface (WUI) and interfaces to Soldier Computer and integrate visible aiming laser and pointer/illuminator. Conduct laboratory demos and live fire assessments of modified XM104. Integrate FFW system with Multi-function Laser/ Small Tactical Optical Rifle Mounted Micro-Laser Range Finding System, Medium Thermal Weapon Sight and Daylight Video Sight for long range target acquisition . Procure lethality components to support FY06 experimentation. In FY07, will complete development and integration of wireless WUI. Will fabricate 6 wireless WUIs and other distributed lethality components to support field experiments and demonstrations. Will perform systems engineering tasks to support integration, interoperability and supportability.	0	2166	1499
Precision Position System (PPS): In FY06, develop a high fidelity personal navigation system utilizing Micro Electro-Mechanical System Inertial Measurement Unit technology. This effort will provide improved accuracy (3 m vs. 10+ m) necessary to enable precision netted lethality/fire control capabilities and 3-D position location in Global Positioning System denied areas (e.g. inside buildings), while reducing system size, weight and power. Integrate precision position/navigation system into overall FFW architecture. Initiate fabrication of 5 PPS systems. In FY07, will complete development of PPS systems and conduct integration into FFW HW/SW architecture to support field experiments and demonstrations. Will perform systems engineering tasks to include metrics, requirements allocation, interoperability and supportability.	0	3418	2365
Technical Evaluations, Analysis, Assessments and Demonstrations: In FY06, conduct technical evaluations in a Soldier Integration Lab environment, and conduct modeling and simulation evaluations/assessments to validate component/subsystem performance, integration, and "what if" analyses to explore system robustness. Conduct reduced-scope Map Exercise analysis. Conduct FFW system level evaluation through participation in C4ISR On the Move (OTM) experiment to validate system performance progress and network interoperability. Conduct SCU combat effectiveness and cost benefit analyses to compare FFW capability enhancements against currently fielded soldier equipment and LW baseline capability sets to show extent of performance improvements. Initiate planning for demonstration(s) to be conducted in FY07, including early development of Experimental Force (EXFOR) training and test plans. Develop Tactics, Techniques and Procedures for SCU tactical employment of FFW capabilities and associated training program. In FY07, will conduct EXFOR training and execute FFW System level demonstrations through participation in C4ISR OTM and Air Assault Expeditionary Force Spiral D experiments employing an FFW equipped squad, adjacent squad leaders, and platoon headquarters element, (minimal required configuration needed to demonstrate platoon level communications network) to validate system performance at Technical Readiness Level 6. Will complete final analyses regarding SCU combat effectiveness.	0	7338	6567
Total	49121	49321	38250

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	300328	300784	50757	58521	56804	53626	54117
800	TELEMEDICINE TESTBED	1786	3296	3861	3967	4125	3994	4080
801	DEF WOMEN'S HEALTH RES	0	1479	0	0	0	0	0
804	PROSTATE CANCER RSCH	957	1971	0	0	0	0	0
810	IND BASE ID VACC&DRUG	16618	18979	21237	21723	22442	21096	21242
814	NEUROFIBROMATOSIS	23955	16758	0	0	0	0	0
819	FLD MED PROT/HUM PERF	1323	1110	1172	1211	1267	1235	1267
840	COMBAT INJURY MGMT	12356	19224	22507	29605	26882	25292	25478
893	TISSUE REPLACEMENT	0	4534	0	0	0	0	0
923	PROSTATE DIAGNOSTIC IMAGE	0	2760	0	0	0	0	0
929	ARTIFICIAL LUNG TECHNOLOGY	0	1774	0	0	0	0	0
932	Minimally Invasive Surgery (CA)	3449	1084	0	0	0	0	0
938	Tissue Engineering	957	986	0	0	0	0	0
941	Diabetes Research	4791	4238	0	0	0	0	0
945	BREAST CANCER STAMP PROCEEDS	1874	0	0	0	0	0	0
954	DIGITAL X-RAY	0	986	0	0	0	0	0
955	ASSISTIVE TECHNOLOGY	0	2563	0	0	0	0	0
969	ALCOHOLISM RESEARCH	3593	5520	0	0	0	0	0
97A	BIOSENSOR RESEARCH	2491	986	0	0	0	0	0
97B	BLOOD SAFETY	4600	3548	0	0	0	0	0
97D	CENTER FOR AGING EYE	1916	1971	0	0	0	0	0
97E	CENTER FOR PROSTATE DISEASE RESEARCH AT WRAMC	4120	0	0	0	0	0	0
97O	LUNG CANCER RESEARCH	9103	6604	0	0	0	0	0
97T	NEUROTOXIN EXPOSURE TREATMENT	24913	22672	0	0	0	0	0
97W	SEATREAT CANCER TECHNOLOGY	2875	0	0	0	0	0	0
97X	SYNCHROTRON-BASED SCANNING RESEARCH	9773	8379	0	0	0	0	0

97Z	TAFENOQUINE ANTIMALARIAL AGENT	7187	0	0	0	0	0	0
FH4	FORCE HEALTH PROTECTION - ADV TECH DEV	0	1909	1980	2015	2088	2009	2050
MB1	ADV DIAGNOSTICS & THERAPEUTIC DIG TECH	7187	986	0	0	0	0	0
MB2	BRAIN, BIOLOGY, AND MACHINE	2875	1971	0	0	0	0	0
MB3	CENTER FOR INTEGRATION OF MEDICINE & INNOV TECH	11500	10843	0	0	0	0	0
MB4	CENTER FOR UNTETHERED HEALTHCARE	3833	986	0	0	0	0	0
MB7	HEMOGLOBIN BASED OXYGEN CARRIER	1342	0	0	0	0	0	0
MB9	JOINT US NORWEGIAN TELEMEDICINE	1727	986	0	0	0	0	0
MC4	SECURE TELEMEDICINE TECH PROGRAM	957	1971	0	0	0	0	0
MC7	NATIONAL TISSUE ENGINEERING CENTER	2396	1725	0	0	0	0	0
MD1	EMERGENCY TELEMED RESPONSE & ADV TECH	1342	1971	0	0	0	0	0
ME3	INSTITUTE FOR RESEARCH AND EDUCATION	3593	0	0	0	0	0	0
ME4	LASER FUSION ELASTIN	4600	0	0	0	0	0	0
ME9	BEHAVIORAL/COMPARATIVE GENOMICS	2491	986	0	0	0	0	0
MF2	ADVANCED PROTEOMICS (CA)	1437	1479	0	0	0	0	0
MF3	BATTLEFIELD RESPIRATOR AND VENTILATOR (BRAV) (CA)	1820	0	0	0	0	0	0
MF9	GENOMIC MEDICINE AND GENE THERAPY (CA)	3257	2168	0	0	0	0	0
MG1	GYNECOLOGIC DISEASE PROGRAM (CA)	4120	3351	0	0	0	0	0
MG3	MEDICAL TRAINING TECH ENHANCEMENT INITIATIVE (CA)	957	1084	0	0	0	0	0
MG5	NATIONAL FUNCTIONAL GENOMICS CENTER (CA)	8144	4928	0	0	0	0	0
MG7	ON-LINE MEDICAL TRAINING (CA)	0	2070	0	0	0	0	0
MG8	OPERATING ROOM OF THE FUTURE (CA)	3833	0	0	0	0	0	0

MG9	PENNINGTON BIOMEDICAL CENTER (CA)	2491	0	0	0	0	0	0
MH1	PICTURE ARCHIVING AND COMMUNICATIONS SYSTEM (CA)	1342	1676	0	0	0	0	0
MH2	PROJECT COLLABORATION MATERIAL (CA)	957	986	0	0	0	0	0
MH3	PROTEOMICS CENTER (CA)	4120	2563	0	0	0	0	0
MH4	RAPID BIO-PATHOGEN DETECTION TECHNOLOGY (CA)	0	986	0	0	0	0	0
MH5	REGIONAL ANESTHESIA AND PAIN MGMT INITIATIVE (CA)	5749	0	0	0	0	0	0
MH6	RUGGED TEXTILE ELECTRONIC GARMENTS (CA)	1437	1084	0	0	0	0	0
MH7	STUDY OF HUMAN OPERATOR PERFORMANCE (CA)	2396	1479	0	0	0	0	0
MH8	ACCEL DIAGNOSIS-DIGITAL IMAGING PATTERN RECOG (CA)	2684	0	0	0	0	0	0
MH9	ADVANCE OF NON-INVASIVE GLUCOSE MONITORING (CA)	957	1676	0	0	0	0	0
MI1	CLINICAL ED INSTITUTE/SURGERY INTERACTIVE SYS (CA)	957	0	0	0	0	0	0
MI2	AD IMAGE PROCESSING TECH FOR BIOMED INFORMATICS	959	0	0	0	0	0	0
MI3	ADVANCES IN BREAST CANCER CARE THERAPY (CA)	1245	1676	0	0	0	0	0
MI4	ALLIANCE FOR NANOHEALTH (CA)	2684	2070	0	0	0	0	0
MI5	BEHAVIORAL GENOMICS SLEEP APNEA RESEARCH (CA)	957	986	0	0	0	0	0
MI6	CANCER VACCINE (CA)	3257	0	0	0	0	0	0
MI7	COLLABORATIVE IN ADVANCED EMR WITH THE ARMY GUARD	2396	0	0	0	0	0	0
MI8	FULL-FEATURED PATIENT MONITOR WITH DEFIBRILLATOR	1437	986	0	0	0	0	0
MI9	EMERGENCY EYE CARE PROGRAM (CA)	957	0	0	0	0	0	0
MJ1	EXTRA CORPOREAL MEMBRANE	5749	0	0	0	0	0	0

	OXYGENATION AT TRIPLER							
MJ2	FIBRINOGEN BANDAGES FOR BATTLEFIELD WOUNDS (CA)	3354	2464	0	0	0	0	0
MJ3	FORT DETRICK TECHNOLOGY TRANSFER INITIATIVE (CA)	957	0	0	0	0	0	0
MJ4	HANDS FREE ELECTRONIC HEALTH RECORD (CA)	957	986	0	0	0	0	0
MJ5	IMPROVED LUNG CANCER MGMT-ADV IMAGING TECH (CA)	2012	0	0	0	0	0	0
MJ6	LEISHMANIASIS PREVENTION TREATMENT & DIAGNOSIS	7187	0	0	0	0	0	0
MJ7	LIGHT-BASED SELF TREATMENT FOR PFB (CA)	1437	986	0	0	0	0	0
MJ8	WRAMC HUMAN BRAIN MAPPING FOR CMBT TRAUMA RSCH	1727	0	0	0	0	0	0
MJ9	MEDICAL ENTERPRISE MGMT FOR THE U.S. ARMY (CA)	957	0	0	0	0	0	0
MK1	MEDICAL M&S THROUGH SYNTHETIC DIGITAL GENES (CA)	1437	986	0	0	0	0	0
MK2	METROPLEX COMPREHENSIVE MEDICAL IMAGING RESEARCH	6612	6900	0	0	0	0	0
MK5	MOBILE I V SYSTEM (CA)	2491	0	0	0	0	0	0
MK6	ORPHAN DISEASE DRUG DISCOVERY PROGRAM (CA)	1916	1676	0	0	0	0	0
MK7	PEDIATRIC BRAIN TUMOR & NEUROLOGICAL DISEASE PRGM	1437	1479	0	0	0	0	0
MK8	PLASMA STERILIZER (CA)	1342	1479	0	0	0	0	0
MK9	PROPHET FOR COMBAT CASUALTY CARE (CA)	480	0	0	0	0	0	0
ML1	RARE BLOOD PROGRAM (CA)	957	0	0	0	0	0	0
ML2	SEAmed ORAL HEALTH PROJECT (CA)	1820	493	0	0	0	0	0
ML3	SOLDIER-MOUNTED EYE-TRACKING & CONTROL SYSTEM (CA)	1437	2464	0	0	0	0	0
ML4	SuperQR Powder Development (CA)	957	0	0	0	0	0	0

ML5	SURGICAL WOUND DISINFECTION & BIO AGENT DECON PROJ	1342	1971	0	0	0	0	0
ML6	Tripler Army Medical Ctr eICU Remote Critical Care	3833	986	0	0	0	0	0
ML7	UNIVERSAL MEDICAL AND SURGICAL PRODUCT CATALOG(CA)	2396	2760	0	0	0	0	0
ML8	UNIVERSAL VACCINE DEVELOPMENT FOR BIOTERRORISM(CA)	957	0	0	0	0	0	0
ML9	VASCULAR GRAFT RESEARCH FOR COMBAT SETTINGS (CA)	1727	0	0	0	0	0	0
MM1	WEIGHT MEASUREMENTS & STANDARDS FOR MIL PERSONNEL	1820	1725	0	0	0	0	0
MM2	MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)	0	86425	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) funds advanced technology research for healthy, medically protected Soldiers, consistent with the Medical and Survivability technology areas of the Future Force. The primary goal of this program is to provide maximum Soldier survivability and sustainability on the battlefield as well as in military operations other than war. All medical research is conducted in compliance with U.S. Food and Drug Administration (FDA) regulations. The FDA requires thorough testing in animals (referred to as preclinical testing) to assure safety and efficacy prior to approving controlled clinical testing of experimental (previously unproven in humans) 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, including an increasing number of people in each subsequent phase. All test results are submitted to the FDA for evaluation to obtain approval for routine medical use. This PE funds maturation and demonstration of promising medical technologies identified during the applied research phase in the following areas: Militarily Relevant Infectious Diseases; Combat Casualty Care; and Military Operational Medicine. The Military Relevant Infectious Diseases effort focuses research on medical protection against naturally occurring diseases of military importance. Methods are identified and matured for prevention and treatment of infectious disease including conducting FDA-required preclinical and clinical safety and efficacy trials on candidate vaccines, prophylactic interventions, diagnostics, and therapeutic drugs. Methods for controlling disease-carrying insect vectors are refined and tested. The Combat Casualty Care effort matures and demonstrates methods for the care of trauma and burns associated with battlefield injuries. FDA preclinical and clinical safety and efficacy testing is included for candidate drugs, biologics, and diagnostics for resuscitation, treatment of injuries, and life support. Candidate medical devices and products for the warfighter include clotting drugs, freeze-dried plasma, neuroprotective drugs, handheld acoustic energy hemorrhage control devices, and an assisted automated critical care system. Candidate products for prevention of combat maxillofacial (face/neck) injuries and reduction of lost time due to dental disease are refined and demonstrated. The focus of the Military Operational Medicine (MOM) effort is on refining and demonstrating biomedical solutions that protect Soldiers and enhance their performance in the face of multiple stressors in operational and training environments. Products such as soft body armor and biomonitors are matured and demonstrated to determine their effectiveness in protecting Soldiers from injuries resulting from exposure to hazardous environments and materials. Prevention of health and performance degradation in military environments is another important objective of MOM research, which examines and refines selected physiological indicators and associated algorithms/sensors that may indicate performance degradation produced by operational stressors such as high altitude, extreme temperatures, hydration, fatigue, isolation, and sleep deprivation. Findings from research and treatment of Gulf War Illnesses are used to better understand military health issues to protect Service members against 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, work funded in PE 0602787A. 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 PE is performed by Walter Reed Army Institute of Research, Silver Spring, MD; U.S. Army Medical Institute of Chemical Defense, Aberdeen Proving Ground, MD; U.S. Army Medical Institute of Infectious Diseases, Fort Detrick, MD; U.S. Army Research Institute of Environmental Medicine, Natick, MA; U.S. Army Institute of Surgical Research, Fort Sam Houston, TX; U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL; the Naval Medical Research Center, Silver Spring, MD and U.S. Army Medical Detachment Brooks, San Antonio, TX.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	299561	45160	50300
Current BES/President's Budget (FY 2007)	300328	300784	50757
Total Adjustments	767	255624	457
Congressional Program Reductions		-1314	
Congressional Rescissions		-3037	
Congressional Increases		259975	
Reprogrammings	767		
SBIR/STTR Transfer			
Adjustments to Budget Years			457

Software limitations preclude listing the One hundred fifteen FY06 Congressional adds totaling $259975 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 2006, House Report 109-359, pages 356 to 358.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
800 TELEMEDICINE TESTBED	1786	3296	3861	3967	4125	3994	4080

A. Mission Description and Budget Item Justification: This project matures and demonstrates future medical concepts of operations, operational architectures, and operational requirements to support forward echelon telemedicine presence, medical command and control, and collaborative planning tools for mission planning and rehearsal. The project funds development, evaluation, and demonstration of prototype advanced technology concepts and materiel pertaining to enhanced Force Health Protection. The major effort in this project is Sleep Research/Environmental Monitoring. Sleep Research evaluates the extent to which loss of sleep and fatigue can interfere with the Soldier's ability to perform missions and develop methods to mitigate these effects. Environmental Monitoring research matures and demonstrates an Environmental Sentinel Biomonitor, which can identify the presence of toxic industrial chemicals in water so that Soldiers may ascertain the potability of water. 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 U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Sleep Research/Environmental Monitoring - In FY05, conducted comparative studies of higher order mental abilities that reflect militarily relevant capacities (judgment/decision-making, distinguishing friend from foe, course-of-action determination, and situational awareness) to determine which may be degraded by sleep loss; and determine whether any of the abilities can be restored through use of stimulants. In FY06, mature sensitive and repeatable measures to detect changes in higher order mental abilities with increasing levels of sleep deprivation and the effectiveness of a stimulant (caffeine) on restoration of these abilities. In FY07, will determine efficacy of caffeine in comparison to dextroamphetamine and modafinil (proprietary stimulants available by prescription only) for restoring operationally relevant high-order mental performance versus simple psychomotor performance; will integrate components into the Environmental Sentinel Biomonitor and conduct field test.	1786	3296	3861
Total	1786	3296	3861

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
810 IND BASE ID VACC&DRUG	16618	18979	21237	21723	22442	21096	21242

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 pose a significant threat to operational effectiveness and forces deployed outside the United States. Countermeasures matured under this project will protect the force from infection during periods of sustained operations and prevent hospitalizations and evacuations from the theater of operations. Major efforts include development of vaccines against malaria, diarrhea, dengue, meningitis, and hemorrhagic fever; antimalarial drug candidate testing; and insect vector control and infectious disease diagnostic development. Of major importance to the military are the parasitic diseases malaria and leishmaniasis, the bacterial diseases responsible for diarrhea (caused by Shigella, enterotoxigenic Escherichia coli (ETEC), and Campylobacter), and viral diseases such as dengue fever. This project also matures improved materiel for control of insect/arthropod disease vectors and addresses a variety of infectious disease threats to deployed and mobilizing forces, including meningitis, viral encephalitis (inflammation of the brain), and viral hemorrhagic fevers (hemorrhagic fevers with renal syndrome (HFRS)). Improved diagnostic capabilities are also pursued that enable rapid battlefield identification and management of diseases and allow informed medical operational and tactical decisions. Program goals include preclinical and clinical testing of protein and DNA vaccines; testing new technologies to enhance effectiveness and duration of vaccines; compounding and testing multicomponent vaccines to provide protection against multiple disease strains; producing vaccines and antimalarial drugs under U.S. Food and Drug Administration (FDA)-regulated Good Manufacturing Practices (GMP) and demonstrating their safety and efficacy under FDA Investigational New Drug (IND) applications. Work is managed by the U.S. Army Medical Research and Materiel Command. The Army is lead service for infectious disease research within the DOD 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 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 Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, MD; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Malaria Vaccines - In FY05, performed preclinical testing of malaria liver stage vaccine components for integration into leading malaria vaccine candidate; and completed clinical safety testing of two promising malaria blood stage vaccine components. In FY06, continue clinical safety and efficacy testing of several promising malaria vaccine components to include testing of new adenovirus-based malaria vaccine before combining with the current RTS,S vaccine (hybrid protein fusing a malaria protein to the hepatitis B vaccine protein) which by itself does not provide strong protection against infection, in a prime boost strategy (i.e. prime humans with RTS,S, then administer a second immunization with the adenoviral vaccine, an approach thought to increase immune response of white blood cells in addition to producing antibody response); testing of a malaria blood stage cell surface protein vaccine in pediatric trial in Africa and safety and immunogenicity clinical trials of a second blood and liver stage protein vaccine in African adults. In FY07, will conduct additional clinical safety trial in adults or children as required/approved by the FDA to demonstrate safety and potential protection afforded by candidate multicomponent vaccines; will begin combined safety/immunogenicity clinical trial of multicomponent vaccines composed of combinations of RTS,S with additional blood and /or liver stage vaccine candidate and adenovirus vaccines once safety and efficacy has been demonstrated in clinical trials; and will establish partnership with industry for manufacturing of multicomponent vaccine for advanced clinical trial and future FDA licensing. The future objective is to downselect a multi-protein vaccine that will provide strong	5077	5513	5906

protection from infection and, if infected, reduce severity and symptoms of disease.			
Diarrheal Vaccines - In FY05, continued clinical testing of lead Campylobacter vaccine; and conducted clinical safety trials of one component of multiagent Shigella vaccine (vaccines which will prevent dysentery in US forces); produced a current GMP lot of diarrhea-causing enterotoxigenic Escherichia coli (ETEC) vaccine, along with protein encapsulated formulations which can be applied by intranasal spray. In FY06, complete a clinical efficacy trial with Campylobacter vaccine and continue clinical development of Shigella vaccines. In FY07, will conduct clinical efficacy trial in adult subjects to show induction of protective immune response by Shigella Invaplex intranasal vaccine (the most advanced vaccine candidate composed of bacterial surface material shed from the cells and to which most antibody binding would occur resulting in protection against Shigella dysentery); will prepare improved ETEC vaccine for clinical safety trial; and will continue clinical testing of other antidiarrheal vaccine candidates.	3630	4357	5225
Dengue, Meningitis and Hemorrhagic Fever with Renal Syndrome (HFRS) Vaccines - In FY05, began preclinical testing of new modified dengue virus and DNA vaccine candidates; completed genetic modification of a third meningococcal strain vaccine component and prepared GMP lot of this vaccine component, and initiated preparation of the FDA required data package for a prototype meningitis vaccine to demonstrate proof of principle for this approach. In FY06, conduct additional clinical testing of best dengue vaccine candidates; conduct human clinical safety testing of vaccine and begin efficacy testing of a DNA-based Hemorrhagic Fever with Renal Syndrome (HFRS) vaccine; and begin clinical testing of additional component of the meningococcal vaccine. In FY07, will conduct clinical safety trial of a vaccine (active against several immunologically different subtypes of the meningococcal organisms); and will continue critical human efficacy testing of HFRS and dengue vaccines.	4240	3599	4697
Antimalarial Drug Candidates - In FY05, completed fourth cohort of single dose safety study and initiated multi-dose clinical safety testing of intravenous Artesunate, a drug to treat severe malaria and to replace quinidine, the only FDA approved drug for severe malaria, a drug with known cardiotoxicity; continued to test/optimize new drugs against malaria for advancement to clinical testing. In FY06, complete safety trials and two clinical efficacy trials of Artesunate in Thailand and Kenya and select a second malaria prevention/prophylaxis candidate drug (based on evaluation of all candidates in development (see Project 870) for clinical testing. In FY07, will complete clinical testing of Artesunate and submit New Drug Application to FDA if the Agency accepts historical clinical data in place of performing expanded safety and efficacy testing; and will continue clinical testing of additional new prophylactic drugs to prevent malaria and a potential replacement for Larium.	3056	3881	3310
Insect Vector Control and Infectious Disease Diagnostics - In FY05, continued dengue vector control system (DVCS) component product improvement; assessed potential point-of-care and hospital-based infectious disease diagnostic systems for effectiveness against leishmania and reickettsial. In FY06, transition the initial DVCS to preventive medical units; assess leishmania diagnostic systems in clinical testing, and mature approaches to supplement infectious disease diagnostics for use in common clinical laboratory diagnostic systems; continue sand fly vector control component testing and evaluation; evaluate a current FDA-approved drug for efficacy in treating cutaneous leishmania. In FY07, will conduct comprehensive field testing of sand fly control measures and transition to the Preventive Medicine Detachment tool kit; will continue to provide additional diagnostic sets for use in military clinical laboratories and point-of-care diagnostic sets for testing; and will transition leishmania diagnostic systems to advanced development or commercial partner.	615	1629	2099
Total	16618	18979	21237

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
819 FLD MED PROT/HUM PERF	1323	1110	1172	1211	1267	1235	1267

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 and physiological stressors and materiel hazards in training and operational environments. The major effort, Chemical and Bacterial Hazard Research, focuses on identifying stressors and methods of assessing risk. Research matures and demonstrates methodologies and tools associated with assessing weapon system user health risks, diagnostics as related to biomarker (indicator) identification of environmental health hazard exposures, predicting injury and assessing Soldier survivability, evaluating effectiveness of individual protective equipment, assessing drugs to sustain Soldier performance during continuous operations, and assessing health risks to Soldiers in operational environments. 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 Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, U.S. Army Center for Environmental Health Research (USACEHR), Fort Detrick, MD, and U.S. Army Medical Research Institute of Chemical Defense (USAMRICD), Aberdeen, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Chemical & Bacterial Hazard Research - In FY05, developed methods using gene microarray technologies to identify biomarkers, which can be used in a health surveillance screening assay to determine if Soldiers have been exposed to toxic chemicals. In FY06, conduct tests using laboratory animals to determine and select animal biomarkers that indicate chemical exposure. In FY07, will identify and validate potential human biomarkers through extrapolation of animal data.	1323	1110	1172
Total	1323	1110	1172

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

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

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
840 COMBAT INJURY MGMT	12356	19224	22507	29605	26882	25292	25478

A. Mission Description and Budget Item Justification: This project matures and demonstrates new medical technologies in support of the Future Force. Major efforts include hemorrhage control, blood and resuscitative fluids discovery and development, combat trauma therapies, far-forward medical systems development (including diagnostic and therapeutic medical devices), and combat casualty care bioinformatics and simulation development. Included are new candidate intravenous clotting drugs, advanced technologies for treating extremity injuries to bone and flesh, freeze-dried plasma to treat hemorrhage and further reduce the medical footprint, neuroprotective drugs to minimize consequences of head injury, preventive dental care technologies including peptides to fight dental disease, and remote triage technologies designed to maximize field medic resources. The "Warrior Medic," a promising Future Force medical technology capability, will enable the combat medic to rapidly assess casualty vital signs and link to other physiological monitors. Other key technologies funded include new and advanced resuscitation fluids and strategies for combat medic administration that improve survival of casualties with severe blood loss (shock) on the battlefield; an automated assisted critical care system for enhanced management, transport, and survival of stabilized casualties far-forward, within and outside of the battle area; and a handheld system employing acoustic energy to control internal hemorrhage for forward use at the battalion aid station. Selected technologies are integrated into Medical Mission Packages incrementally to provide comprehensive far-forward treatment for the Future Force. All research is conducted in compliance with U.S. Food and Drug Administration (FDA) requirements. 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 U.S. Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; and Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Hemorrhage Control, Blood and Resuscitative Fluids - including discovery and development of drugs, biologicals, and medical procedures to prevent or minimize secondary organ system injury and failure (including brain and spinal cord injury) after major trauma. In FY05, conducted studies in animals of a handheld device that stops bleeding with sound waves for use at the battalion aid station; studied in animals the effectiveness of candidate drugs and agents to enhance blood clotting and restore normal blood clotting; conducted clinical studies of freeze-dried plasma; finalized research for guidelines for the optimum resuscitation strategy; began studies of fluids that aid in oxygen transport and free radical scavenging; conducted investigations that indicate inhibiting complement activation (the body's natural reaction to trauma that can cause harmful inflammation and organ failure) reduces tissue damage associated with shock. In FY06, complete animal studies and sample analyses from coagulation studies; conclude comparative studies of resuscitation fluids; test FDA-approved complement inhibitors in additional animal models to confirm their safety. In FY07, will conduct multiple studies using blood components singly and in combination to match the effectiveness of whole blood in a combined injury/shock model; will conduct large scale testing of complement inhibitors in swine, prepare and analyze data for submission of Investigational New Drug application to the Food and Drug Administration and commence Phase 1 human safety trials upon approval; will finalize multiple studies in a collaborative effort across hemorrhage control, blood products, and resuscitation fluid programs; will complete data analysis and validate new regimens for treatment of shock in combat trauma.	4303	9304	13220
Combat Trauma Therapies - including discovery of drugs, biologicals, and medical procedures to minimize the immediate and long-term effects from battlefield injuries. In FY05, completed safety and efficacy studies of intranasal Ketamine in treatment of chronic malignant,	2456	3966	3092

post-operative dental, and orthopedic injury pain with all data accepted by the Food and Drug Administration; conducted Phase 1 clinical tests of an improved tourniquet; matured and demonstrated wound-cleaning devices, antimicrobial bone graft substitutes, and lightweight materials for splints; and matured prototype of device to assess tissue viability. In FY06, complete testing of composite systems to validate cure time and rigidity to transition long bone splint to advanced development; and test combinations of growth factors that accelerate bone splint regeneration to select best bone substitute. In FY07, will begin human clinical trials of tissue viability assessment device; will transition best bone substitute material to advanced development; and will use the PHI model in further studies to evaluate the body's response mechanism to this type of injury.			
Far-Forward Medical Systems - including diagnostic and therapeutic medical devices and associated algorithms, software, and data processing systems for resuscitation, stabilization, life support, surgical support, and dental care. In FY05, conducted parallel studies of various antimicrobial compounds for safety and efficacy of preventing cavities; studied properties of application methodologies of an anticavity/antiplaque food additive to prevent dental disease; began to transition handheld Microimpulse radar (MIR) vital signs monitor to System Development and Demonstration; completed algorithms for detection of ballistic wounding, life signs, hydration, and sleep status in the prototype Future Force Warrior ensemble; and prepared to conduct human trials of a fieldable acoustic collapsed lung detector once human use approval is received; demonstrated proof of concept of closed-loop fluid infusion system; and started on oxygen and ventilation delivery system. In FY06, complete integration of the sensor suite, and generate algorithms with the Personal Area Network; complete integration of the initial capability with Future Force Warrior Advanced Technology Demonstration; evaluate relationships among variables that signal cardiovascular collapse and indicate the need to apply a Life Saving Intervention (LSI); demonstrate effectiveness of closed-loop oxygen and ventilation control and fluid resuscitation systems; and complete formulation of antimicrobial delivery vehicle for prevention of dental disease. In FY07, will complete analysis of data to develop and verify algorithms for prediction of cardiovascular collapse that indicate the need to apply a LSI; will complete clinical validation of closed-loop fluid infusion system; will evaluate neuroprotective drugs for reduction of morbidity following burn injury; and will establish antimicrobial activity profiles in animals for prevention.	4325	4505	5495
Combat Casualty Bioinformatics and Simulation - including a far-forward-compatible system for creation and management of patient records and theater regulation of patient flow and development of casualty simulations and durable, realistic simulators for initial and reinforcement training of care providers. In FY05, matured a prototype patient simulator with advances in materiel sciences, including realistic skin and physiologically accurate injuries, sensor technologies, miniaturization/packaging technology, and ad hoc wireless networking in collaboration with RDECOM. In FY06, complete testing of the RDECOM system to assess training effectiveness and interoperablility. In FY07, will finalize prototype by incorporating user test results and transition to the Army Medical Department Center and School.	1272	1449	700
Total	12356	19224	22507

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603002A - MEDICAL ADVANCED TECHNOLOGY**	**FH4**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
FH4	FORCE HEALTH PROTECTION - ADV TECH DEV	0	1909	1980	2015	2088	2009	2050

A. Mission Description and Budget Item Justification: This project funds efforts that support Force Health Protection (FHP) with the goal of enhancing protection of Service members against health threats in military deployments both by increasing understanding of military health issues through advanced technology research and by applying findings from a decade of research on the etiology (cause and origin of disease) and treatment of Gulf War Illnesses (GWI). This project is conducted in close coordination with the Department of Veterans Affairs. The project is divided into five thrust areas: (1) global health monitoring, (2) health behavior interventions, (3) health risk communication, (4) health risk assessment methods, and (5) medical materiel safety. The goals of this project are to demonstrate the linkage between physical activity and a healthy lifestyle, and to determine the effectiveness of healthy lifestyle programs. Starting in FY06 this program transferred management from the Office of the Secretary of Defense to the U. S. Army. This project contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; the Naval Health Research Center (NHRC), San Diego, CA; and the U.S. Army Center for Environmental Health Research (USACEHR), Fort Detrick, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY06, demonstrate the cross-linkage between physical activity, weight management and healthy lifestyle to assess research findings and linkages to symptoms of the condition described as "chronic multi-symptom illness," which is a condition characterized by health problems that include a variety of chronic symptoms such as headache, fatigue, joint pain, rashes, respiratory problems, and neuropsychological difficulties. In FY07, will determine the effectiveness of current and state-of-the-art programs for healthy lifestyles (tobacco cessation and preventing alcohol abuse) in the military environment to assess research findings linking these approaches to mitigating the condition described as "chronic multi-symptom illness."	0	1909	1980
Total	0	1909	1980

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	92788	106577	64654	80406	90682	92838	92778
313	ADV ROTARYWING VEH TECH	47004	34331	49994	52027	55858	55165	56360
435	AIRCRAFT WEAPONS	3879	3860	3335	2931	3207	3744	2672
436	ROTARYWING MEP INTEG	5616	1894	2948	16875	22914	24036	23484
447	ACFT DEMO ENGINES	6873	7544	8377	8573	8703	9893	10262
BA7	AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	25680	55498	0	0	0	0	0
BA8	VECTORED THRUST DUCTED PROPELLER (CA)	3736	3450	0	0	0	0	0

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 will be matured and integrated into realistic and robust demonstrations. Emphasis will be placed on maturing manned and unmanned teaming in combat and combat support operations for attack, reconnaissance, air assault, survivability, and command and control missions. Components and subsystems that enable increased system survivability, platform lift, maneuverability, agility, and endurance; autonomous flight; common mission equipment architecture; full spectrum effects; team-based intelligent mission operations; and manned / unmanned battlespace integration will be demonstrated. Major efforts within this PE include component maturation and flight demonstrations; manned-unmanned system teaming demonstrations; manned-unmanned common architecture maturation; joint heavy lift concept exploration and 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. Projects BA7 and BA8 fund Congressional interest items. Upgrade activities for Department of Defense (DoD) systems such as the AH-64 Apache, UH-60 Black Hawk, CH-47 Chinook; the U.S. Navy SH-60 Seahawk; and U.S. Marine Corps V-22 Osprey, AH-1 Cobra and CH-53 Super Stallion are supported 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 and supports Project Reliance for which the Army is the lead service for the maturation of rotorcraft science and technology. 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 PE is performed by the Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	96465	48318	67154
Current BES/President's Budget (FY 2007)	92788	106577	64654
Total Adjustments	-3677	58259	-2500
Congressional Program Reductions		-467	
Congressional Rescissions		-1074	
Congressional Increases		59800	
Reprogrammings	-3677		
SBIR/STTR Transfer			
Adjustments to Budget Years			-2500

Twenty Five FY06 Congressional adds totaling $59800 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1000) Advanced Performance for Military Helicopters
($1500) Army/Joint Aviation Technical Data Integration (JADTI)
($1000) Cutting Tools for Aerospace Materials
($800) Electromagnetic Weapons Systems for UAV Payloads
($6900) Excalibur Unmanned Combat Aerial Vehicle
($3500) Fuel Cells for Mobile Robotics System Projects
($1000) Helicopter Nanocrystaline Diamond Rotor Blade Leading Edge Protection
($1500) Helicopter Situational Awareness Enhancement in Zero Visibility Conditions
($4900) Improved VAROC/Unmanned Aerial Vehicle Compression System Development
($1500) Integrated Oil Debris and Condition Sensor for Condition-Based Maintenance
($2800) Joint Ground Forces Interoperability
($3700) Locust USA Heavy Fuel Burning Engines for UAVs
($2100) Mission Execution Technology Implementation
($1000) Multilayered Sacrificial Film Laminates for Helicopter Windscreens
($1000) Portable Reconfigurable Tooling System
($6000) Process Technologies for Replacement Part Production
($1400) Reconfigurable Tooling Systems
($500) Remotely Piloted Airship Testbed
($1400) UAV Guided Dispenser Unit
($2000) Universal Control - Full Authority Digital Engine Control(FADEC)

($3750) Unmanned Aerial Vehicle - Resupply
($2400) Versatile Affordable Advanced Turbine Engine (VAATE)
($2250) Vertical Takeoff and Landing Unmanned Aerial Vehicle
($3500) VTDP Compound Helicopter Technology Flight Demonstration
($2400) Wiring Traceout for Joint Aviation Technical Data Integration

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**313**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
313 ADV ROTARYWING VEH TECH	47004	34331	49994	52027	55858	55165	56360

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. It is envisioned that the Future Force will require 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 will be matured through demonstration of prototype Unmanned Aerial Vehicles (UAVs), rotors, active controls, structures, drive-train, integrated architecture and threat protection. The near-term demonstration of Vertical Take Off and Landing (VTOL) UAVs will focus on the A-160 Hummingbird for Reconnaissance, Surveillance and Target Acquisition (RSTA) capability. The integration of technology into UAV and manned teaming operations will be demonstrated through the merging of common operating architecture and team survivability. The Manned Unmanned Common Architecture Program (MCAP) will enable the manned and unmanned teams to use low cost modular, commercial-off-the-shelf electronics and open systems interface standards for advanced mission processing. The Survivable, Affordable, Reparable Airframe Program (SARAP) will reduce weight and increase the survivability for both manned and unmanned systems. This technology is a significant contributor to Future Force capability and will enable an increase in range for the UH-60 Black Hawk. The Rotorcraft Survivability program will reduce infrared (IR) signatures by up to 50%, incorporate innovative directional IR jamming, small arms and Rocket Propelled Grenades (RPG) hostile fire warning, threat location cueing and eye-safe visual dazzler components to improve aircraft survivability by at least 50% against small arms, RPG and Man-Portable Air Defense Systems (MANPADS) threats. This project also supports Concept Exploration of a Joint Heavy Lift platform. This effort will assess the technologies and system design trades to enable Future Combat System (FCS) vertical maneuver and Naval sea-basing. 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 Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Integrated UAV Operations - [Includes the Manned Unmanned Common Architecture Program (MCAP) and part of the Unmanned Autonomous Collaborative Operations (UACO) program]. MCAP - In FY05, completed software development environment, fabrication of mission processing architecture, development of an avionics integration laboratory at the contractor facility, on-aircraft ground tests, and flight tests on an AH-64D Apache Longbow; completed hardware/software architecture designs and development; conducted laboratory tests of the UAV embedded mission processing architecture on a Shadow 200 UAV; and investigated software application re-use between manned and unmanned mission processing architectures. UACO - In FY05, completed advanced development of software enabling air and ground vehicle autonomy and collaboration and completed integrated mission equipment hardware and software subsystems. In FY06, complete systems integration, checkout and preliminary flight validation for unmanned team of multiple autonomous UAVs. In FY07, will conduct final demonstrations of Air-Ground Cooperative Engagement using XFOR combat trained soldiers commanding unmanned teams consisting of multiple autonomous UAVs and UGVs at the McKenna MOUT site.	7475	6135	2874
UAV Systems Demonstration - In FY05, conducted flight tests using a test-fix-test approach to validate performance predictions; demonstrated ability to deliver payload via payload pod or sling load; conducted integration efforts for a turboshaft engine by developing a compatible transmission and accomplishing preliminary engine testing; and developed an indoor ground test facility where the testbed can be tested at full power. In FY06, continue ground and flight testing of several Phase I air vehicles with increasing operational tempo	15000	16696	30740

(OPTEMPO) to 20 flight hours per month, and gross weight up to 5,000 pounds. Testing includes approximately 250 flight test hours and 2,000 full power ground test runs. Complete integration and flight demonstration of a turbine engine and continue upgrading vehicle systems, as necessary, for improved reliability. In FY07, will fly UAV testbed in an OPTEMPO consistent with goals of 3 flights per week consisting of 8 hours per flight; will include approximately 700 flight test hours with multiple vehicles under single ground station control; will complete flight envelope expansion; will improve durability, damage tolerance and reliability and will characterize utility of system beyond Reconnaissance, Surveillance and Target Acquisition missions.			
Rotorcraft Survivability program - In FY05, designed and ground demonstrated, on a full-scale engine test stand, an adaptive IR suppressor system that reduces engine signatures by 50% while providing an additional 3% increase in engine performance relative to current IR suppressor systems. A 3% power increase on an AH-64 Apache helicopter translates into approximately 225 lbs. of additional lift capability. In FY06, integrate and flight demonstrate adaptive IR suppressors, super lightweight thermal insulation and multi-spectral coatings to achieve up to 50% reduction in total aircraft IR signature. In FY07, will design and flight demonstrate an integrated hostile fire warning, visual cueing and visual dazzler system that reduce small arms and RPG pointing accuracy by 50%.	1254	4500	8000
Rotorcraft Structures - In FY05, fabricated component level building block hardware and validated virtual prototype models through ballistic and crash testing. In FY06, fabricate virtual prototype (full digital definition and simulations/models) validation hardware for ballistic, static, and crash testing and transition Survivable, Affordable, Repairable Airframe Program structural technologies, concepts, and methodologies to current and developmental manned and unmanned rotary wing systems such as UH-60 Black Hawk, CH-47 Chinook, and CH-53 Super Stallion.	4193	1000	0
Rotorcraft Drive System for the 21st Century (RDS21) - In FY05, conducted goal testing (weight/durability/noise) of RDS21 demonstrator; completed design, advanced materials research and manufacturing techniques evaluation; and selected RDS21 technologies for integration onto AH-64D Apache Block III.	6082	0	0
Enhanced Drive Train - In FY07, will develop baseline design of the Enhanced Rotorcraft Drive System applicable for upgrades to the Armed Reconnaissance Helicopter, UH-60 Black Hawk, the Mission Enhanced Little Bird and scaleable to Joint Heavy Lift aircraft, with goals of 40% increase in power to weight ratio, 15dB reduction in transmission noise, and 30% reduction in operating and sustainment costs.	0	0	2380
Joint Heavy Lift (JHL) - In FY05, initiated the Joint Concept Refinement activity to include the Aerial System Concept Design and Analysis; formed Joint Integrated Product Teams for programmatic, technology, and requirements support; explored five VTOL concepts across a wide spectrum of speed bands as a result of five contract awards to industry; and initiated the requirements analysis concept that encompasses conventional and compound helicopters as well as more advanced rotorcraft configurations. In FY06, advance these concept designs and assess their performance characteristics as part of the ongoing joint requirements refinement. Initiate a Joint Analysis of Alternatives (AoA). In FY07, will complete Concept Design and Analysis including an Independent Government performance and risk assessment; will complete the Joint Concept AoA; and will develop a draft Capabilities Development Document.	13000	6000	6000
Total	47004	34331	49994

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**435**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
435 AIRCRAFT WEAPONS	3879	3860	3335	2931	3207	3744	2672

A. Mission Description and Budget Item Justification: The Aircraft Weapons project matures 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 supports the Future Force by providing mature technologies to focus combat power on multiple targets. The technologies will 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 assure 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 system will be matured and demonstrated. 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 Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Weapons Integration - [Includes the Aerial Delivery of Effects from Lightweight Aircraft (ADELA) and Directed Energy Non-Lethal Weapons Integration programs] - In FY05, the Unmanned Light Armed Reconnaissance Testbed (ULART) program, a spin-off of the ADELA program, leveraged an industry program to convert a small, fielded helicopter (AH-6) into a robust Vertical Take Off and Landing (VTOL) Unmanned Aerial Vehicle (UAV) testbed with a lethal weapons suite while carrying an on-board pilot as a safety backup. The ULART program matured and demonstrated precision targeting and weapons delivery, limited coupling of weapon systems with vehicle management, understanding operator weapons interface issues, and manned/unmanned aircraft teaming. The ULART program demonstrated a precision weapons firing at Yuma Proving Ground. In FY06, mature ADELA unmanned teaming and cueing for collaborative engagements and demonstrate integration of a variety of existing low-cost, lightweight sensors and weapons on small UAV platforms to aid in the delivery of full spectrum of effects in complex terrain under close support conditions. In FY07, ADELA will demonstrate tactical fire control, human-in-the-loop protocols and collaborative, team-based weapons and precision targeting processes to demonstrate a Revenge Kill capability and an airborne sniper capability on small UAV platforms. In FY07, the Directed Energy Non-Lethal Weapons Integration program will address the application of directed energy (e.g., laser, Radio Frequency, acoustics) non-lethal weapons concepts to manned and unmanned aviation assets.	3879	2860	3335
Enhanced Rotorcraft Drive System program - In FY06, initiate design of the Enhanced Rotorcraft Drive System with goals of 40% increase in power-to-weight ratio, 15dB reduction in transmission noise, and 30% reduction in operating and sustainment costs. Work here is done in conjunction with this PE, Project 313 and Program Element 0602211, Project 47B.	0	1000	0
Total	3879	3860	3335

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**436**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
436 ROTARYWING MEP INTEG	5616	1894	2948	16875	22914	24036	23484

A. Mission Description and Budget Item Justification: The Rotary Wing Mission Equipment Package Integration project matures and validates man-machine integration and mission equipment technologies in support of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This project improves the overall mission execution by demonstrating manned and unmanned system teaming, enhanced helicopter pilotage capability and improved crew workload distribution. This project supports the Future Force by providing mature technology to enhance near-real time situational awareness for manned and unmanned rotary wing vehicles. The manned / unmanned team will be capable of performing reconnaissance, surveillance, target acquisition and attack while maintaining constant tactical situational awareness. Integration of state-of-the-art approaches in artificial intelligence, intelligent agents, sensors, avionics, communications, pilot vehicle interfaces, and autonomous assistants will enable a manned / unmanned team that enhances Army aviation battlefield effectiveness. This project provides Cognitive Decision Aiding (CDA) tools for crews by maturing knowledge-based information systems. Advanced integration technology in information management, sensors, displays, and controls is optimized for combat helicopter mission effectiveness and survivability for day / night adverse weather operations. Virtual prototyping capability is used as the foundation for evaluating combined rotorcraft control and crew performance. The cited work is consistent with the 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 Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Airborne Manned and Unmanned System Technology (AMUST) [Includes the Hunter Standoff Killer Team (HSKT) Advanced Concepts Technology Demonstration (ACTD)] - In FY05, conducted flight tests of AMUST/HSKT system on AH-64D Longbow Apache, Army Airborne Command & Control System (A2C2S) UH-60 Black Hawk, and Hunter UAV in preparation for operational demonstration and military utility evaluation in FY06 under the HSKT ACTD.	5616	0	0
Integrated UAV System Demonstration - This program captures the results of the AMUST, Unmanned Autonomous Collaborative Operation (UACO), and the Manned-Unmanned Rotorcraft Enhanced Survivability (MURES) programs, TARDEC's Human Robot Interaction (HRI) and Armed Robotic Vehicle (ARV) Robotic Technologies (ART) programs and the Army Research Laboratory's Robotics Collaborative Technology Alliance (CTA) to develop, integrate and demonstrate the foundational technologies to enable UAVs to act as uninhabited wingmen. In FY06, assess contribution of technology and operational factors on safe separation of small UAVs and manned helicopters; mature and integrate systems for real-time and preplanned flight path deconfliction that are transparent to helicopter crew; and perform engineering validation flight tests of autonomy and collaboration technologies and simulation and evaluation of autonomous collaborative systems. In FY07, will flight test deconfliction systems and will begin maturing autonomy and human interface technologies to enable UAVs to provide overwatch and protection to moving and stationary ground forces by leveraging technologies from decision aiding, autonomy, collaboration, networking, and architecture programs.	0	1894	2948
Total	5616	1894	2948

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**447**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
447 ACFT DEMO ENGINES	6873	7544	8377	8573	8703	9893	10262

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 providing mature technologies for lighter turbine engines that provide more power, can go farther, and are easier for the warfighter to maintain and sustain. This will improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. The Small Heavy Fuel Engine (SHFE) program is 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 provides significantly increased range and payload capabilities for future manned and unmanned rotorcraft and sustainment upgrades for current engines. This will include significant Operation and Support cost savings and a significantly reduced logistics footprint. The SHFE program is focusing on maturing and demonstrating advanced, affordable turbine engine technology in the 700 horsepower (HP) class engine. The SHFE will result in significant improvements in SFC and P/W ratio that will enable a heavy fuel (JP-8) engine capability for applications such as the UAV Testbed, Armed Reconnaissance Helicopter (ARH), AH/MH-6 Mission Enhanced Little Bird, and Future Combat System (FCS) ground and aerial vehicles. 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 Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Small Heavy Fuel (Turbine) Engine (SHFE) - In FY05, procured parts, completed successful rig test of components of a 700 Horsepower engine, including the compressor, combustor, mechanical components, spin validation, and turbine validation and initiated Build 1 core testing. In FY06, complete Build 1A core and Build 1B engine testing; incorporate design improvements of the compressor, combustor, turbines, mechanical components, and control and accessories into Builds 2 and 3; complete the fabrication of redesigned components for engine Build 2; and conduct rig test on redesigned combustor and mechanical systems. In FY07, will complete engine testing of Build 2 and rig test optimized components consisting of a combustor, controls and associated mechanical systems; will complete the fabrication of components for engine Build 3; and will conduct final engine ground stand test for Build 3 to demonstrate program goal achievement.	6873	7544	8377
Total	6873	7544	8377

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	84538	101841	74717	68495	78004	79575	86035
232	ADVANCED MUNITIONS DEM	48481	46628	46665	35555	36964	37163	36744
43A	ADV WEAPONRY TECH DEMO	16855	27995	47	48	49	50	52
L94	ELECTRIC GUN SYS DEMO	19202	18347	13570	13345	15758	17487	22595
L96	HIGH ENERGY LASER TECHNOLOGY DEMO	0	7885	13402	18513	24198	23840	25609
L97	SMOKE AND OBSCURANTS ADVANCED TECHNOLOGY	0	986	1033	1034	1035	1035	1035

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 Combat System (FCS), 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 funds munitions maturation efforts including the FCS 120mm Line-of-Sight (LOS)/Beyond Line-of-Sight (BLOS) System Advanced Technology Demonstration (ATD), which completed in FY05 and successfully demonstrated the guided BLOS Mid Range Munition (MRM) for use in FCS Mounted Combat System (MCS). Project 232 also funds MCS and Abrams Ammunition System Technologies (MAAST), which provides enhanced capabilities beyond the baseline LOS/BLOS armament and munition suite and further matures MRM to add an objective dual-mode hardened seeker for autonomous and designated engagement modes; Objective Non Line-of-Sight (NLOS) Mortar Technology, which demonstrates a 120mm breech loaded, recoiling mortar for the FCS NLOS-Mortar System; Common Smart Submunition, which 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; Fuze and Power for Advanced Munitions, which integrates enabling fuze technologies such as Micro-Electro-Mechanical Systems (MEMS), proximity sensors, Electronic Safe & Arm Devices (ESADs) and hybrid power systems in end item munitions for demonstration purposes; and Non-Lethal Payloads for Personnel Suppression, which designs and demonstrates the munitions to suppress activity or deny access to designated areas using non-lethal means. Project 43A funds Congressional special interest items. Project L94 matures enabling technologies for an Electromagnetic (EM) Gun armament system that will lead to demonstrations of the key sub-systems in FY06. Based on successful completion of the component technologies, the Army will initiate an effort in FY07 for the design, fabrication and test of a full-scale, medium caliber EM armament demonstrator with robust LOS capability. EM Gun has the potential to revolutionize the future battlefield with its unique performance characteristics, including hypervelocity lethality effects and greatly reduced logistics burden. Starting in FY06, project L96 matures and demonstrates technologies that comprise a high energy, solid-state laser weapon. Beginning in FY06, a new Project L97 was established with funds reprogrammed from PE 0602622A to mature and demonstrate 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), PE 0602618A (Ballistics Technology). Work in Project L96 is related to, and fully coordinated with, efforts in PE 0603005A/441 (Pulse Power for FCS)and PE 0602307/042 (High Energy Laser Technology). Work in this PE associated with project L97 is related to and fully coordinated with, efforts in PE 0602622A/A552 (Smoke/Novel Obscurant Munitions). Work in this PE is performed by the US Army Armament Research, Development and Engineering Center (ARDEC), Picatinny, NJ, the Army Research Laboratory (ARL), Edgewood Chemical and Biological Center, Aberdeen Proving Ground, MD, and Space and Missile Defense Technology Center, Huntsville, AL. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	83337	74927	80632
Current BES/President's Budget (FY 2007)	84538	101841	74717
Total Adjustments	1201	26914	-5915
Congressional Program Reductions		-447	
Congressional Rescissions		-1039	
Congressional Increases		28400	
Reprogrammings	1201		
SBIR/STTR Transfer			
Adjustments to Budget Years			-5915

Seventeen FY06 Congressional adds totaling $28400 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1000) Advanced Technology Center
($1000) Advanced Technology for Fabrication at Remote Sites
($2000) Armament and RangeSafe Technology
($1000) Armament Titanium Casting Advancement Program
($2100) Demonstration of Corrosion Control Tool Kits for Effective Corrosion Removal and Surface Preparation
($2800) Disruptive Technology Acceleration
($1000) Electromagnetic Gun Technology Maturation and Demonstration Program
($1000) Joint Manufacturing Technology Center
($2800) Manufacturing of Precision Molded Aspheric Optics
($1000) Mid-Range Munition (MRM-KE) Project 232
($2000) Miniaturized RAMAN Chemical Indentification System
($2100) Munitions Public Private Partnering
($1500) Nanotechnology Manufacturing Research
($500) National Nano Manufacturing Center (NNMC)
($2800) Rapid Insertion of Development Technology
($2800) Rapid Prototyping for Special Projects
($1000) Storage and Quality Requirements to Military MEMS

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**	**232**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
232 ADVANCED MUNITIONS DEM	48481	46628	46665	35555	36964	37163	36744

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 will 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 in this project is the Future Combat System (FCS) 120mm Line of Sight/Beyond Line of Sight (LOS/BLOS) System Advanced Technology Demonstration (ATD), which completed in FY05 with a demonstration of BLOS Mid Range Munition (MRM) with a hardened single mode seeker and a design for a hardened dual mode seeker adaptation. MRM is a gun launched precision munition for MCS capable of defeating high-value heavy armor and other targets out to 12km. In FY06 further maturation and demonstration of hardened dual mode seeker technology for MRM is conducted under the MCS and Abrams Ammunition System Technologies (MAAST) effort. The MAAST effort also matures technologies to enhance the capabilities of the FCS armament system and munition suite for FCS spiral insertion or MCS upgrade and the M1A2, including a Low Cost Precision (LCP) effort that matures and demonstrates components and subsystems for command-guided projectiles that will contribute to the development of low-cost precision munitions. This project also funds Objective Non Line-of-Sight Mortar (NLOS-M) Technology, which provides a 120mm breech-loaded mortar with a design optimized for lighter weight and thermal balance; Lightweight Dismounted Mortar Weapon, which is a man-transportable 81mm mortar fabricated from lightweight advanced materials and structures; 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; Non-Lethal Payloads for Personnel Suppression, which enables personnel suppression and area denial at BLOS ranges; Robotic and Network Technologies, which addresses various aspects of making armaments and munitions part of the networked battlespace; and Kinetic Energy Active Protection System (KEAPS), which develops 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 and add 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/IED Neutralization which exploits Laser Induced Plasma Channel (LIPC) to defeat Improvised Explosive Devices (IEDs) and mines; and Extended Area Protection & 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). 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, and Tank, Automotive Research, Development and Engineering Center (TARDEC), Detroit, MI.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
FCS 120mm LOS/BLOS System : In FY05, completed design of integrated dual-mode seeker for MRM; conducted multi-mode software development (target acquisition, seeker hand-off, target tracking); performed software-in-the-loop and processor-in-the-loop performance testing; fabricated components and assemblies and conducted high-g survivability tests; and fabricated prototype integrated dual-mode seekers and conducted seeker performance Tower and Captive Flight Tests. Further maturation and demonstration of MRM is conducted under the MAAST program.	16700	0	0
MAAST-MRM: In FY06, continue seeker performance testing and procure advanced seeker components; fabricate, assemble and	0	10000	10000

demonstrate seeker performance in a gun-fired, designated-mode guided engagement against a BLOS moving target; optimize software to improve tactical capabilities; and conduct processor-in-the-loop and hardware-in-the-loop simulations for integrated dual-mode seeker. In FY07, will complete fabrication and assembly of integrated dual-mode MRM target acquisition, guidance, and counter active protection systems; will demonstrate gun-fired multi-mode MRM at a BLOS target.			
MAAST: In FY05, fabricated, assembled and conducted subsystem airframe and warhead testing of Line-of-Sight Multi-Purpose (LOS-MP) munition; integrated warhead and fuzing subsystems into airframe and demonstrated LOS-MP air burst capability for anti-personnel effects and effectiveness of penetrator and fuzing mechanisms against concrete wall targets; matured designed, fabricated and conducted initial airframe testing of Enhanced Kinetic Energy (KE) round at ambient temperature; evaluated target and projectile tracking capability for Low Cost Precision (LCP) effort. In FY06, continue maturing LOS-MP and Enhanced KE rounds; fabricate, assemble and conduct gun-fired demonstration of two-way ammunition data link which will be applicable to all MCS ammunition types; and will complete fabrication, assembly and demonstration of integrated advanced propulsion capability with temperature compensation and precision ignition; and for LCP effort, down-select to lowest cost sub-component alternatives, complete initial designs and conduct component demonstrations. In FY07, will complete fabrication, assembly and demonstration of multi-function warhead for chemical energy munition for LOS-MP; and will complete demonstration of advance propellant and robust cartridge case technologies; and will complete fabrication, assembly and demonstration of in-flight tracking and maneuver control performance of projectile with LCP technologies.	13045	18155	17206
Objective Non Line-of-Sight (NLOS) Mortar Technology: In FY05, conducted live fire tests to demonstrate rates of fire commensurate with threshold requirements.	2000	0	0
Lightweight Dismounted Mortar Weapon: In FY05, conducted lightweight material engineering evaluations, fabricated components for mechanical assessment and tested ballistic performance of a full-scale, lightweight barrel prototype. In FY06, develop, test and ballistically demonstrate a lightweight full-scale prototype.	3500	2929	0
Common Smart Submunition (CSS): In FY05, conducted electronics, sensor and algorithm testing to evaluate performance and completed trades on alternate component and packaging configurations for Preliminary Design Review. In FY06, conduct tower test to characterize Laser RADAR (LADAR) sensor, signal processing, and recognition algorithms for detection, and discrimination of potential targets in dynamic environments. In FY07, will mature sensor and algorithms for follow-on captive flight tests to achieve 0.95 probability of discriminating and firing at a target of interest; will conduct warhead performance and lethality tests; will provide test data for system analysis model and develop and validate a CSS system model for simulation and wargaming evaluation.	2207	6904	8300
Non Lethal Payloads for Personnel Suppression: In FY05, conducted non-lethal payload effectiveness modeling, dispersion and dissemination testing and analysis; refined design based on analysis; conducted initial gun launch and payload expulsion test. In FY06, demonstrate kinetic energy mitigation of payload module, complete target effects analysis and conduct system flight test demonstration .	4000	1673	0
Robotic and Network Technologies: In FY05, Special Weapons Observation Reconnaissance Direct action System (SWORDS)/ Joint Manned-Unmanned System Teaming (JMUST) conducted safety confirmation testing, modified software and hardware with improvements and conducted safety tests of modified prototype; Networked Sensors for the Future Force integrated and demonstrated a low cost, distributed and networked unattended ground sensor systems; Fire Control-Node Engagement Technology provided full functional networked effects software configured for insertion into Future Force Warrior; Dual Use Composite (DUC) material--conducted test trials for optimization of critical material thickness and mechanical strength and integrated DUC material into Silent Operating Aerial Reconnaissance (SOAR) Unmanned Aerial Vehicle (UAV) airframe. In FY06, conduct full up DUC demo using SOAR UAV or DUC Multi-Target (MT) Shoulder Fired Ammo. In FY07, will optimize DUC munition to increase accuracy and lethality through test demonstrations in an operational environment; for Future Force Gun and Munitions will develop most promising light weight solutions for remote weapon stations on robotic vehicle.	3140	1230	993

Kinetic Energy Active Protection System: In FY05, conducted dynamic warhead arena demonstration and spinning brassboard sensor test and began fabrication of dynamic demonstration hardware. In FY06, fabricate rocket hardware and conduct testing to verify spin rate and fly-out dispersion. In FY07, will conduct warhead optimization for KE defeat; will conduct active optical sensor optimization for KE defeat.	2000	2968	2000
Fuze and Power for Advanced Munitions: In FY06, conduct explosive safety testing of Micro-Electro-Mechanical Systems (MEMS) Safe and Arm (S&A) components and multipoint Electronic Safe & Arm Device (ESAD) components; evaluate performance of proximity and safety sensors in limited/simulated environmental and flight tests. In FY07, will continue explosive compatibility and safety tests of MEMs, will demonstrate prototype battery designs in laboratory and conduct air gun high-g tests for new thermal and liquid reserve batteries and hybrid power systems; will conduct field tests for new thermal batteries and alternative/hybrid energy systems.	0	1244	4583
Countermine/IED Neutralization: In FY07, will integrate 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.	0	0	2483
Sparrow-Global War on Terrorism (GWOT): In FY05 designed a sentry portal system for neutralizing Human Borne Improvised Explosive Devices (HBIEDs); built and evaluated one ruggedized and automated system utilizing a directed energy source to pre-detonate HBIEDs.	1889	0	0
Extended Area Protection & Survivability (EAPS): In FY06, analyze and model gun based concepts for a gun based air defense capability against rockets, artillery and mortar rounds (RAM) to establish an appropriate caliber, firing rate and kill mechanism; define system requirements and component technology specifications. In FY07, will integrate advanced warhead and fuze configurations within the EAPS projectile; and will conduct live fire demonstrations to validate lethality against static RAM targets.	0	1525	1100
Total	48481	46628	46665

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**	**L94**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
L94 ELECTRIC GUN SYS DEMO	19202	18347	13570	13345	15758	17487	22595

A. Mission Description and Budget Item Justification: This project matures and demonstrates Electromagnetic (EM) armament subsystems and the enabling technologies for tactically relevant EM launchers, pulsed power and launch packages (projectiles). EM Guns have the potential to revolutionize the future battlefield by their unique performance characteristics (hypervelocity and reduced-signature launch), potential for elimination of vulnerable propellants, synergistic relationship with hybrid electric vehicles, and potential for significant reduction in sustainment burden. In addition to designing, fabricating and demonstrating subsystem components, the project resolves 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, an Advanced Technology Demonstration (ATD) effort will be conducted to integrate next generation subsystems into a stand-alone medium caliber armament prototype, comprising robust launcher, pulsed power supply, launch packages, prime power, cooling and auxiliaries, to demonstrate system performance. In FY06, the Kinetic Energy Active Protection System (KEAPS) effort complements work in Project 232 that focuses on maturing and demonstrating effectiveness of munitions associated with Active Protection Systems. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). 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 0602618A/H75 and PE0601104A/H56.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
EM Gun System Demo: In FY05, designed, fabricated, conducted tests and evaluated critical materials and components including composite alternator and barrel structures, low-density and high-strength metals, electrical insulation and thermal management systems, and high performance solid state switches; fabricated and evaluated performance of subscale launchers to characterize barrel architectures and to support forensic analysis; test fired Integrated Launch Packages (ILPs) in a laboratory environment to assess performance of flight body, fuze and high-explosive that comprise multi-purpose projectiles; conducted component validation tests for breadboard Pulsed Power Supply (PPS) rotating machines and provided design and manufacturing plans for PPS including torque management system and mount. In FY06, complete fabrication of a partially cantilevered railgun test bed and demonstrate strength of design and scaling effects testing at full scale launch peak loading conditions; perform full caliber lethality tests with unguided multipurpose rounds and demonstrate the launchability of high-explosive, fuzed ILPs in an EM armament environment; fabricate breadboard PPS components, conduct verification testing of PPS sub-assemblies and integrate the twin counter-rotating machines. In FY07, will build a lightweight cantilevered high fidelity railgun with integrated breech and muzzle shunt and demonstrate full scale launch at hypervelocity and multi-round launchability; will integrate the compact, twin counter-rotating pulsed alternator power supply, conduct subsystem functional tests and accomplish high fidelity breadboard PPS demonstrations that will establish and validate requisite performance criteria.	18244	14347	13570
Electromagnetic Gun Initiative: This one year Congressional add designed and validated performance of an advanced, optically controlled silicon switch with a novel voltage protection device for high energy pulsed duty. No additional funding is required to complete this effort.	958	0	0
Kinetic Energy Active Protection System (KEAPS): In FY06, fabricate munition hardware and integrate system components, sensor, propulsion system, and warhead for initial dynamic/dynamic testing. The main part of this effort is conducted within Project 232.	0	4000	0

Total	19202	18347	13570

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**	**L96**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
L96	HIGH ENERGY LASER TECHNOLOGY DEMO	0	7885	13402	18513	24198	23840	25609

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced technologies for Future Force High Energy Laser (HEL) weapons technology, and, where feasible, exploits opportunities to enhance Current Force capabilities. The major effort under this project is the development of a mobile one-hundred kilowatt (kW) class Solid State Laser (SSL) weapon demonstrator that is traceable to the form, fit, and function requirements of the Future Combat Systems (FCS). 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, rocket propelled grenades, 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; and 4) Neutralizing mines and other ordnance (especially improvised explosive devices (IEDs)) from a stand-off distance. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. At weapon system power levels of greater than 100kW, SSL technology has the potential to enhance Future Combat Systems (FCS) 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. This program will use the appropriate power laser based on knowledge gained from the 100kW SSL laboratory device developed in PE 0602307A to be demonstrated in FY08. Work in this project is related to, and fully coordinated with, efforts in PE 0602890 D8Z and PE 0603924D8Z (High Energy Laser Joint Technology Office), PE 0605605A (DOD High Energy Laser Systems Test Facility), and PE 0603005A/441 (Combat Vehicle and Automotive Advanced Technology). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed by the US Army Space and Missile Defense Command (SMDC), in Huntsville, AL and the High Energy Laser Systems Test Facility, White Sands Missile Range, NM.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Solid State Laser (SSL) Weapons System Demonstrator: In FY06, conduct SSL weapon system studies based on the 100kW SSL laboratory devices being developed in PE 0602307A to derive demonstrator technical performance specifications and assess the capabilities of the existing Air Defense target acquisition and C3I capabilities to meet the DEW specifications. Initiate subcomponent development for items such as a precision radar for target acquisition and tracking with hemispherical coverage that supports detection and discrimination at ranges of interest, and high resolution track for impact point prediction. In FY07, will initiate development of a SSL weapon system demonstrator that is compatible with tactical ground vehicle requirements, including conducting trade studies, detailed system engineering designs, and initiation of long lead item procurements. Will identify and initiate required modification to ensure the ability to interface with Air Defense systems that address the capability gaps identified above.	0	7885	13402
Total	0	7885	13402

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**	**L97**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
L97	SMOKE AND OBSCURANTS ADVANCED TECHNOLOGY	0	986	1033	1034	1035	1035	1035

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 4 times the previous performance. Modeling and simulation tools developed in PE 0602622A will be matured to predict performance and analyze strategic use of obscurants on the battlefield. Other efforts mature dissemination, delivery, and vehicle protection technology 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. Funding in this project was realigned from PE06022622A project A552 to establish an advanced technology development line for technology maturation. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Area Plan (DTAP). Work in this project is performed by the Army Research, Development and Engineering Command, Edgewood Chemical Biological Center, Edgewood, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Obscurant Enabling technologies: In FY06, mature concepts for prototype systems for use in grenades, artillery rounds, and other smoke generating systems; identify techniques for field evaluation of prototype dissemination systems. In FY07, will refine design of prototype packaging/dissemination concepts; develop prototype system for advanced IR obscurant. Will conduct experiments of new dissemination techniques in a relevant operational environment.	0	986	1033
Total	0	986	1033

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	284720	242013	109952	124336	96592	86706	82086
221	COMBAT VEH SURVIVABLTY	26650	18323	20712	35101	18027	23490	21215
440	ADV CBT VEHICLE TECH	19945	0	0	0	0	0	0
441	COMBAT VEHICLE MOBILTY	28002	51599	34581	34295	30489	41818	39078
497	COMBAT VEHICLE ELECTRO	5331	9353	9671	13212	7513	7643	7763
515	ROBOTIC GROUND SYSTEMS	11545	18740	17585	10158	11266	11490	11720
533	Ground Vehicle Demonstrations	34257	34304	0	0	0	0	0
53D	NAC Demonstration Initiatives (CA)	54407	67227	0	0	0	0	0
53G	FUTURE COMBAT SYSTEMS (FCS)	103218	40568	25331	29442	27117	0	0
C66	DC66	1365	1899	2072	2128	2180	2265	2310

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. Army S&T continues to play an important role in the Future Combat System (FCS) program by providing critical technology solutions for FCS. Supporting FCS remains a high priority for Army S&T and is the primary effort funded in this PE; therefore a significant portion of the FY05-FY07 funding supports the collaborative Army/Defense Advanced Research Projects Agency (DARPA) FCS Enabling Technologies efforts (Project 53G). Memoranda of Agreement (MOA) between the Army and DARPA delineate the collaborative enabling technology efforts, the cost-shared funding profile and responsibilities associated with this partnership. In addition, this PE supports maturation and demonstration of enabling component technologies in the areas of survivability (Project 221), mobility (Project 441), robotic ground systems (Project 515), and combat vehicle electronics (Project 497). It also funds efforts to integrate and evaluate diverse vehicle technologies matured by the Army, other DoD agencies and industry. These advanced technologies are demonstrated in coordination with Army warfighter organizations through vehicle component and system level technology demonstrations. The completing Integrated Survivability Advanced Technology Demonstration (ATD) (Project 221) identified the integration issues associated with upgrading FCS baseline survivability capabilities to meet FCS system survivability requirements, while monitoring individual technologies for direct transition opportunities into Current Force systems. The Crew Integration and Automation Testbed (CAT) ATD (Project 497) demonstrates multi-mission crew stations required for the versatility of the Future Force. In the Future Force, Soldiers and robots will be required to fight side by side. Technologies for human-robot interaction in Soldier-robot teams such as: intelligent agents, adaptive automation, and user-friendly displays will be developed to reduce the soldier's burden in the control of manned and unmanned ground and air systems (Project 497). The Robotic Follower ATD (Project 515) matures and demonstrates Unmanned Ground Vehicle (UGV) technologies, including those that enable UGVs to follow manned vehicles and that allow UGVs to be more autonomous for FCS. Additionally, technologies such as tactical behaviors and human detection and deterrent will be developed, matured, and demonstrated for Armed Robotic Vehicles (ARVs) . These technologies will allow robotic vehicles to act more independently during tactical maneuvers and protect themselves from intruders, thereby enabling the soldier to perform other mission tasks (Project 515). Hybrid electric and electric vehicle technologies are key enablers for enhancing Current Force, FCS and Future Force capabilities. Future vehicles will be designed with hybrid electric architectures, providing power for propulsion, communications and control systems, life support systems, electric weapons and protection systems. In the near term, the Tactical Wheeled Vehicle Fleet Modernization and Future Tactical Truck Systems (FTTS) Advanced Concept Technology Demonstration (ACTD)

(Project 440) will assess military utility of tactical vehicles that are enhanced with high payoff technologies and coupled with current and Future Force sustainment concepts in an operational environment. Project 441 demonstrates critical power, propulsion and electric systems including energy storage, power distribution and Pulse Forming Networks (PFNs). In the mid-term, electromagnetic (EM) armor enabled by pulse power technology, developed in Project 441, will be integrated and demonstrated on combat vehicles. In the longer term, vehicle energy and power levels will be increased to accommodate advanced electric weapons (lasers, high power microwaves and electric guns) and advanced electric-based protection systems. Work in this program element is related to, and fully coordinated with PE 0602601A (Combat Vehicle and Automotive Technology) and 0602618 (Ballistics Technology). Projects 533 and 53D fund Congressional special interest items. Project C66 supports programs that are classified. Work in this PE is coordinated with the U.S. Marine Corps through 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 and DARPA. 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 PE is performed by the Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	279260	142866	122661
Current BES/President's Budget (FY 2007)	284720	242013	109952
Total Adjustments	5460	99147	-12709
Congressional Program Reductions		-1410	
Congressional Rescissions		-2443	
Congressional Increases		103000	
Reprogrammings	5460		
SBIR/STTR Transfer			
Adjustments to Budget Years			-12709

FY 07 decrease of -12.7 million attributed to realignment of funding to higher priority requirements.
Forty-nine FY06 Congressional adds totaling $103000 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($2500) 3-D Advanced Battery Technology (3-D ABT)
($1300) Advanced Battery Development
($1000) Advanced Drivetrains for Enhanced Mobility and Safety
($1000) Advanced Technology Integration Environment
($4000) Advanced Thermal Management
($4900) All Composite Mil Vehicle
($4000) Alternative Mobility Vehicles for Special Operations Forces
($2600) Amphibious Personal Mobility Vehicle
($2000) Armored Composite Cab Development Program
($1700) Battery Charging Technology
($1500) CCMMC Lightweight Diesel Engine Initiative for Army Ground Vehicles
($1000) Center for Innovative Materials Research (CIMR) at Lawrence Tech University
($8100) Center for Military Vehicle Technologies
($1400) Collaborative Development Approach for Non-line of Sight Cannon and Mortar
($1000) Combat Vehicle Research-Weight Reduction, Survivability & Mobility
($5000) Commercially Based Logistical Support Trucks
($1500) Component Optimization for Ground Systems (COGS)
($2800) Composite Body Parts - Composite Armored Vehicle Technology Transition
($2600) Composite Shelters for the Future Tactical Truck and Retrofit of Current Vehicle Shelters

($1000) Counter Sniper/RPG self protection system
($1800) Development of Logistical Fuel Processors to Meet Army/TARDEC/TACOM Needs
($1400) Digital Humans and Virtual Reality for Future Combat Systems
($1000) Electrochromatics Program
($1400) Fastening and Joining Research
($1000) FREEDOM Software
($2500) Full Spectrum Active Protection Close-In Layered Shield (FCLAS)
($4000) Future Light-weight Military Trailer Chassis
($1700) HAZ-MAT Material Vacuum System
($2500) HEMTT Structural Weight/Cost Reduction and Efficient Armor Integration Initiative
($1000) High Strength Powder Metal Gears for Vehicle Transmissions
($5000) Hydraulic Hybrid Vehicles for the U.S. Army
($2100) Improved Abrams Track
($500) Joint Technology Evaluation and Analysis (JTEA) Program
($2600) Light Weight Structural Composite Armor for Blast and Ballistic protection
($1000) Lightweight Composite Structural Armor for Ground Combat Vehicles
($1400) Liquid Hydrogen Storage System
($500) Mobile Hydrogen Infrastructure (MHI)
($2000) Next Generation Non-Tactical Vehicle Propulsion
($1900) Non-Line of Sight Cannon (NLOS-C) and Mortar (NLOS-M) lightweight technologies including aluminum vehicle design technologies
($3600) N-STEP Enabled Manufacturing Cell for FCS
($1000) On-Board Secure Telematics for Advanced Combat Vehicles
($1700) Pacific Rim Environmental Degradation of Materials Research Program at UH
($1500) PEM Fuel Cell-Based Ground Support Equipment
($1000) Rocket Propelled Grenade Vehicle Protection System
($2800) Secure Pervasive Computing (PvC) for Advanced Combat Vehicles
($900) ShotSpotter Individual Soldier Worn Weapon Detection and Location System
($2100) Solid Oxide Fuel Cell Materials and Manufacturing
($1200) Split-Cycle Engine Technology
($1000) Virtual Explosives Detection-Image Matching (VED-Imatch)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**221**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
221 COMBAT VEH SURVIVABLTY	26650	18323	20712	35101	18027	23490	21215

A. Mission Description and Budget Item Justification: This project matures and demonstrates combat vehicle survivability technologies essential for Future Combat System (FCS) and the Future Force. Where practical, it also provides potential technical solutions for enhancing survivability capabilities of the Current Force. These technologies include: Electronic Warfare (EW), Active Protection (AP), advanced lightweight armor, and signature management. As combat vehicle systems become smaller and lighter to provide the necessary strategic deployability and tactical mobility, one of the greatest technological and operational challenges is providing adequate crew and vehicle protection without reliance on heavy passive armor. This challenge will be met by using a layered approach, including long-range situational awareness, multi-spectral signature reduction, EW and AP systems, and advanced lightweight armor instead of heavy conventional armor. The goal of the AP against Kinetic Energy (KE) effort is to defeat KE threats with a multi-purpose hard kill countermeasure warhead. The goal of the Ballistic Protection effort is to provide a suite of lightweight armor component technologies for all manned FCS ground vehicle variants. Armor technologies include electromagnetic (EM), smart and ceramic armors integrated with advanced composite and laminate structures. Lightweight, integrated armor technologies, using components from Program Elements (PEs) 0602601A (Combat Vehicle and Automotive Technology), 0602618A (Ballistics Technology) and 0602105A (Materials Technology), will be demonstrated through ballistic testing of quarter vehicle sections to validate performance versus weight as required for frontal and side armor protection. The goal of the FCS Laser Hardened Vision and Sensor/Eye Protection effort is to develop optical systems for battlefield viewing and fire control, which are protected from frequency-agile laser weapons. Nonlinear optical materials will be incorporated into new optical designs to meet the needs of FCS. The Full Spectrum Active Protection Close in Layered Shield (FCLAS) effort demonstrates the defeat of Rocket Propelled Grenades (RPGs) and small Anti-Tank Guided Missiles (ATGMs) on a light, moving platform with a vehicle integrated countermunition. The Signature Management effort improved existing multi-spectral signature modeling tools, characterized hardware performance, and provided inputs to FCS virtual prototyping tools. Multi-spectral combat vehicle signature models are validated using hardware samples with measured signature characteristics and will be used to assess FCS platform designs. Work in this PE is related to and closely coordinated with work conducted in PE 0602601 (Combat Vehicle and Automotive Technology) and in collaboration with the Army Research Laboratory's PE 0602618 (Ballistics Technologies). 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 Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI; Army Research Laboratory (ARL), Aberdeen Proving Ground, MD; and Army Research, Development and Engineering Center (ARDEC), Picatinny, NJ.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
AP and EW against Chemical Energy (CE): In FY05, completed full evaluation of AP system, demonstrated ability to defeat multiple threats while vehicle was On-the-Move (OTM); tested mature OTM algorithms for EW; field tested the multi-function EW countermeasure; and provided design information on the demonstrated components and system to appropriate acquisition program(s).	7143	0	0
AP against KE - In FY05, performed a top level technology evaluation on system and component upgrades necessary to make the CE AP system work against the much faster and heavier KE rod; selected KE AP countermeasure components to be demonstrated; performed laboratory tests to evaluate multiple countermeasure warheads; and completed initial upgrades to AP tracking radar. In FY06, perform system engineering technical trade and engineering modeling of point of departure systems and conduct field test firings of critical components to demonstrate technical feasibility; assess tracking radar, interceptor, countermeasure and launcher assemblies against tank fired KE threats; and characterize kill radius, and warhead effects. Evaluate and test high risk KE components for various approaches,	6093	11423	17788

including to sensors, fuzes and warheads. In FY07, will evaluate AP system performance with candidate warhead designs; will conduct interceptor technology field demonstration in order to select interceptor and warhead design; will mature selected interceptor and warhead through design refinement and sensor redesign as well as by conducting kill mechanism and sensor component evaluations; will conduct lab evaluation of AP system performance with selected interceptor; and will begin detailed design of mature KE interceptor concept for fabrication in support of live fire KE experiments.			
AP against close-in threats (Full Spectrum Active Protection Close In Layered Shield (FCLAS)): In FY05, characterized fragment pattern to determine safe and hazard zones; demonstrated an intelligent controller with dynamic exclusion zones to minimize collateral damage and protect the dismounted Soldier in the vicinity of the vehicle; modified existing sensor to increase effectiveness against RPG's; redesigned reduced size and weight of interceptor and integrated an onboard safe and arm; demonstrated a full-up FCLAS round. In FY06, demonstrate FCLAS on a moving platform and evaluate performance; test alternate FCLAS launch mechanisms for other possible applications.	5500	4000	0
Signature Management - In FY05, developed and validated signature management virtual models; and provided signature modeling capability to Research Development and Engineering Command's Modeling Architecture for Technical and Research Experimentation (MATREX).	4945	0	0
Ballistic Protection for FCS - In FY05, completed integration of armor appliqué solutions for FCS threats; tested advanced frontal armor on the FCS-armor testbed for ability to defeat medium KE threats and improved RPGs.	2469	0	0
Countermine (Lightweight Appliqués and Structures): In FY05, completed evaluation of FCS mine resistant lower hull appliqué concept integrated into FCS prototype designs and used finite element models to evaluate FCS prototype vehicle designs against multiple mine scenarios to assess which capabilities remained beyond the first blast event and to characterize multi-blast performance.	500	0	0
FCS Laser Hardened Vision/ Sensor/Eye Protection from Frequency-Agile Lasers: In FY06, develop and provide designs to meet targeting requirements of the electro-optic visions system and demonstrate the ability to deny passage of the laser beam through the optical system. In FY07, will integrate and evaluate nonlinear optical materials solutions that protect the sensor and eyes from laser-induced damage and begin construction of a brass-board targeting system utilizing these concepts and will design laser protected FCS navigation camera system.	0	2900	2924
Total	26650	18323	20712

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**441**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
441 COMBAT VEHICLE MOBILTY	28002	51599	34581	34295	30489	41818	39078

A. Mission Description and Budget Item Justification: This project develops and tests advanced mobility and electric component technologies for next generation ground combat and tactical vehicles and demonstrates increased vehicle performance and capability. It enables lightweight, agile, deployable, fuel efficient and survivable ground vehicles needed for the Future Combat System (FCS), the Future Force, and enhancements to the Current Force. The main efforts funded by this project are Hybrid Electric Vehicle (HEV) FCS Propulsion Technologies, Advanced Engine Technologies, Advanced HEV Technologies, JP-8 Reformation for Fuel Cells, and Pulse Power. HEV FCS Propulsion matures components, sub-systems and systems for hybrid-electric vehicles 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. Demonstrations of these items will be conducted in the Power and Energy (P&E) Hardware-in-the-Loop Systems Integration Laboratory (SIL) that replicates combat vehicle power and vehicle performance characteristics. HEV technology potentially offers improved automotive performance, 15-25% reduction in fuel consumption, silent watch, silent mobility, and vehicle design flexibility. The P&E SIL demonstrates electrical power and energy sources, significantly enhanced control methodologies, and electrical architectures (enabled by high-speed switching) to provide on-board power management. The P&E SIL is also used as a cost effective way to validate vehicle performance models and simulations. The project will also assess the performance of hybrid electric vehicles while developing tactical mission duty cycle profiles critical to evaluations of HEV technologies. These cycles will be integrated into the P&E SIL for future technology evaluations. The goal of the Advanced Engine Technology effort is to mature and demonstrate prime power (engines) options for hybrid combat vehicles with a goal to more than double the power density (horsepower per cubic foot (hp/cu.ft.)) of currently fielded combat engines and raise the state-of-the-art from 6 hp/cu.ft to 8-10 hp/cu.ft. The Advanced HEV Technologies efforts will seek further increases in vehicle mobility, efficiency and mission capability without increasing vehicle weight and volume. This effort applies advanced technologies (traction wheel motors, active suspension, high temperature electronic components, regenerative brakes, thermal management, lightweight track and segmented band track) to next generation vehicles and identifies changes in vehicle performance. The objective of the Pulse Power effort is to mature pulse power component technologies and demonstrate compact pulse power components that enable revolutionary survivability and lethality applications. The goal is to make significant advances in the maturity of high power density, capacitor-based Pulse-Forming Networks (PFNs) that enable advanced electromagnetic (EM) armor and advanced electric weapons for FCS spiral insertions. The JP-8 Reformation for Fuel Cells effort matures reformer and desulphurization technologies, which convert battlefield fuels to the hydrogen required for fuel cell operation. This will enable fuel cells to be practical for military vehicle power generation as an alternative to the reciprocating engine for Auxiliary Power Units (APUs) and prime power. The Advanced Lightweight Track program develops a segmented band track to increase maintainability and reliability of tracked vehicles, while incorporating the lower heat signature and inherently lower noise emissions for stealth operations. 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 Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI in conjunction with Army Research Laboratory (ARL), Adelphi, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
HEV FCS Propulsion - In FY05, evaluated advanced hybrid electric components in the P&E SIL; demonstrated increased hybrid electric system power density in the P&E SIL; advanced modeling and simulation (M&S) capability to include real time power and energy vehicle analyses; began design of an integrated mobile Dynamic Test Rig (DTR); performed trade-off and performance assessments of spiral upgrade concepts for FCS and Current Force vehicles; developed detailed power and energy mission profile data; and provided vehicle integration support. In FY06, purchase/build, integrate and evaluate enhanced hybrid electric propulsion components (batteries, switches,	7326	15130	8864

motors, controllers, active suspensions and wheel/band track stations) in the P&E SIL; demonstrate significantly increased hybrid electric system power density (i.e., provide same power that now occupies 4 cu.m. in a volume of 3 cu.m.); conduct SIL experiments using various mission profiles to validate propulsion system performance and gather data that can be used to design future combat and tactical vehicles. In FY07, will continue to integrate new component technologies and subsystems that support the creation of a 2 cu.m. sized hybrid electric system power; will implement advanced thermal management system/techniques in the SIL; will conduct SIL experiments and evaluate propulsion system performance across mission scenarios.			
Advanced Engine Technologies- In FY05, fabricated and tested to NATO durability standards an advanced in-line 4-cylinder high power density FCS candidate engine; initiated very high power density design studies for Internal Combustion (IC) engines in preparation for development efforts. In FY06, investigate advanced turbo-machinery systems along with associated control system development and electronics integrated into the engine control system and complete design studies and trade-off analyses for advanced IC configuration and high speed combustion. In FY07, will initiate test engine modifications for high speed combustion and fabrication of a prototype single-bank 8 hp/cu.ft. power density Opposed Piston/Opposed Cylinder (OPOC) engine module; will install Turbo-machinery system, including controls on a high power density capable test engine and evaluate to obtain performance data and durability.	9963	2000	2112
Advanced Hybrid Electric Vehicle (HEV) Technologies - In FY05, demonstrated 30 kW high-temperature all-SiC motor inverter; advanced Lithium-Ion (Li-Ion) battery technology to achieve higher energy/power densities; demonstrated improved traction motor and active electric suspension for FCS; advanced the performance and maturity of hybrid electric component technologies to allow integration and characterization at the subsystem and system level; and provided upgrades to power and energy modeling and simulation efforts. In FY06, demonstrate a 40 kW high temperature all-SiC motor inverter, a 100 kW/cu.ft. traction motor and enhancements to Li-Ion battery technology (up to 120 Wh/kg); advance HEV component performance and maturity via multiple competitive efforts in motor, battery and power electronics development; procure long lead items for and initiate assessment of HEV tactical mission profiles. In FY07, will complete maturation of inverter, battery, traction motor and DC-DC converter component technologies; complete assessment of HEV's by using tactical mission profiles; will integrate and validate component performance in the P&E SIL; and will evaluate advanced thermal management technologies for coolant temperatures in the range of 110 degrees Centigrade during system demonstrations.	5576	14872	11554
Pulse Power: In FY05, incorporated high energy density capacitors, high power density/high temperature Si/SiC pulse chargers, and high action/fast rise-time output switches into high-energy density, dual mode PFN for EM Armor/Electrothermal Chemical Gun and evaluated the PFN in the P&E SIL; fabricated and demonstrated modular, high-action solid state output switches in support of EM Gun development; designed and developed higher energy density PFN circuit boards in support of the Solid State Laser (SSL); and provided Operational Effectiveness. In FY06, improve component characteristics and performance ranges, to include producing faster output switches with greater capacity, HED capacitors with greater energy density, and pulse chargers with greater power density and insert these into the high-energy density, dual mode PFN, and integrate and evaluate the performance of the SSL PFN/Power Supply/Diode Load in P&E SIL; demonstrate and transition PFN required for Electromagnetic Armor. In FY07, will demonstrate and validate the technical maturity and size reduction for all components (60% for switches, 50% for capacitors and 30% for switches while 33% faster) over previous state-of-the-art components for the high-energy density, dual mode PFN, the SSL PFN and EM Gun switch, validating performance in the P&E SIL.	3937	11252	5258
JP-8 Reformation for Fuel Cells: In FY05, completed power studies and selected a JP-8 reformation approach, and initiated plan for laboratory hardware fabrication, performance demonstration, and durability maturation to achieve future tactical and combat vehicle power generation system requirements. In FY06, mature and verify selected reformation technology approach refining system models and simulations. In FY07, will assess selected reformation and desulphurization technology approaches; and will begin initial limited system integration efforts for future laboratory hardware performance demonstration.	1200	4245	2593

Advanced Lightweight Track: In FY06, leverage technology from the continuous band track program into the design of new hybrid segmented band track technology, combining these lightweight characteristics with the higher supportability and robustness of linked steel track; model and analyze mine blast phenomena to develop survivable lightweight track system; investigate new approach to the development of advanced elastomers. In FY07, will fabricate prototypes of new segmented band track and lightweight steel track, incorporating new bushing elastomers; and will conduct analyses on reinforcement and joint structural performance for AP mine blast survivability, heat transfer, and sprocket/track interfaces.	0	4100	4200
Total	28002	51599	34581

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**497**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
497 COMBAT VEHICLE ELECTRO	5331	9353	9671	13212	7513	7643	7763

A. Mission Description and Budget Item Justification: This project matures and demonstrates vehicle electronics hardware and software that will result in increased crew efficiencies, performance and/or reduced crew size for Future Combat System (FCS) vehicles with potential spin-outs to Current Force systems. In addition, the project advances open system architectures for ground combat vehicles that will allow vehicle crew stations to be adapted for a variety of FCS and Future Force ground platforms. The Crew Integration and Automation Testbed (CAT) Advanced Technology Demonstration (ATD) focuses on automation of crew functions and integration of advanced electronic architectures compatible with automotive and system platform requirements. Products include simplified, user friendly, responsive controls for unmanned ground and air systems improved electronic and power architectures, and reusable software modules. The CAT ATD, in cooperation with the Robotic Follower ATD (Project 515), evaluates configurations of multi-role crew stations that may enable a two-man crew to perform functions associated with fighting the battle, reconnaissance, logistics and sustainment, as well as control of unmanned ground and air vehicle assets. Goals include a full mission rehearsal via an embedded simulation for FCS. Technical challenges include achieving increased levels of autonomy for both manned and unmanned systems, an advanced user interface supporting improved/increased span of control for mixed initiative (e.g. reconnaissance and lethality) robotic operations, mixed mode operations with both unmanned ground and aerial assets, collaborative vehicle operations for workload management, continued maturity of auto driving aids, commanders aids, embedded simulation for battlefield visualization, and fully integrated virtual test and evaluation. The Human-Robot Interaction (HRI) effort matures and demonstrates a common scaleable user interface that maximizes the mounted/dismounted Soldier's primary mission performance by automating robotic control tasks, to include efficient operations of multiple unmanned assets through scalable interface designs and intelligent agent software. A common scaleable interface has the 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. HRI will mature, through a robust systems engineering approach, advanced models, metrics, and user validated interface design recommendations for mounted and dismounted soldier-robot performance, and employ this information to mature, integrate and demonstrate technology required for effective interaction with both air and ground unmanned battlefield systems. This effort will implement model-driven embedded intelligent agents that lessen soldier workload, reduce and or automate controlling tasks, support adaptive and dynamic performance across mounted (embedded) and dismounted systems and enable efficient mixed-initiative operations where manned and unmanned systems team to perform missions. 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 2005	FY 2006	FY 2007
CAT ATD: In FY05, investigated technology enablers for on-the-move embedded simulation and mission rehearsal; implemented and demonstrated autonomous capability using an upgraded autonomous mobility sensor suite; and matured a distributed workload management system across manned/unmanned assets that supports the FCS network centric concept by incorporating weapon/target pairing algorithms and components from the FC-NET project PE 63313/704. In FY06, conduct final operational warfighter experiments in a relative military environment; demonstrate commander's and driver's crew aiding behaviors and automated planning features for both manned and unmanned systems; evaluate electronic control architecture and embedded mission planning, mission rehearsal, and training capabilities; and create final technical reports and deliver to FCS.	4000	2000	0

HRI: In FY05, determined baseline workload levels for intelligent agent functionality that will reduce and automate Soldier tasks associated with controlling ground and air unmanned assets and established platform baselines of interfaces for scaling and the reduction of mounted and dismounted soldier training burden. In FY06, begin software development of intelligent agents and baseline task identification for application of adaptive automation; initiate design for common scalable interface that will reduce unique training requirements between mounted and dismounted operations; demonstrate initial interface designs in simulation and experimentation in a relative field environment and provide deliverables to FCS; refine and validate requirements for FCS-compatible interfaces. In FY07, will determine optimal workload levels for selected relevant FCS mission scenarios and continue refinement of intelligent agent software to reduce soldier control workload; will develop adaptive automation algorithms to assess Soldier workload and employ intelligent agents when required; will validate adaptive automation and intelligent agent software and scalable interface through simulation and joint Soldier operational field experimentation with the Armed Robotic Technologies (ART) program; will transition experimentation data, algorithms and documentation to FCS.	1331	7353	9671
Total	5331	9353	9671

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**515**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
515 ROBOTIC GROUND SYSTEMS	11545	18740	17585	10158	11266	11490	11720

A. Mission Description and Budget Item Justification: This project matures and demonstrates unmanned ground vehicle technologies for Future Combat System (FCS) and the Future Force, and explores feasibility for enhancements to the Current Force. The main focus is on integrating and demonstrating sensor technologies, perception hardware and software, and robotic control technologies that are required to enable unmanned ground vehicle (UGV) systems to maneuver with minimal human intervention, for on-and off-road missions while at militarily significant speeds. Mature technologies are incorporated in UGV technology demonstrators, so that performance can be evaluated for multiple tactical and sustainment applications. Technical challenges addressed include obstacle avoidance, perception limitations, intelligent situational behaviors, command and control, frequency of human intervention, and operations in adverse weather. The Robotic Follower ATD focuses on UGVs that follow other vehicles directly at user definable separation times and distances, or that follow a designated path requiring little human intervention. An experimental UGV (XUV) and a converted Stryker Infantry Carrier variant serve as demonstration vehicles. This program provides critical information on design and performance of robotic technologies and demonstrations of "Follower" UGVs for FCS. The project also advances UGV technologies to enable semi-autonomous and near autonomous operation and to expand the missions in which UGVs contribute to Future Force operations. The Armed Robotic Vehicle (ARV) Robotic Technologies (ART) effort matures a set of automated tactical behaviors and intruder detection and deterrence 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, which are consistent with the unmanned platform missions in the FCS Brigade Combat Team. These technologies will be integrated with sensor hardware, appropriate mission modules, and integrated onto a demonstration platform. Potential missions/functions include perimeter security, medical supply and evacuation, scout/reconnaissance and remote weapons delivery. The Technology for Human-Robot Interaction (HRI) in Soldier-Robot Teaming program will optimize the way Soldier-robot teams perform mixed-initiative operations by validating through FCS-relevant scenarios and experimentation, both simulated and fielded collaboration of manned and unmanned ground and air systems. It will optimize warfighter-machine interfaces for maximum span of control with minimal task loading across a broad range of control devices. It will address safe operations of unmanned systems around humans and other vehicles. The approach builds upon previous and ongoing investments such as the Demo III program, conducted under the Joint Robotics Program Office, and the ongoing DARPA UGCV program. It is coordinated with the Crew Integration & Automation Testbed (CAT) ATD (described in Project 497). The work in this project is fully coordinated with and complements efforts conducted in PE 0602601A (Project H91, Tank and Automotive Technology) and PE 06026118A (Ballistic Technology). 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 Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI, in conjunction with the Army Research Laboratory (ARL), Adelphi, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Robotic Follower: In FY05, matured/incorporated intelligent situational behaviors to enable significant increase in time and distance separation between the leader and follower vehicles and to assist vehicles in performing safely in case of loss of vehicle communication; matured/integrated vehicle tracking capability to enable operation within traffic; matured pedestrian detection capability to enable safe operation among pedestrian traffic; and conducted engineering evaluations and Soldier operational evaluations of follower performance in logistic and tactical mission scenarios. In FY06, integrate improved obstacle detection algorithms for detection of small positive and negative obstacles; implement road following traffic avoidance baseline for improved lane maintenance as well as traffic/pedestrian detection and avoidance; implement improved leader-follower technology with increased mobility and waypoints augmented with terrain	6979	3000	0

intelligent navigation; demonstrate significant operator workload reduction; conduct experiments focused on dismounted support and MULE operations in urban areas; perform final engineering evaluations and operational warfighter experiments that demonstrate ATD performance exit criteria; and create final technical reports/documentation to transfer to FCS.			
ARV Robotic Technologies: In FY05, initiated design of a tactical behavior suite that allows unmanned systems to act decisively while maneuvering around the battlefield; initiated design of a non-lethal intruder detection and deterrence system for increased UGV survivability; began evaluating tactical behavior, intruder detection suites and maneuverability in a simulated environment and a System Integration Laboratory (SIL) prior to the technology being integrated into the ART platform; modified ART platform to accept mission packages and subsystems. In FY06, integrate a perception suite designed in PE 0602618A (Project H03) on a highly instrumented mobile demonstrator to validate improved semi-autonomous operations; update algorithms in the perception suite to improve operations in fog/dust and reduce frequency of operator interventions; mature concepts and technologies for unmanned tactical behavior, intruder detection and analysis, and self-monitoring to meet user requirements; continue to mature UGV SIL for tactical behavior maneuverability and intruder detection and analysis maturation; begin to integrate tactical behavior, intruder detection and deterrence suite, and self monitoring subsystems into ART platform in preparation for field evaluations; conduct warfighter operational field evaluations and experiments in conjunction with user community. In FY07, will complete integration of tactical behavior, intruder analysis and deterrence suite, and self monitoring subsystems into ART platform in preparation for field evaluations; will conduct warfighter operational field evaluations and experiments in conjunction with user community; will continue to mature tactical behaviors and intruder analysis technologies using data collected from field experiments, semi-autonomous perception, intrinsic mobility; and will begin integration of ART subsystems into test platform or demonstrator in preparation for final exit criteria field evaluations.	4566	13785	13526
Technology for HRI in Soldier - Robot Teaming: In FY06, through simulation and field experimentation, perform iterative data collection and modeling of Soldier and robot interactions; conduct simulation and experimentation for handoff of mounted to dismounted unmanned systems control; begin addressing safe operations around humans for UGV's; transition models, data and documentation to FCS. In FY07, based on FY06 experimentation results, will draft guidance for design of Soldier-robot teaming interaction and performance; will model Soldier-robot team performance and improved and validated Soldier-robot interactions; will integrate developed hardware/software onto existing manned and unmanned platforms to include ART program and conduct simulation and field experimentation to validate teaming and safe operations models and software algorithms; will transition models, algorithms, data and documentation to FCS.	0	1955	4059
Total	11545	18740	17585

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**53G**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
53G	FUTURE COMBAT SYSTEMS (FCS)	103218	40568	25331	29442	27117	0	0

A. Mission Description and Budget Item Justification: Although the Future Combat Systems (FCS) program transitioned into the System Development and Demonstration phase in May 2003, maturing, demonstrating and transitioning enabling technologies to FCS remains a priority for Army S&T. This project funds the Army's share of the Army/DARPA collaboration on Enabling Technologies for FCS. Funds in this project are executed in collaboration with DARPA for selected collaborative projects focused on enabling and enhancing FCS capabilities and are executed by DARPA in accordance with project-specific Memoranda of Agreement. When mature, technologies developed under this project will be available for transition into the FCS acquisition program to enable objective capabilities. Major efforts include the following: Unmanned Ground Combat Vehicle (UGCV)/PerceptOR Integration (UPI), which matures and demonstrates an Armed Robotic Vehicle (ARV) with advanced sensors to enable agile, tactical performance and reduce ARV development risk; Affordable Adaptive Conformal Electronically Scanned Array Radar (AACER), which demonstrates a high resolution Ground Moving Target Indicator/ Synthetic Aperture Radar (GMTI/SAR) to provide FCS all weather, tactical surveillance and tracking of ground targets and dismounts; Multi-cell and Dismount (M&D) Command and Control (C2), which demonstrates software and handheld C2 situational awareness and decision aid displays and conducts field experiments to demonstrate benefits of real time battlefield awareness; Organic Air Vehicle (OAV), which demonstrates ducted fan technology for Class II unmanned air vehicle (UAV) including a demonstration of Class II mission equipment package; Micro Air Vehicle (MAV) Advanced Concept Technology Demonstrator (ACTD), which demonstrates the utility of an affordable, man-portable, and responsive reconnaissance and surveillance UAV that fits into a backpack; Jigsaw, which demonstrates three dimensional Laser Radar (LADAR) for day or night detection and identification of hard-to-find targets through foliage or camouflage; Foliage Penetration (FOPEN) Reconnaissance, Surveillance, Tracking and Engagement Radar (FORESTER), which demonstrates an airborne FOPEN ultra high frequency GMTI radar to detect and track small and medium size moving targets; WolfPack, which demonstrates a small sensor package capable of long duration and having multi- delivery options, for unattended, networked ground sensor/jammer capabilities that will enable signal detection of low power, low probably intercept/low probably detection threat signals and provide for interruption via blanket or precision electronic attack; Mobile Network Multiple Input Multiple Output (MIMO) (MNM), which demonstrates a mobile MIMO radio network in a legacy radio form factor; Sensor DART, which demonstrates earth-penetrating unmanned ground sensor (UGS)darts that are dispensed from a glider released from an airborne platform or launched from a ground platform; Electromagnetic (EM) Mortar, which demonstrates an EM launch capability for large caliber mortar-type weapons; DP-5X, which demonstrates an alternative Class-III UAV utilizing a multifunctional vertical take off and landing (VTOL) UAV design; and Air Assault Expeditionary Force experiment (AAEF), which demonstrates tactical vertical maneuver of mounted forces enabled by emerging C4ISR and other promising technologies with live forces in a field environment. 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 managed by DARPA, Arlington, VA. Expanded description of these efforts may be found in the DARPA R2 Exhibits.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05: AACER - evaluated preliminary system designs, production cost estimates, and results from critical antenna technology demonstrations and selected best design(s); AAEF - integrated enhanced surrogate network technologies (sensors, battle command tools, robotic elements) into live combat environment; DP-5X - performed flight test demonstrations with 75lb. payload and waypoint navigation; EM Mortar - conducted exploratory laboratory demonstrations of EM coil and rail technology; FORESTER - designed, assessed and evaluated a brassboard hardware system; Jigsaw - conducted critical design review and began demonstrator fabrication; MAV - conducted demonstrator flight tests and selected a diesel engine design; MNM - fabricated competitive demonstrator hardware,	103218	0	0

validated concept with field demonstration of the Mobile Ad Hoc Network and custom wideband RF/signal processing designs; OAV - conducted preliminary design review for concept and began design of demonstrator; Sensor Dart - performed preliminary design review and fabricated demonstrator hardware; UPI - evaluated and tested algorithms with a UGCV mounted weapon system; WolfPack - refined and improved demonstrator design based on initial demonstrations.			
In FY06, AACER - complete fabrication of demonstrator modules and perform subsystem tests, system integration, and rooftop tests; AAEF - execute a full scale experimental demonstration; DP-5X - will perform flight demonstration tests with weapons payload and demonstrate potential operational scenarios; FORESTER - design, assess, and evaluate form-fit-and-function demonstrator hardware system for rotorcraft installation and demonstrate end-to-end system performance tests that include aircraft effects under static and dynamic conditions; Jigsaw - complete fabrication of demonstrator equipment and demonstrate active 3-D imaging for hard-to-identify targets; MAV - complete flight-testing and experimentation with 25th ID; MNM - perform 2-node demonstration tests; OAV - conduct critical design review and begin demonstrator fabrication; Sensor Dart - complete demonstrator fabrication and perform flight demonstrations; UPI - select ARV weapon payload and conduct initial demonstration testing of two platforms;; WolfPack - demonstrate threat sensor/jammer capabilities as part of the FCS C4ISR structure.	0	40568	0
In FY07, AACER - will fabricate optimized integrated airborne system and perform ground performance demonstrations; AAEF - will perform operational assessment of warfighting utility of FCS enabling technologies and concepts, in an operational environment, via experimentation with surrogates and mature demonstrator hardware/software. MNM - will perform 10-node demonstration tests on improved MIMO hardware/software demonstrator; OAV - will perform demonstrator ground and flight tests; UPI - will conduct full-up demonstration of enhanced capability sensors on two UGCV platforms.	0	0	25331
Total	103218	40568	25331

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technolo**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		9540	12880	10851	10550	6052	6210	6060
257	DIGITAL BATTLEFLD COMM	0	986	0	0	0	0	0
588	HIGH ALTITUDE AIRSHIP ACTD	274	2957	0	0	0	0	0
592	SPACE APPLICATION TECH	9266	8937	10851	10550	6052	6210	6060

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates advanced technologies for space applications that benefit the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. It provides Space Force Enhancement applications for intelligence, reconnaissance, surveillance, target acquisition, position/navigation, missile warning, ground-to-space surveillance, and command and control capabilities. Advanced Space Force Enhancement technologies include electro-optical, infrared, multi/hyperspectral, synthetic aperture radar, and advanced data collection, processing and dissemination in real and near real time. Project 588 funds the High Altitude Airship (HAA) Advanced Concept Technology Demonstration (ACTD), which matures technologies to enable a "near space" application. HAA technologies include airship structure, propulsion, flight control, and power generation required to carry heavy multi-mission payloads in an airship that has long dwell time at altitudes up to 65,000 feet. Project 592 funds the Space Applications Technology effort, which develops algorithms that optimally process space sensor data in real and near real time for integration into battlefield operating systems and demonstrates, evaluates, and defines Army technical requirements for space platform/sensor/datalink systems development. This project also provides space advanced technology risk reduction capability for ground-to-space surveillance and system development. 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 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 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technolo**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	9544	12066	11040
Current BES/President's Budget (FY 2007)	9540	12880	10851
Total Adjustments	-4	814	-189
Congressional Program Reductions		-56	
Congressional Rescissions		-130	
Congressional Increases		1000	
Reprogrammings	-4		
SBIR/STTR Transfer			
Adjustments to Budget Years			-189

One FY06 Congressional add totaling $1000 was added to this PE.

FY06 Congressional add with no R-2A (appropriated amount is shown):
($1000) Communications and Electronics Cost Module (CECM)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technolo**	**588**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
588 HIGH ALTITUDE AIRSHIP ACTD	274	2957	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project validates and demonstrates the technology, engineering feasibility and potential military utility of a large unmanned, helium filled airship within an Advanced Concept Technology Demonstration (ACTD). The High Altitude Airship (HAA) ACTD will demonstrate capabilities to fly un-tethered at 65,000 feet, carry a heavy multi-mission payload, self deploy from continental United States (CONUS) to worldwide locations, and remain on-station for weeks to months before returning to a fixed launch and recovery area in CONUS for service on the ground. HAA technologies will focus on airframe structures and related components to carry payloads which augment space-based capabilities and missile defense architectures. The airship payload will consist of a communication relay and sensor suite to support the Future Force. Other agencies providing additional support and funding include Missile Defense Agency, and the Office of the Secretary of Defense. 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 PE is performed by the US Army Space and Missile Defense Technical Center in Huntsville, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
In FY05, these funds constituted the Army's contribution to the HAA ACTD which was terminated based on several high risk technical challenges and significant cost overruns.	274	0	0
In FY06, funding being reprogrammed to complete (Army/Airforce) Joint Warfighting Space/Tactical Satellite cooperative payload development for demonstration with direct satellite tasking and satellite mission downlink capabilities.	0	2957	0
Total	274	2957	0

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technolo**	**592**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
592 SPACE APPLICATION TECH	9266	8937	10851	10550	6052	6210	6060

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced space technology applications in support of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. It provides Space Force Enhancement applications for intelligence, reconnaissance, surveillance, target acquisition, position/navigation, missile warning, and Space Situational Awareness by ground-to-space surveillance, and command and control capabilities. Advanced Space Force Enhancement technologies include electro-optical, infrared, multi/hyperspectral, synthetic aperture radar, and advanced data collection, processing and dissemination in real and near real time. The project develops algorithms that optimally process space sensor data in real and near real time for integration into battlefield operating systems; and demonstrates, evaluates, and defines Army technical requirements for space platform/sensor/datalink systems development. This project provides space advanced technology risk reduction capability for ground-to-space surveillance and systems development. 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 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 2005	FY 2006	FY 2007
Distributed Imaging Radar Technology - In FY05, verified the algorithms; detected and located moving targets using distributed radar and space-time coded aperture waveforms; and initiated miniaturization of high fidelity and stabilized radar receiver/exciter hardware for Upper Tier and space platform application. In FY06, verify algorithms for distributed array implementation of Moving Target Indication (MTI) and integrate radar component for distributed aperture demo with precise time synchronization. In FY07, will field demonstrate and evaluate the distributed aperture radar brassboard with wide area MTI and imaging of moving targets; Will modify software and refine algorithms based on analysis of demonstration results.	4120	6368	6154
All Weather Radio Frequency (RF) Launch Detection - In FY05, assessed theater rockets, artillery, mortars signatures for ordnance events; initiated characterization algorithm development and RF receiver requirements for real time processor applications. In FY06, initiate development of detection, location and classification algorithms and demonstrate feasibility for rockets artillery and mortars. In FY07, will initiate RF receiver breadboard fabrication to implement the baseline algorithm; will mature algorithms and expand threat set; will assess system receiver hardware requirements to extend field of view for increased detection range.	2146	1369	2297
Ground Based Space Surveillance - In FY05, initiated baseline algorithm improvements for an adjunct mobile data processor to a ground sensor. In FY06, continue to reduce algorithm processing timelines and initiate new threat signature development; initiate netted sensor hardware and software development. In FY07, will complete expanded threat set signature and processing efforts and integrate hardware/software and demonstrate adjunct mobile data processor with ground sensor.	500	1200	2400
Joint Warfighting Space/Tactical Satellite - In FY05 cooperatively developed Hyperspectral Imaging payload development with Air Force Research Laboratory to demonstrate Joint Warfighting Space/Tactical Intelligence, Surveillance and Reconnaissance (ISR) needs with in-theater satellite tasking and satellite mission downlink capabilities.	2500	0	0
Total	9266	8937	10851

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603007A - Manpower, Personnel and Training Advanced Technolo**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		8390	10235	6794	6336	6383	6395	6479
792	Personnel Performance & Training	7433	6687	6794	6336	6383	6395	6479
79A	Personnel & Training Adv Tech Initiatives (CA)	957	3548	0	0	0	0	0

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 develops, matures, and demonstrates (1) technologies to assess how Soldiers and units are impacted by mission, policy, or program changes; (2) training techniques that will enable Soldiers to take full advantage of advances in technology and systems as they evolve and that will help the Army attain its goals of embedded training in future combat systems; and (3) strategies and tools to enhance leader development so younger leaders have tactical and strategic capabilities and can easily adapt to changing mission demands. In addition, this program also 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). 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). This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603007A - Manpower, Personnel and Training Advanced Technolo**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	8070	6783	7024
Current BES/President's Budget (FY 2007)	8390	10235	6794
Total Adjustments	320	3452	-230
Congressional Program Reductions		-45	
Congressional Rescissions		-103	
Congressional Increases		3600	
Reprogrammings	320		
SBIR/STTR Transfer			
Adjustments to Budget Years			-230

Two FY06 Congressional adds totaling $3600 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($2100) Battle Command Team Training Program Phase II
($1500) Modeling and Simulation Technologies for Homeland Defense/Security Training

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603007A - Manpower, Personnel and Training Advanced Technolo**	**792**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
792 Personnel Performance & Training	7433	6687	6794	6336	6383	6395	6479

A. Mission Description and Budget Item Justification: The objective of this project is to develop, 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 Force. The project, where feasible, exploits opportunities to enhance Current Force capabilities. Advanced technology development efforts include: developing and demonstrating training methods and techniques that prepare battle commanders to effectively operate in digitized, networked environments and that will enable the use of embedded training technologies envisioned for the Future Combat System (FCS) and future command and control (C2) systems; devising strategies to use distributed and game-based technologies for effective multi-site training, assessment, and feedback; developing improved tools for selecting personnel for flight training; and developing tools that capitalize on the various synthetic environments that will facilitate the advancement of leader knowledge, skills, and abilities (KSAs), and that can provide "virtual mission experiences" to leaders earlier in their career development cycle to foster cognitive flexibility, adaptability, and mission readiness. In addition, this project develops techniques to determine the effects of policy changes (such as personnel stabilization) and operational changes (such as increased number and length of deployments) on unit cohesion and Soldier retention. This program leverages and coordinates with work at the Institute for Creative Technologies (ICT), Simulation and Training Technology Center (STTC), and Communication-Electronics Research Development & Engineering Center (CERDEC). Work in this PE is related to and fully coordinated with efforts funded in PE0602785. 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). This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Personnel Technology: In FY05, identified factors influencing small-unit cohesion in a stabilized personnel (unit) environment; assessed the impact of operational tempo on Soldier attitudes and retention; and developed prototype selection tools to improve the aviator selection process. In FY06, continue longitudinal (i.e., over time) data collection to assess impact of personnel stabilization and conduct trend analyses to identify most critical factors that influence small unit cohesion; develop a preliminary model of the effects of operational tempo on Soldier readiness and retention; and design new test battery to select individuals for Army flight training. In FY07, based on trend analysis of longitudinal research findings will document and provide lessons learned to DCS G-1 and HRC for improving the personnel stabilization process; will continue the analysis of factors that affect Soldier and leader attitudes and retention; will validate new tests for selecting individuals for Army flight training.	2391	2274	1087
Training Technology: In FY05, assessed prototype training support packages for selected leader, staff, and unit C2 skills; demonstrated prototype tools to manage and adapt training for changing unit requirements; and identified and documented design variables likely to impact the training effectiveness of single-user immersive interactive simulations. In FY06, analyze performance requirements and refine training and performance support products needed in an initial technology spin out of Future Force C2 capabilities to the Current Force; and evaluate an initial learning model and assessment methods to determine the effectiveness of single-user immersive training technologies. In FY07, will refine prototype training and performance support products to support initial spin out experiments designed to accelerate the fielding of network-enabled battle command training capabilities prior to complete system fielding; and will refine and validate a learning model and the metrics used for assessing training effectiveness of multi-player immersive interactive simulations.	1917	2741	3329
Leader Development Technology: In FY05, evaluated web-based modules for training selected critical thinking skills; developed	3125	1672	2378

prototype vignettes for teaching interpersonal communication skills; identified small group modifications to the "Think Like a Commander - Excellence in Leadership" (TLAC-XL) program and demonstrated preliminary computer-based coaching techniques for leader development (cooperative effort with the Institute for Creative Technologies (ICT)). In FY06, evaluate three additional critical thinking modules online; refine leader performance measurement for the Future Force; and evaluate and fine-tune Special Operations leader development products and tools for their application to conventional forces. In FY07, will refine online instruction and diagnostic tools to enhance leader self awareness in the Future Force; and will field test a package of training approaches to create agile, self-aware junior leaders.			
Total	7433	6687	6794

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		58185	60515	44022	37663	37780	43456	41175
TR1	TAC C4 TECHNOLOGY INT	17567	21714	22319	13993	13215	16277	14365
TR2	DIGITAL BATTLEFLD COMM	33336	28845	21703	23670	24565	27179	26810
TR8	C3 DEMONSTRATIONS (CA)	7282	9956	0	0	0	0	0

A. Mission Description and Budget Item Justification: The goal of this PE is to provide enabling 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 will be 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 will investigate and leverage external communication technologies and combine 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 Future Combat System (FCS) Brigade Combat Team (BCT) and 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.

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 PE contains no duplication with any effort within the Military Departments and 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 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	57662	45322	48050
Current BES/President's Budget (FY 2007)	58185	60515	44022
Total Adjustments	523	15193	-4028
Congressional Program Reductions		-792	
Congressional Rescissions		-615	
Congressional Increases		16600	
Reprogrammings	523		
SBIR/STTR Transfer			
Adjustments to Budget Years			-4028

Seven FY06 Congressional adds totaling $16600 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1500) Advanced Antenna Technologies
($6500) Applied Communications and Information Networking (ACIN)
($1700) Joint Unified Maritime Protection System (JUMPS)
($2500) Portable and Mobile Emergency Broadband System
($1700) Rock Drill Battlefield Planning Tool
($1700) Soldier/Sensor Intrusion Detection
($1000) TACOM Software Tools Supporting Structural Assessment of Wheeled Vehicles

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**	**TR1**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
TR1	TAC C4 TECHNOLOGY INT	17567	21714	22319	13993	13215	16277	14365

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 will enable commanders and individual soldiers to survive and fight by providing secure, reliable, mobile communications network solutions that function in complex and diverse terrain. The Joint Tactical Radio System (JTRS) Squad-Level Communications program matures and demonstrates communications technology to provide a JTRS Software Communications Architecture (SCA) Soldier Radio Waveform (SRW). This effort addresses communications connectivity and network interoperability between dismounted Soldiers and Future Combat System (FCS) Brigade Combat Team (BCT) manned and unmanned systems under the size, weight, power consumption, and safety constraints of embedded JTRS Cluster 5 Small Form Fit (SFF) platform environments. Antenna Technologies will develop 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 and improved survivability. The Tactical Wireless Network Assurance (TWNA) program provides network protection for mobile wireless ad hoc networks and provides safeguards against modern network attacks. It provides network assurance through enhanced net access controls. It also focuses on wireless intrusion detection to detect unauthorized access attempts. The program matures and demonstrates mobile data security solutions and protection of secure database elements. TWNA leverages and matures a variety of security efforts from DARPA and the Army Research Lab (ARL). The Proactive Integrated Link Selection for Network Robustness effort matures and integrates technologies to provide automatic link selection that address challenge of limited network connectivity due to an inability to optimally use all available communication link types The Communications Planner for Operational and Simulation Effects with Realism (COMPOSER) program will mature 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 will provide an open and scalable communications planning solution for dynamic OTM networks, providing the commander with the ability to ensure full network connectivity throughout the battle.

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

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- JTRS Squad-Level Communications: In FY05, completed development of Software Radio Waveform (SRW) software for Non-Line of Site Launch System and Dismounted Soldier applications; fabricated and assembled 102 software defined radio(SDR) prototypes supporting Radio Frequency (RF) operation across 225-960 MHz band; validated communications system design demonstrating interoperability between manned and unmanned systems; characterized system performance of integrated SRW voice and data network communications services; demonstrated a 85 node SDR network in mounted, dismounted and unattended operational environments which included the employment of actual troops, training, tactics and procedures at the C4ISR OTM experiment. In FY06, deliver initial release of SRW application software to JTRS JPEO for porting to JTRS Clusters 1 and 5 target operating environments to support Future Combat	8550	11000	10000

System (FCS) Brigade Combat Team (BCT) Spin Out #1 system integration; mature hardware to extend RF operation of radio prototypes in the 1350-2500 MHz band for aeronautical mobile applications; continue SRW spiral development to extend software application for FCS unmanned aerial vehicle and unmanned ground vehicle applications to support teleoperations/navigation, ISR data transport, and communications relay services; develop compatible interface with JTRS heterogeneous network services for Joint interoperability; participate in Future Force Warrior (FFW) ATD and FCS BCT Spin Out #1 experimentation. In FY07, will complete SRW voice and data communications services for Dismounted Soldier applications; will develop compatible interface to JTRS network management support application; will participate in follow-on FFW ATD and FCS BCT Spin Out #1 experiments; will deliver final release of SRW software application to JTRS JPEO for porting to JTRS Cluster 1 and Cluster 5 and for JTRS Software Communications Architecture certifications.			
- Antenna Technologies: In FY05, performed technical evaluation and integration for Multiband Phased Array antenna technologies to maintain OTM SATCOM links over rolling terrain; conducted evaluation of body wearable antenna prototypes and down selected to best designs; matured the body-wearable, aviation and low profile antennas to improve performance and conduct radio frequency (RF) performance; conducted RF safety evaluation. In FY06, complete development of Wideband Networking Waveform (WNW) high gain antennas and conduct test; evaluate tri-band antennas with improved gains and reduced form factors; develop a diplexer to couple a fourth waveform to the tri-band antenna; complete live fire evaluation of ballistic radome and improve gain of survivable low profile antenna and test antenna prototypes. In FY07, will improve gain performance of WNW high gain single antenna solution; will conduct test/demonstration of prototype WNW high gain antennas; will mature Ka band power amplifier (PA) material and initiate design PA module for directional antennas.	2858	4880	3248
- Tactical Wireless Network Assurance (TWNA): In FY05, matured and evaluated Tactical Public Key (TPK) enabling technologies to ensure secure user access to platforms and services; matured and tested wireless intrusion detection technologies to detect cyber attacks against distributed mobile hosts and networks; demonstrated Group Key Management protocol in mobile ad-hoc field environment. In FY06, provide intrusion detection algorithms for FCS BCT to deter intruders and recognize attempts to attack/exploit Mobile Ad-hoc Networks (MANETs); mature and test TPK enabling capabilities in a simulated MANET environment. In FY07, will mature intrusion detection system framework and integrate with FCS security management capability; will mature certificate revocation capability within TPK framework to reduce impact of security overhead on MANETs; will provide demonstration encapsulating matured wireless security capabilities; will provide Tactical Public Key enabling technologies to FCS/WIN-T.	3345	3843	5044
- Proactive Integrated Link Selection for Network Robustness: In FY05, completed initial system architecture design and development of planning mode link selection technologies; conducted modeling & simulation (M&S) effort to support link selection development efforts. In FY06, perform initial implementation of planning mode link selection algorithms; perform M&S and provide initial performance results. In FY07, will conduct integration of components of planning mode link selection algorithms onto prototype hardware/software platforms; will mature system architecture to include deploy mode link selection technologies; will conduct M&S of deploy mode link selection algorithms.	2814	1991	3183
- Communications Planner for Operational and Simulation Effects with Realism (COMPOSER): In FY07, will integrate COMPOSER technologies to interface with applications from the Project Manager Warfighter Information Network-Tactical (PM WIN-T). Work on this program is also done in 62782/H92.	0	0	844
Total	17567	21714	22319

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**	**TR2**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
TR2 DIGITAL BATTLEFLD COMM	33336	28845	21703	23670	24565	27179	26810

A. Mission Description and Budget Item Justification: 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. 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 two 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; and 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. Several key programs support these goals. The C4ISR OTM experiment provides a venue for the experimentation of emerging C4ISR technologies and architectures that will increase the survivability and lethality of Future Force platforms. The experiments will expand both the functionality and complexity of the integrated C4ISR system-of-systems, including the participation of Joint, Current, and dismounted elements experiments align with Army Transformation critical objectives for C4ISR, and exploit opportunities to enhance Current Force (e.g. Stryker BCT) modernization. Adaptive Joint C4ISR Node (AJCN) ACTD for mobile airborne communication nodes seeks to provide assured communications and also has the capability to perform signals intelligence, information warfare and electronic attack missions simultaneously. The Protective Integrated Link Selection for Network Robustness effort will integrate automatic link selection algorithm components in support of future TRL 6 field testing. The Command, Control and Communications (C3) OTM Network Mining matures and demonstrates network technologies that exploit and fuze existing data on the network to enable critical combat functions such as countermine/counter Improvised Explosive Devices (IED), rapid Battle Damage Assessment (BDA), targeting/retargeting, and Combat Identification (CID). Radio Enabling Technologies and Nextgen Applications (RETNA) matures and demonstrates affordable radio components and enabling technologies to reduce Joint Tactical Radio System (JTRS) programmatic risk and improve performance reliability. Antenna technologies will be pursued that and will develop a family of mission tailored antennas for ground vehicles and for the Soldier. The ground vehicle antennas efforts will focus on high gain antennas to sustain Wideband Network Waveform (WNW) link connectivities, affordable On-the-Move (OTM) directional antenna technologies to reduce visual signature on ground platforms, and multi-band antennas that consolidate multiple waveforms using a single antenna to reduce the number of platform antennas. Soldier antenna efforts mature and integrate conformal, lightweight antennas within the soldiers' protective combat wear for suppressed equipment visual signatures, improved mobility and improved survivability.

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, 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 2005	FY 2006	FY 2007
- C4ISR On-The-Move Experiment: In FY05, conducted a series of experiments, in a fully instrumented, relevant operating field environment, to assess the increased force effectiveness of providing emerging C4ISR capabilities to a platoon size unit; demonstrated over 40 C4ISR enhanced capabilities including: 85 node software defined radio network operating the solder radio waveform (SRW), aerial communications relays, satellite communications reachback, a distributed unattended ground sensor system, and Force XXI Battle Command, Brigade-and-Below (FBCB2) battle command soldier interfaces; evaluated and provided resultant data against Future Combat	10000	12758	12013

System (FCS) Brigade Combat Team (BCT) C4ISR risks. In FY06, conduct experiments to determine the impact of: (1) FCS BCT Spiral 1 network performance; (2) battle command interface functionality and decision aids, (3) how information quality is impacted by varying the number and types of sensor suites; different fusion processing techniques, and information dissemination architectures; and (4) how information affects leadership decision making and mission execution, on multiple variations (real and simulated) of Current and Future BCT platoon-sized reconnaissance units. In FY07, will conduct experiments with various platoon-sized infantry units to explore, observe, measure and quantify: (1) cross-domain and multi-level security communications, (2) networked unattended ground and air vehicles utilizing SRW for communications and data dissemination, (3) playing electronic attack capabilities to observe network performance vulnerabilities in a jamming environment, (4) on-the move distributed fusion for Distributed Common Ground System - Army spirals, (5) company to higher-level organization battle command interoperability addressing FCS BCT to Net-Centric Enterprise Services (NCES) service-oriented architecture issues, and (6) network-aware battle command application analysis.			
- Adaptive Joint C4ISR Node (AJCN) ATCD: In FY05, matured payload functionalities, completed payload integration, installed payloads and antennas on the Air Force's Paul Revere and two Army Hunter aircrafts; conducted flight tests to verify operation of payload and AJCN network at first Joint Military User Assessment exercise. In FY06, conduct Extended User Evaluation (EUE) flights and provide sustainment support for leave behind equipment and support transition initiatives. In FY07, will complete EUE and sustainment for leave behind equipment.	8850	1950	1120
- Proactive Integrated Link Selection for Network Robustness: In FY06, conduct controlled environment testing/demonstration of stand-alone link selection algorithms. In FY07, will mature planning mode components; will implement deploy mode link selection algorithms; will mature interfaces and begin design of necessary interactions amongst link selection algorithms.	0	1922	2080
- C4ISR Network Mining: In FY06, mature algorithms, intelligent agent technologies and decision aids that exploit individual and combined network sources to enhance countermine/counter improvised explosive devices and rapid battle damage assessment; validate methodologies in the context of the C4ISR OTM experimentation. In FY07, will mature and demonstrate networked target identification and situation awareness for improved combat identification at the C4ISR OTM experiment.	0	3865	4058
- Radio Enabling Nextgen Applications (RETNA): In FY06, identify, evaluate, and adapt emerging commercial technologies for military application to Cluster 5 Manpack and embedded Wideband Power Amplifiers (WBPAs); apply thermal management technologies that efficiently transfer unwanted heat from targeted hot spots in JTRS radios. In FY07, will evaluate functional, integrateable, and operationally suitable products; will validate performance of thermal management technology via testing and analysis of Cluster 5 WBPAs' environmental performance.	0	607	1412
- Antenna Technologies: In FY06, evaluate vest antenna prototypes and down-select to best designs for integration into FFW soldier ensemble; mature body wearable antennas to meet Ground Soldier System JTRS Cluster 5 requirements; conduct M&S of body wearable antenna designs & specific absorption rates for safety assessment. In FY07, will complete development and conduct test/demonstration of body wearable antenna prototypes for Ground Solider System/Cluster 5.	0	1450	1020
- Networked Sensors for the Future Force (NSFF) Communications: In FY05, simulated a 100 node network to determine large sensor network effectiveness; integrated and tested a 50-node network to demonstrate sensor network capabilities and to validate the simulation; demonstrated communications range 200-400m and sensor connectivity of 3-10km depending on sensor type and terrain; integrated Soldier Level Integrated Communications Environment radio hardware running JTRS compliant Soldier Radio Waveform (SRW) with tactical sensors and command and control software for the NSFF Advanced Technology Demonstration at Fort Knox.	3946	0	0
- Applied Communications & Information Networking (ACIN): In FY05, this one year Congressional add matured and demonstrated commercial communications technologies in the areas of high power wideband amplifiers, Ku/Ka-Band SATCOM subsystem transceiver	10540	0	0

modules, predictive network planning, IPv4 to IPv6 conversion, and software defined radios modeling and simulation. No additional funds are required to complete this effort.			
- Applied Communications & Information Networking (ACIN): In FY06, this one year Congressional add is to mature and demonstrate commercial networking and communications technology in the areas of intelligent agents across mobile networks, air-ground unmanned vehicle collaboration, real time change detection, and modeling and simulation for communications/network planner. No additional funds are required to complete this effort.	0	6293	0
Total	33336	28845	21703

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	26888	27927	18296	20319	20436	20700	20973
HB5	IMMERSIVE ENVIRONMENTS DEMONSTRATIONS (CA)	2396	2464	0	0	0	0	0
S28	INSTITUTE FOR CREATIVE TECH (ICT)-Adv Tech Dev	1571	5069	5310	5321	5320	5427	5535
S29	MODELING & SIMULATION - Adv Tech Dev	2784	1485	1720	3803	3923	4007	4091
S31	MATREX	12950	13142	11266	11195	11193	11266	11347
S33	TRAINING AND SIMULATION SYSTEMS INITIATIVES (CA)	7187	5767	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element 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) will demonstrate a framework for future embedded training and simulation systems for the FF to include Future Combat Systems (FCS) and dismounted warrior systems. The MATREX project (S31) develops and demonstrates the overarching M&S architecture that facilitates force-on-force modeling, supports the play of systems models, and provides access to measures of effectiveness. The MATREX project will also enable interoperable component engineering-level simulations and models that conform to the architecture specification to support and augment testing and training of the FF. Projects HB5 and S33 fund Congressional special interest items. Work in this program element is related to and fully coordinated with efforts in PE 0602308A, Project C90 (Advanced Distributed Simulation); PE 0602308A, Project D02 (Modeling and Simulation for Training and Design); and PE0601104A, Project J08 (Institute for Creative Technology). This work does not duplicate an effort within the military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). Work in this PE is performed by the Research Development and Engineering Command (RDE Command), Simulation and Training Technology Center, Orlando, FL, and Fort Belvoir, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	26900	19982	20710
Current BES/President's Budget (FY 2007)	26888	27927	18296
Total Adjustments	-12	7945	-2414
Congressional Program Reductions		-123	
Congressional Rescissions		-282	
Congressional Increases		8350	
Reprogrammings	-12		
SBIR/STTR Transfer			
Adjustments to Budget Years			-2414

FY 07 decrease of -2.4 million attributed to realignment of funding to higher priority requirements.

Four FY06 Congressional adds totaling $8350 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($4000) CAVE Automatic Virtual Environment - Desert Research Institute
($2500) Institute for Creative Technologies Joint Fires and Effects Trainer System
($1350) Medical Combined Arms Tactical Trainer - Hospital Based (MedCATT-HB)
($500) Vigilant Auto ID and Access Control System

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S28**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
S28	INSTITUTE FOR CREATIVE TECH (ICT)-Adv Tech Dev	1571	5069	5310	5321	5320	5427	5535

A. Mission Description and Budget Item Justification: This project will mature and demonstrate 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 will 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 PE will 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 will use advanced modeling, simulation, and leadership development techniques to leverage the emerging immersive technologies that are being created at the Institute of Creative Technologies (ICT) University Affiliated Research Center (UARC) at the University of Southern California to formulate training demonstrations that will have an emphasis on urban operations and asymmetric warfare. The ICT's collaboration with its entertainment partners and the Army Training and Doctrine Command (TRADOC) will create 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. This project was set up to enable transition of basic and applied research resulting from PE0601104A, Project J08 (Institute for Creative Technology) and PE 0602308A, Project D02 (Modeling & Simulation for Training & Design). 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 Research Development and Engineering Command (RDECOM), Simulation and Training Technology Center, Orlando, FL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Immersive Techniques - In FY05, integrated new algorithms and techniques for scenario development and execution into an immersive environment created for training. Developed the design for the single user environment that will integrate the techniques for coaching, mentoring and rapid scenario generation. In FY06, mature initiatives in artificial intelligence and immersive technologies that enable intelligent agent mentoring and coaching capabilities. Demonstrate a prototypical highly immersive multi-sensory environment that provides mixed reality (real and synthetic) objects for training and mission rehearsal. Mature the techniques and interfaces to support interoperability between the virtual human enabled immersive environment and the One Semi-Automated Forces system; develop single user immersive leaning environment prototype integrating techniques for coaching, mentoring and rapid scenario generation. Establish framework to insert cultural models into immersive environments to increase realism of training. In FY07, will demonstrate and assess the integration of rapid scenario development techniques, virtual humans and intelligent agent mentoring and coaching capabilities in a single user immersive simulation learning environment. Will develop the multi-user immersive leaning environment prototype that integrates the techniques for coaching, mentoring and rapid scenario generation. Will integrate cultural models into asymmetric immersive environment supporting training associated with the Global War on Terrorism.	1571	5069	5310
Total	1571	5069	5310

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S29**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
S29	MODELING & SIMULATION - Adv Tech Dev	2784	1485	1720	3803	3923	4007	4091

A. Mission Description and Budget Item Justification: This project will mature and demonstrate 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 systems to include the Future Combat System (FCS) and the dismounted warrior systems. This project will use 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 will enrich the Army's training capabilities and readiness. It will provide 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 will create 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 will contain 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 will provide Army units with a set of complementary embedded and deploy on-demand systems that provide just-in-time, dynamic, realistic training and mission rehearsal capabilities. Demonstrations will include technologies that form a framework for future training applications for the range of FCS operations such as robotic control and other sensor operations; mission planning and rehearsal; command, control, and maneuver; Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) network analysis to support distributed simulations; and vehicle system interface requirements. This project was established to transition basic and applied research from PE 0602308A, Project C90 (Advanced Distributed Simulation). 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 Research Development and Engineering Command (RDECOM), Simulation and Training Technology Center, Orlando, FL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Embedded Techniques. - In FY05, developed and demonstrated an integrated prototype of mounted and dismounted soldier embedded training systems for small unit training and mission rehearsal while identifying interoperability issues with embedded training for vehicles and dismounted soldiers. Developed mounted and dismounted embedded training system prototype with integrated dismounted command and control system to identify issues related to adding C2 into future embedded training designs. Developed and demonstrated an initial distributed embedded After Action Review and mission rehearsal demonstration supporting the network-centric warfare concept. In FY06, mature and demonstrate an integrated mounted and dismounted embedded training system that includes collaborative mission planning, rehearsal and After Action Review capabilities. In FY07, will create a fully embedded soldier prototype capability supporting future Soldier systems demonstrating a man wearable, integrated live, virtual, and constructive training and mission rehearsal capability. Will develop distributed simulation environment with asymmetric human behavior representation and complex environment conditions and initiate integration of asymmetric immersive environment with combat unit training and instruction to include coalition forces.	2784	1485	1720
Total	2784	1485	1720

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S31**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
S31 MATREX	12950	13142	11266	11195	11193	11266	11347

A. Mission Description and Budget Item Justification: This project provides the foundation for the Modeling Architecture for Technology, Research, and EXperimentation (MATREX) modeling and simulation (M&S) architecture which includes core integrated modeling and simulation architecture development efforts and associated collaborative environment and M&S component development efforts. The MATREX architecture integrates live, virtual, and constructive simulations in a distributed joint battle space. This enables the determination of the best and most cost effective system-of-systems designs as compared to individual component solutions. The integrated M&S architecture supports the examination of joint C4ISR concepts and system-of-systems solutions by facilitating studies and demonstrations that assess the operational impact of joint Network-Centric Warfare (NCW) force concepts through a simulation environment that adequately models the Current and Future Force (FF) tactical network systems, the information that flows through that network, and the impact of this information on force effectiveness. Efforts include the creation of a MATREX-enabled Distributed Virtual Laboratory (DVL) that will be used to conduct collaborative distributed simulation experiments, studies, and analyses to facilitate acquisition decisions using the Simulation and Modeling for Acquisition, Requirements and Training (SMART) process. The DVL also will support the development and selection of "best of breed" high-resolution engineering-level simulation model components to support the evaluation of Joint Forces and FF concepts to include Future Combat System (FCS) and dismounted warrior systems. Integration of high-resolution engineering-models within the MATREX architecture will provide the framework to operate a true multi-resolution environment that can scale to the FCS Brigade Combat Team (BCT) within the context of a Unit of Employment (UE), enhancing the user's ability to study the Measures of Effectiveness of interest. The DVL will network geographically dispersed M&S assets, and therefore reduce the Army's cost of developmental testing, integration, and experimentation. The DVL will provide a continuously available secure M&S environment that facilitates technical and subject matter experts working together from remote, distributed labs. The Cross Command Collaboration Effort (3CE) will establish a common development, training, and testing environment to support the development and evaluation of FCS for PM FCS BCT by leveraging the MATREX DVL to bring together the M&S and networks of RDECOM component organizations, Army Test & Evaluation Command (ATEC), and Army Training and Doctrine Command (TRADOC). 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 Research Development and Engineering Command (RDECOM), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Modeling Architecture for Technology, Research, and EXperimentation (MATREX). In FY05, delivered MATREX (classified) to Future Combat System Lead Systems Integrator (FCS LSI) establishing environment for Simulation Virtual Framework; established MATREX-enabled Distributed Virtual Laboratory among Army S&T Modeling & Simulation (M&S) community; established baseline simulation environment for Current Force Modularity, FCS Spin-Outs, and Future Force experimentation, integration, and evaluation; initiated support of M&S architecture interoperability development across RDECOM, ATEC, & TRADOC. In FY06, deliver MATREX to FCS LSI, FCS Program Office and TRADOC including incremental updates that implement and integrate Network Effects Command & Control capabilities and Human-Centered Information Distribution to support evaluation of Network Centric Warfare (NCW); support FCS development of Network, Effects, Maneuver, and ISR for current, future, and Spin-Out 1 by delivering simulation infrastructure and capability critical to the development of FCS Integration & Verification Phase I architecture and necessary to support critical FY06 and FY07 FCS LSI milestones; advance cross-Army M&S capability and re-use by maturing initial Common Object Model; provide capabilities to FCS LSI in direct support of the FCS Program; develop a transition plan toward an interoperable cross-command and LSI environment for M&S. In FY07, will transition interoperable environment and integrated tool suite to support TRADOC and ATEC; will	12950	13142	11266

integrate Maneuver Command & Control, Logistics, and environment capabilities; will deliver a capability that demonstrates end-to-end analysis in an environment that integrates NCW capabilities to support programmatic decisions throughout concept exploration, design, integration, logistics, and training.			
Total	12950	13142	11266

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603103A - Explosive Demilitarization Technology**	**D51**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
D51 Explosives Demil Tech	18397	21041	10376	10429	10651	11049	11270

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 400,000 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 by FY 2006-2010. 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 Demil's technical and programmatic support staff in this effort. The program supports the 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 IPT 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP) and the Defense Technology Area Plan (DTAP).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Resource Recovery and Reuse (R3): In FY 05, increased Near-Infrared (NIR) calibration library for propellants and performed field demonstration of NIR explosives detection unit; continued development of sporting powder formulations; optimized Explosive D conversion process; validated propellant conversion technology; completed design analysis of alternatives for missile demilitarization. In FY 06, continue development of calibration curves for the NIR propellant scanner; complete demonstration/validation of NIR explosives detection unit; continue conversion of gun propellant to small arms ammunition (SAA) propellant for military applications; transition Explosive D conversion process; complete validation of the propellant conversion technology for optimal throughput. In FY 07, will transition NIR explosive detection unit; will continue development of SAA propellant formulations. Will initiate optimization of propellant conversion technology, and will continue Joint Program integration.	5148	4583	4777
Advanced Destruction: In FY 05, incorporated performance enhancements to the stationary contained detonation technology (CDT) based on prior demonstrations; initiated permitting of transportable CDT. In FY 06, demonstrate/validate enhanced stationary CDT; continue permitting of transportable CDT. In FY 07, will transition stationary CDT; will initiate demonstration of transportable CDT; perform operability demonstration of confined burn technology.	786	1305	1166
Waste Stream Treatment: In FY 05, demonstrated enhanced Super Critical Water Oxidation (SCWO) technology; completed fabrication and initiated demonstration of Molten Salt Oxidation (MSO). In FY 06, validate SCWO technology; complete MSO validation and continue advanced development of MSO for explosives. In FY 07, will conduct extended demonstration and initiate transition of SCWO and MSO; initiate pilot demonstration of MSO for explosives.	1922	1099	1700

Advanced Munitions Disassembly: In FY05, initiated transition demonstration of robotic disassembly for the Area Denial Anti-personnel Mine (ADAM) projectile; optimized water jet cutting parameters for medium caliber projectiles. In FY06, complete demonstration/ validation of robotic disassembly for ADAM projectile; design and fabricate waterjet prototype for medium caliber projectiles. In FY07, will complete transition robotic disassembly of ADAM projectile and will initiate design for disassembly of 155mm RAP; will complete fabrication and initiate demonstration/validation of waterjet prototype for medium caliber projectiles; and will initiate advanced cutting for disassembly of CBUs/submunitions.	739	1309	1816
Advanced Removal: In FY05, optimized induction heating parameters for medium caliber projectiles. In FY 06, design and fabricate induction heating prototype for medium caliber projectiles. In FY 07, will complete fabrication and initiate demonstration/validation of induction heating prototype for medium caliber projectiles.	302	1265	917
The purpose of this Congressional add is to support an integrated Cryofracture/Plasma Arc capability. Design parameters will be tested with this funding. No additional funds are required to complete this project.	4500	2500	0
This one year Congressional add supported the Missile Recycling Center capability. No additional funds are required to complete this project.	1400	0	0
This one year Congressional add supported propellant conversion to fertilizer. No additional funds are required to complete this project.	1500	0	0
This one year Congressional add supported the Thin Layer Chromatography technology. No additional funds are required to complete this project.	2100	0	0
This one year Congressional add for Explosives Demilitarization Technology will focus on development of closed disposal technologies for munitions demilitarization. No additional funds are required to complete this project.	0	980	0
This one year Congressional add for the HMX Requalification Program will refine explosives recovery process and test the recovered explosives for reuse. No additional funds are required to complete this project.	0	1400	0
This one year Congressional add for NAVAIR Systems Command Data Conversion will need discription. No additional funds are required to complete this project.	0	1300	0
This one year Congressional add for the Western Area Demilitarization Facility will further development of closed disposal technologies, specifically for advanced incineration, size reduction and recycling of energetics. No additional funds are required to complete this project.	0	5300	0
Total	18397	21041	10376

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603103A - Explosive Demilitarization Technology**	**D51**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	18405	9865	10241
Current BES/President's Budget (FY 2007)	18397	21041	10376
Total Adjustments	-8	11176	135
Congressional Program Reductions		-92	
Congressional Rescissions		-212	
Congressional Increases		11480	
Reprogrammings	-8		
SBIR/STTR Transfer			
Adjustments to Budget Years			135

Five FY06 Congressional adds totaling $11480 were added to this PE.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603105A - MILITARY HIV RESEARCH**	**H29**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H29 MED PROTECT AGNST HIV	13545	13644	7042	7052	7175	6814	6944

A. Mission Description and Budget Item Justification: This project supports the medical technology area of the Future Force by conducting advanced technology development of candidate vaccines to include safety and efficacy in model systems and to prepare and conduct clinical studies. It funds human immunodeficiency virus (HIV) research to control the infection in military environments, protect the military blood supply, and protect military personnel from risks associated with infection. HIV research is focused on the following areas: diagnosis, natural history, epidemiology, and vaccine development. All HIV research is conducted in compliance with U.S. Food and Drug Administration (FDA) regulations and conducted under an Investigational New Drug (IND) application with the FDA. The FDA requires thorough testing in animals (referred to as preclinical testing) to assure safety and efficacy prior to approving controlled clinical testing of experimental (previously unproven in humans) 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 the FDA for evaluation to obtain approval 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 PE 0602787. 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 program element is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories. Most work is conducted under a cooperative agreement with the Henry M. Jackson Foundation (HMJF), Rockville, MD.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Medical Protection Against HIV: In FY05, continued to study a variety of vaccine technologies to assess their ability to impact HIV infection and disease: completed preclinical testing of a DNA vaccine that includes different type of gene strains coupled with a vaccine made by using a nonpathogenic, infective adenovirus into which HIV genes have been inserted; continued clinical efficacy trials of previously developed DNA Plasmid HIV vaccine(s) and began safety trial of a poxvirus based vaccine in East Africa; improved tests needed to assess HIV vaccine-induced immune responses; and continued to conduct a multicenter clinical study to investigate HIV drug resistance. In FY06, evaluate the immunogenicity/efficacy of best vaccine candidates in clinical safety and immunogenicity trials as appropriate, and other activities required for vaccine development and testing such as assay improvement, preclinical testing, field site development, preparation and submission of FDA required data packages. In FY07, will continue the next phases of clinical testing of the pox, adenoviral, and anthrax lethal factor based vaccines; and will continue development activities required to support vaccine development, clinical trial site development and assay improvement.	6354	6644	7042
HIV Research: This 1-year Congressional add funded additional research on, and preclinical testing, of a DNA-based vaccine candidate co-developed with the National Institute of Allergy and Infectious Diseases, as well as the preparation for clinical trials of this vaccine at several African field test sites requiring the establishment of clinics and laboratory facilities and training of personnel to conduct these trials.	7191	7000	0
Total	13545	13644	7042

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603105A - MILITARY HIV RESEARCH**	**H29**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	13552	6842	7131
Current BES/President's Budget (FY 2007)	13545	13644	7042
Total Adjustments	-7	6802	-89
Congressional Program Reductions		-60	
Congressional Rescissions		-138	
Congressional Increases		7000	
Reprogrammings	-7		
SBIR/STTR Transfer			
Adjustments to Budget Years			-89

One FY06 Congressional add totaling $7000 was added to this PE.

FY06 Congressional add with no R-2A (appropriated amount is shown):
($7000) Test, Treatment and Preventive Vaccines

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603125A - Combating Terrorism, Technology Development for**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		30427	10159	7497	8102	8280	8278	7761
DF1	SURVIVABILITY & DENIAL	3239	0	0	0	0	0	0
DF2	DETERRENCE, INDICATION & WARNINGS	400	0	0	0	0	0	0
DF3	CONSEQUENCE MANAGEMENT & RECOVERY	7764	3943	0	0	0	0	0
DF5	AGILE INTEGRATION & DEMONSTRATION	9024	6216	7497	8102	8280	8278	7761
DF6	RAPID EQUIPPING FORCE - ADV DEVELOPMENT	10000	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to mature and demonstrate advanced survivability technologies against asymmetric threats in support of the Future Force and, where feasible, exploit opportunities to enhance Current Force. This PE also 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 & 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. Projects DF2, DF3, and DF6 fund Congressional special interest items. 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. The cited work is consistent with Strategic Planning Guidance, Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this PE is performed by the U.S. Army Engineer Research and Development Center headquartered at Vicksburg, Mississippi and Research Development and Engineering Command (RDECOM), Ft. Belvoir, Virginia.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603125A - Combating Terrorism, Technology Development for**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	8034	6306	7399
Current BES/President's Budget (FY 2007)	30427	10159	7497
Total Adjustments	22393	3853	98
Congressional Program Reductions		-44	
Congressional Rescissions		-103	
Congressional Increases		4000	
Reprogrammings	22393		
SBIR/STTR Transfer			
Adjustments to Budget Years			98

FY 05 increase of $22.4M is attributed to $19.5 million in reprogrammings from OSD Iraqi Freedom Fund for Rapid Equipping Force, IED Detection, Suicide Bomber and FIDO/PACKBOT and an increase of +$2.9 million (after adjustment for Congressional Undistributed Reductions) for the reprogramming of a Congressional Add for Advanced Mobile Microgrid from PE 0603734A for proper execution.

Two FY06 Congressional adds totaling $4000 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($3000) Advanced mobile microgrid liquid fueler
($1000) Secure Commercially Interoperable Cell Phone Transmission System for Sensitive but Unclassified Information

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603125A - Combating Terrorism, Technology Development for**	**DF5**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
DF5	AGILE INTEGRATION & DEMONSTRATION	9024	6216	7497	8102	8280	8278	7761

A. Mission Description and Budget Item Justification: This project focuses on exploiting maturing technology development efforts at the Army Research Laboratory (ARL) and Research Development and Engineering Centers (RDECs) to address emerging or already identified warfighter requirements. This project would identify and work with Labs and RDECs to address the critical maturation issues necessary to make identified technologies viable candidates for transition to an operational environment. Short term maturation could include, but is not limited to, accelerating the technology development schedule and/or performing detailed safety & validation tests in field/operational environment testing to improve technology readiness. While not limited to this area, a major effort under this project supports the accelerated maturation of counter IED capabilities (detection, surveillance of deployment and disruption / destruction of threat) for transition into an operational environment. This effort is coordinated with the Joint IED Task Force and the Rapid Equiping Force (REF). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this project is managed by the US Army Research, Development and Engineering Command, Ft. Belvoir, Virginia.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Agile Integration and Demonstration Efforts (AIDE) - In FY06, in conjunction with the Army Labs, RDECs, and the U.S. Army Training and Doctrine Command, identify emerging requirements and capability gaps, assess technologies that fill capability gaps, prioritize potential solutions and mature technology efforts that may have direct impact on emerging warfighter needs that requires a short term (4 to 18 months) maturation prior to becoming a candidate for transition to operational use. AIDE funding enables selected projects to overcome critical maturation issues necessary to make identified technologies viable candidates for transition to an operational environment. Major efforts support the accelerated maturation of counter IED technologies, force protection efforts, and enhanced soldier capabilities. In FY07, will complete maturation, demonstration and evaluation of completing FY06 efforts in preparation of transition operational units. Will continue to assess new and emerging capability gaps and requirements to identify new technology maturation efforts designed to overcome the changing gaps and shortfalls.	0	6216	7497
Force Protection for GWOT - This one year reprogramming from the Iraq Freedom Fund funded a focused development effort to detect improvised explosive devices from a C-12 manned aircraft. In FY05, demonstrated a prototype infrared and television sensor to provide a near term manned aircraft improvised explosive device (IED) detection capability; demonstrated performance of a state of the art sensor package integrated with an ultra-stabilized gimbal, mounted on a C-12 aircraft that provided the required feature data to enable IED detection at > 20,000 ft daytime and > 9,000 ft nighttime; exploited on-board sensor data using an existing Change Detection Workstation; provided near real-time detection messages to convoys and ground forces on suspected IED emplacements.	4170	0	0
Suicide Bomber Detection and Interdiction for GWOT - This one year reprogramming from the Iraq Freedom Fund funded a focused development effort for suicide bomber detection. In FY05, focused on the standoff detection of explosives/weapons hidden under clothing, using thermal imaging and a unique application of millimeter wave (MMW) technology; optimized imaging bandwidth of MMW imager for maximum clothing penetration, development of target features to allow faster recognition by non-technical operators and its integration with multiple sensor modalities (thermal, spectral content and explosive trace detection) for suicide bomber personnel	3000	0	0

screening.			
FIDO PACBOT - The Fido Packbot is a robotic platform with an explosive material detector. In FY05, procured and evaluated ten Fido Packbot systems for effectiveness in locating explosive material associated with IEDs.	1854	0	0
Total	9024	6216	7497

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603238A - Global Surveillance/Air Defense/Precision Strike T**	**177**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
177 JT ALS PS DEMO	10280	11939	12995	13319	13524	14024	14129

A. Mission Description and Budget Item Justification: The Joint Programs Sustainment and Development (JPSD) Project Office, an element of the Program Executive Office, Intelligence, Electronic Warfare and Sensors, provides creative and innovative solutions to operational problems. In response to the requirements of Combatant Commanders and the Department of Defense, JPSD integrates maturing technologies, commercial hardware and software and new tactics, techniques and procedures to facilitate development of capabilities in the areas of Command, Control, Communications, and Computers (C4), and Intelligence, Surveillance and Reconnaissance (ISR). JPSD uses non-traditional acquisition approaches, such as Advanced Concept Technology Demonstrations, Simulation Based Acquisition, rapid prototyping, and other novel approaches to accelerate the maturation and transition of key capabilities to the Army Future Force and future elements of the Joint Warfighting Force. Theater Effects Based Operations (TEBO) will provide 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 will integrate computer-aided decision support tools, concepts, and procedures to provide a more comprehensive understanding of a given adversary and the environment. TEBO will help 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 will provide greater responsiveness and adaptability to better manage the rapidly changing situations of today's environment. TEBO will conduct a limited military utility assessment to determine the extent to which the EBO concept has been adopted and incorporated into their staff organization processes. TEBO assessment tools will be incorporated into USFK Theater Architecture. 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). The JPSD is a element of the Program Executive Office, Intelligence, Electronic Warfare, and Sensors (PEO IEW&S), Fort Monmouth, NJ. Work is done at JPSD, Ft. Belvoir, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Joint Intelligence, Surveillance and Reconnaissance (JISR) ACTD - FY05: - Completed sustainment support to respective service and joint C4ISR user warfighters of the JISR product delivered in FY04. Supported technology transition to programs of record; ASAS-L, CHIMS, AFATDS, C2PC, GCCS, DCGS-A, MCS-L and JC2. Deployed an additional two servers in support of OIF II/OIF III expanding our user base to the coalition partners. Maintained and upgraded the current set of JISR servers in support of operations and transition. Completed the ACTD.	7759	0	0
Interferometric Synthetic Aperture Radar (IFSAR) Mapping ACTD - FY05: Attempted to complete subassembly design, procurement, development integration and test for radome/antenna shroud, RF subsystem, transmitter, radar electronic assemblies 1 through 4, airborne and ground systems managers, and radar operator workstation. Project terminated due to insurmountable technical challenges and significant cost overrun. FY06: Complete contract close-out activities. Remaining funding being reprogrammed to offset business re-engineering efficiencies.	2521	5828	0
Theater Effects Based Operations (TEBO) - FY06 - Initiate Spiral III development phase of TEBO tools and CONOPS. Integrate effects based opeations (EBO) processes and tools into the USFK integrated mission architecture and standard operating procedures. Will conduct a limited military utility assessment focusing on measuring the extent to which the concept has been adopted across the staff organizations and incorporated into their processes by measuring the effectiveness of the process and the tools provided to facilitate that process. FY07 - Will conduct evaluations focusing on the enhanced understanding of an adversaries vulnerabilities and potential actions/reaction, while increasing the number of effects indicators tracked and analyzed. Continue CONOPS development. Participate in USFK and JFCOM exercises.	0	6111	12995

Total	10280	11939	12995

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603238A - Global Surveillance/Air Defense/Precision Strike T**	**177**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	10284	12111	12529
Current BES/President's Budget (FY 2007)	10280	11939	12995
Total Adjustments	-4	-172	466
Congressional Program Reductions		-52	
Congressional Rescissions		-120	
Congressional Increases			
Reprogrammings	-4		
SBIR/STTR Transfer			
Adjustments to Budget Years			466

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603270A - EW TECHNOLOGY**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		36347	22280	18612	18857	18898	19402	18780
K12	EW Demonstrations (CA)	8912	9661	0	0	0	0	0
K15	ADVANCED COMM ECM DEMO	2840	8068	9425	9468	9373	9451	9542
K16	NON-COMMO ECM TECH DEM	21242	4551	9187	9389	9525	9951	9238
K19	MULTIPLE INTEL REMOTED SENSOR SYSTEM - Blk 1	957	0	0	0	0	0	0
K20	SHORTSTOP	2396	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates electronic warfare (EW) survivability and combat identification systems to significantly enhance the survivability, lethality and ability to conduct offensive operations to win the information war for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. It addresses the need to locate, disrupt or destroy the enemy's Command, Control, and Communications (C3) systems and infrastructure, tactical radar surveillance and radio frequency (RF)/infrared (IR)/electro-optical (EO) homing, guided and directed munitions and missile systems. Communications countermeasures (CM) and communications counter-countermeasures (CCM) applications are matured to deny the enemy the use of their sensors while protecting sensors from enemy deception and jamming. Project K15, The Advanced Communications Electronic Countermeasures (ECM), provides technology demonstrations in CM, information collection and reporting to transition to Army intelligence and electronic warfare (IEW) systems. Project K16, Non-communication ECM Technology Demonstration, focuses on the feasibility and effectiveness of non-communications ECM and electronic support/electronic intelligence. This project provides self-protection from radar, (EO), and (IR) guided anti-aircraft artillery, surface-to-surface missiles, artillery, and top attack weapons. Further, it provides precise targeting information on non-communications emitters. Deception and jamming of the enemy through long range netted sensor webs will assist in neutralizing the enemy's ability to see, understand, decide and shoot first. RF based detection and jamming techniques will be matured, in coordination with on-going IR sensor research, to protect ground forces against command and sensor-initiated booby trap improvised explosive devices (IEDs). Efforts in this PE are coordinated with PE 0603313 (Missile and Rocket Advanced Technology) and PE 0603003A (Aviation Advanced Technology), PE 0602270 (EW Techniques), PE 0602120 (Sensors and Electronic Survivability), and PE 0603772 (Advanced Tactical Computer Science). Projects K12, K19 and K20 fund Congressional special interest efforts.

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 PE contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0602270A (EW Technology). Work in this PE 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 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603270A - EW TECHNOLOGY**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	21357	16801	17940
Current BES/President's Budget (FY 2007)	36347	22280	18612
Total Adjustments	14990	5479	672
Congressional Program Reductions		-4097	
Congressional Rescissions		-224	
Congressional Increases		9800	
Reprogrammings	14990		
SBIR/STTR Transfer			
Adjustments to Budget Years			672

FY05 increase of $15.0 million due to reprogramming of WARLOCK funding from OSD Iraqi Freedon Fund.

Five FY06 Congressional adds totaling $9800 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($2000) Aerial Canopy MASINT Sensor (ACMS)
($1000) GeoFence Pipeline Monitoring and Safety Project
($2200) Portable, Level I Fusion Toolset
($1400) Short Range Electronic Detection (SHRED)
($3200) US Army Future Force ELINT

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603270A - EW TECHNOLOGY**	**K15**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
K15 ADVANCED COMM ECM DEMO	2840	8068	9425	9468	9373	9451	9542

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. Electronic Support for the Future Force (ESFF) will provide lightweight, low cost Unmanned Aerial Vehicle (UAV) and Unattended Ground Sensors (UGS) Electronic Support Measures (ESM) to detect and locate modern signals of interest. Information Operations investigates, researches, 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 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, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth NJ.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Electronic Support for the Future Force (ESFF): This effort matures and demonstrates technologies that enable tactical signal intercept and jamming. In FY05, performed lab and field test of the networked radio frequency (RF) ESM sensor architecture for unmanned ground and air vehicle applications for the Brigade Combat Team (BCT); integrated and demonstrated unattended ground and air RF ESM sensors with the network radio links matured by the Networked Sensors for the Future Force Advanced Technology Demonstration program. In FY06, test UAV and UGS ESM in a warfighter operational environment that demonstrates real time collection, ID and location with sensor data fusion. In FY07, will test ESM systems in UAV and UGS in high emitter density suburban and urban environments; will transition ESM to Tactical Signals Intelligence Payload and the Future Combat System BCT.	2500	4000	4500
- Information Operations: In FY05, identified and tested techniques to cross cue/correlate geolocation and virtual address locations in a lab environment; refined techniques for signal detection, identification, location and isolation against representative targets and demonstrated a hardware suite capable of hosting these techniques. In FY06, mature situational awareness algorithms, traffic analysis algorithms, and electronic attack capabilities for signals of interest; mature and demonstrate adaptive array processor for geolocation of signals of interest. In FY07, will refine concept of operations and tactics, techniques and procedures for system implementation with users at the Battle Labs; will continue development of adaptive array processor to counter problems associated with multipath, co-channel and co-site interference, and to provide a precise signal geolocation capability; will leverage broadband antenna work performed under the Tactical SIGINT Technology program, and develop information operation algorithms to provide the capability to influence a potential target's plan of action; will develop software algorithms to map present communications architecture in areas of interest, and perform analysis to determine the optimal network based attack schema. Work on this effort is also being accomplished under PE 62270 Project 906.	340	4068	4925
Total	2840	8068	9425

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603270A - EW TECHNOLOGY**	**K16**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
K16	NON-COMMO ECM TECH DEM	21242	4551	9187	9389	9525	9951	9238

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 will provide 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. The ability to neutralize booby traps will be matured and demonstrated by embedding the maximum capability in projected Brigade Combat Team (BCT)/Future Force systems to minimize vehicle weight, cost, logistics and fielding. Additionally, this project will demonstrate 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 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 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, 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 2005	FY 2006	FY 2007
- Reconnaissance and Defeat of Improvised Explosive Devices: This effort matures and demonstrates an organic, multifunctional on the move force protection capability that will detect and neutralize enemy sensors, communications, and remotely controlled (RC) weapons data links, providing a level of survivability to dismounted, light and medium forces not currently available. In FY05, matured electronic countermeasures (ECM) techniques, using receivers, antennas and jamming sources in a laboratory environment; refined ECM techniques and conducted field-testing of algorithms and radio frequency receivers against weapon control links to neutralize remote controlled weapons. In FY06, investigate the effects of radio frequency (RF) energy on electronic triggers for RC and non RC IEDs and measure the power/modulation required to dud or otherwise neutralize selected devices; develop power/energy requirements for IED neutralization concepts and design parameters. In FY07, will demonstrate hardware incorporating unique waveforms, antenna, high sensitivity receiver, and high power transmitter. Work on this effort is also being accomplished under PE/Project: 62270/442; 62270/906.	1976	2330	2065
- Integrated Survivability and Cueing Sensor: This effort matures and demonstrates technologies that enhance vehicle system survivability. In FY05, demonstrated added capability to missile warning sensors; matured hardware modules and software algorithms to enable ultra-violet and infra-red missile warning sensors to detect muzzle flash from small arms. In FY07, will mature focal plan arrays, algorithms, and signal processing; will perform live-fire test of prototype warning and cueing sensors and systems; will select one system based on test results. Work on this effort is also being accomplished under PE/Project: 62270/442; 62120/H15; 63772/243.	2266	0	2000
- Combat Identification Technologies: In FY06, mature custom application specific integrated circuits (ASICs) for Millimetter Wave	0	1434	1119

(mmW) ID functionality; demonstrate tools for determining cost effectiveness of combat identification (CID) capabilities; mature modeling and simulation of CID concepts. In FY07, will design and fabricate Geometric Pairing (GP) and RF Tag hardware embedded into Ground Soldier System ensembles to demonstrate dismounted integration concepts and technical performance characteristics; will conduct first technical testing of GP situation awareness and RF Tag concepts and complete inserting mmW ID functionality into custom ASICs.			
- Hostile Fire Indication (HFI) and Countermeasure (CM): Program will implement affordable hostile fire indication for aircraft against small arms fire and rocket propelled grenades (RPG) by modifying currently fielded systems. In FY06, initiate modeling and simulation for tactics, techniques and procedures development, follow UK lead program to modify Common Missile Warning System processor to enable small arms detection. In FY07, will investigate RPG detection and warning software modifications to APR-39A(V)1 to display HFI warning and conduct additional firing data collection as needed; will mature modeling and simulation of sensor and threats; will leverage UK/USAF/NVESD optical CM for small arms and RPGs.	0	787	4003
- Fusion Based Knowledge for the Future Force: In FY05, identified requirements and developed a plan for integrating supporting software such as that for terrain reasoning and modeling and simulation with software being developed to retrieve data and to perform fusion.	2000	0	0
- WARLOCK: This one year reprogramming from the Iraq Freedom Fund funded a focused development effort to counter improvised explosive devices. Specifically, it funded resource analysis of waveform technique generation, full spectrum antenna development, frequency de-confliction with Blue Force communication devices and electronic systems; the incorporation and interface with Global Positioning System (GPS) timing protocols and associated software development, and field testing of the improved counter explosive devices. This effort is executed by PEO IEWS.	15000	0	0
Total	21242	4551	9187

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		136319	114018	42127	67167	81003	85248	85305
206	MISSILE SIMULATION	10466	10045	3421	3508	3562	3591	3618
263	FUTURE MSL TECH INTEGR(FMTI)	29941	39070	14485	16020	33214	43335	44919
550	COUNTER ACTIVE PROTECTION	17078	16758	12399	15515	15524	8278	5691
655	HYPERVELOCITY MISSILE TD	50863	11895	0	0	0	0	0
704	Advanced Missile Demo	7494	6776	2989	3439	0	0	0
G03	Army Hypersonics Advanced Technology	0	0	8833	28685	28703	30044	31077
NA6	Missile and Rocket Initiatives (CA)	20477	29474	0	0	0	0	0

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. Efforts are conducted through system simulation, design, demonstration, and test in laboratory and operational scenarios. This PE includes demonstrations of advanced tactical missiles, real-time hardware-in-the-loop simulations, and aircraft and ground system survivability efforts. The technologies focused on in this PE enhance the warfighting capabilities of locating targets in clutter, precision guidance, hypervelocity missile flight, and missile communications, command and control. The major efforts in this PE are the Non-Line-of-Sight Launch System (NLOS-LS), Compact Kinetic Energy Missile (CKEM), Advanced Multi-Mission Precision Guided Munition (AMMPGM), Active Defense for the Current and Future Force (concentrating on defense against rockets, artillery and mortars (RAM)), Close-In Active Protection System (CIAPS) for ground and air platforms, and development and demonstration of hypersonic missile technology. The Army Hypersonics Applied Research program matures and demonstrates expendable hypersonic/hypervelocity missiles and technologies for the defeat of hypersonic threats. Survivability efforts are coordinated with PE 0602303A (Missile Technology), PE 0603003A (Aviation Advanced Technology) and PE 0603270A (Electronic Warfare Technology), 0602624A (Weapons and Munitions Technology) and 0603004A (Weapons and Munitions Advanced Technology). The emphasis in this program element is on smaller, lighter weight, more affordable missiles. 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). This work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	115332	70066	42939
Current BES/President's Budget (FY 2007)	136319	114018	42127
Total Adjustments	20987	43952	-812
Congressional Program Reductions		-499	
Congressional Rescissions		-1149	
Congressional Increases		45600	
Reprogrammings	20987		
SBIR/STTR Transfer			
Adjustments to Budget Years			-812

FY 05 increase of $21 million attributed to: $8.5 million reprogramming for Protector UAV for AC130 Aircraft from the Air Force; $12 million reprogramming for Close in Active Protection System for Stryker from OSD Iraqi Freedom Fund; $487 thousand below threshold reprogramming.

Eight FY06 Congressional adds totaling $45600 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($20500) Applied Counterspace Tech (ACT)
($6000) Close-in Active Protection System for Stryker Family of Vehicles
($2700) Compact Kinetic Energy
($2500) FTT50 High Efficiency Turbine Engine
($7000) Missile Simulation Technology Rapid Assessment and Deployment of Systems Initiative
($1800) Persistent Protective Surveillance for Rotary Winged Aircraft (Year 2)
($3900) Warfighter Protection and Homeland Security Lab
($1200) Waterside Wide Area Tactical Coverage and Homing (WaterWATCH)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**206**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
206 MISSILE SIMULATION	10466	10045	3421	3508	3562	3591	3618

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 will 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Missile Simulation - In FY05, completed the maturation of a tri-mode (RF, semi-active laser, and IR) guidance HWIL capability for missile performance testing and demonstrated its capabilities; continued maturation of a multi-channel laser detection and ranging (LADAR) scene projector for use in HWIL simulation; completed the development of an advanced infrared (IR) scene projector with low temperature background conditions (below laboratory ambient); and continued to improve the capabilities of MMW HWIL simulation at 35 GHz by addressing synthetic aperture radar (SAR) types of missile guidance. In FY06, apply the LADAR scene projector to mature closed-loop HWIL capabilities for NLOS-LS and other related acquisition programs; initiate integrated digital electronic circuit techniques to improve MMW signal generation; extend capabilities for semi-active laser HWIL simulation using updated lasers and detailed laser illuminator scene modeling. In FY07, will complete the application of the LADAR scene projector and integrate it with an advanced passive IR scene projector with low-temperature background scene capability; will continue the development of HWIL simulation techniques for missiles guided by MMW synthetic aperture radar signals; will continue work digital circuit techniques for application in MMW signal generation; and will investigate techniques for generating modular, reusable control software applicable to disparate real time HWIL simulation facilities.	3083	3190	3421
Missile Simulation Technology - In FY05, this Congressional Add continued maturation of the Joint Aviation, Missile, and Unmanned Systems (JAMUS) and Modeling Architecture for Technology and Research Experimentation (MATREX) systems to gain confidence in their capabilities and to initiate simulation validation exercises across a range of varied scenarios. No additional funding is required.	7383	0	0
Missile Simulation Technology Rapid Assessment and Deployment of Systems Initiative. This one-year Congressional add will fund development of a missile simulation capability supporting a rapid assessment capability. No additional funding is required.	0	6855	0
Total	10466	10045	3421

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**263**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
263 FUTURE MSL TECH INTEGR(FMTI)	29941	39070	14485	16020	33214	43335	44919

A. Mission Description and Budget Item Justification: This project demonstrates advanced tactical missile technologies including seekers, propulsion, airframes, communications, and guidance and controls for future missile systems including Non-Line-Of-Sight Launch System (NLOS-LS) Technology program supporting Future Combat Systems (FCS) and the Future Force. These technologies include; multi-mode seekers, controllable thrust motors (gels, pintle-controlled solids, or air breathing), and aided target acquisition (ATA) for missile systems. Seeker technologies address imaging infrared, Laser Detection and Ranging (LADAR), and millimeter wave seeker technologies, combined with semi-active laser technology, to provide precision strike and fire-and-forget guidance modes. Affordable, controllable thrust rocket motors, such as gelled bi-propellants or pintle-controlled solids and high performance, high efficiency turbo fan engine, will be demonstrated to provide longer ranges and shorter flight times while increasing system insensitivity and robustness in air-to-ground, ground-to-ground, and ground-to-air roles. A missile communications network enables target position updates to the missiles, re-tasking orders to the missiles, and transmission of imagery to the ground for target verification and battle damage assessment. These efforts provide support for the NLOS-LS System Development and Demonstration (SDD) program and are supported by the Program Executive Officer for Missiles and Space. In future years, a technology demonstration of air defense capability for the Unit- of- Action, concentrating on defense against rockets, artillery, and mortars will be performed using technologies funded under PE 0602303A. In addition, smaller, lighter weight, and more affordable missile technologies will be demonstrated using the technology matured under PE 0602303A. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Enhanced Seeker Development - In FY05, continued to mature multiple seeker technologies for NLOS-LS and completed maturation of a dual-mode (enhanced uncooled infrared (UCIR)/semi-active laser (SAL)) seeker for the Precision Attack Missile (PAM). Conducted bench, captive flight, and environmental/performance evaluation testing of the seeker and transitioned the enhanced dual-mode (UCIR/SAL) PAM seeker to the Non-Line-Of-Sight Launch System (NLOS-LS) Program Office. Initiated evaluation of several next generation seeker concepts including a tri-mode (infrared/milli-meter wave/SAL) seeker for a potential future technology insertion into PAM; matured/adapted seeker designs for potential integration and performed Aided Target Acquisition (ATA) performance evaluations. In addition, performed trade studies, component maturation, bench testing, and developed conceptual system designs for a dual-mode (semi-active laser/LADAR) seeker for the for the Loiter Attack Missile (LAM) variant of NLOS-LS; Prepared the Precision Attack Missile (PAM) and Loiter Attack Missile (LAM) seekers for NLOS-LS system testing.In FY06, complete the final design of the tri-mode PAM seeker, fabricate components and begin component testing. If successful, begin fabrication and check-out of complete PAM tri-mode seeker. In addition, complete the final design of the LAM dual-mode seeker and begin fabrication and component/subsystem testing of dual-mode LAM seeker. Initiate preparation for seeker captive flight testing in early FY07. Conduct manufacturability and producibility studies of both tri-mode PAM seeker and dual-mode LAM seeker. Continue to integrate seeker model updates for both new seekers into Integrated Flight Simulation models to conduct system effectiveness and performance studies. Provide tri-mode seeker information to Navy Small Diameter Bomb technical leads. In FY07, will evaluate and mature additional seeker technology enhancements; will continue system maturation, fabricat	16745	21265	6785
Advanced Propulsion - In FY05, identified and evaluated critical technology for an enhanced solid propellant pintle; designed, matured,	3821	5925	3500

and fabricated critical PAM propulsion subsystems and performed laboratory subsystem/system level testing, began system trade studies and maturation of a high efficiency turbofan engine leveraging from Loiter Attack Missile - Aviation (LAM-A) propulsion technology advancements. In FY06, continue the design, maturation, and fabrication of critical PAM propulsion subsystems (composite case, igniter, nozzle/pintle/actuator, propellant grain) and perform laboratory/relevant environment system level testing; conduct static tests of flight weight prototype systems (ambient/cold/hot) and perform insensitive munition screening tests; mature and demonstrate a high efficiency turbofan engine and conduct rig testing of critical hardware. In FY07, will continue the design, maturation, and fabrication of critical PAM propulsion subsystems for spiral insertion and perform laboratory/relevant environment subsystem/system level testing; will fabricate and integrate flight worthy prototype subsystems and prepare for controlled test flight; will mature and demonstrate a high efficiency turbofan engine, conduct baseline evaluations and testing of critical hardware and demonstrate prototype engine hardware.			
Warhead Testing and Integration - In FY05, matured advanced, lighter, unitary/multi-purpose warhead technologies and integrated these technologies for increased lethality against anti-armor and other target sets/environments including non-lethal effects; exploited various fragmentation and shape charge technologies and optimized for NLOS-LS; matured explosive fill technologies including thermobarics; matures lethality toolset/models for warhead lethality assessments. In FY06, mature advanced, lighter, unitary/multi-purpose combined effects warhead technologies for potential spiral insertion into NLOS-LS; fabricate, integrate and static/dynamic test critical technologies (fragmentation, shape charge, and explosive fill); and perform verification/validation of toolset/models. In FY07, will continue maturation of warhead technologies and integration for increased lethality against anti-armor and other target sets/environments including non-lethal effects for spiral insertion into NLOS-LS. Will perform integrated warhead static and dynamic tests and validate modeling and simulation tools with test results.	3126	3960	1400
Modeling /Simulation and System Performance Evaluation - In FY05, established an initial integrated flight simulation (IFS) capability, developed capability for few-on-few full-system simulation and performed trade studies to help identify alternate technologies to achieve NLOS-LS Objective System performance. In addition, addressed manufacturing and affordability issues for NLOS-LS and performed component, and system level testing for performance evaluations. In FY06, increase fidelity of models to support few-on-few simulations; perform trade studies, identifying alternate variants and critical subsystem requirements to achieve NLOS-LS Objective System performance and address manufacturing and affordability issues through system research, design and maturation. In FY07, will conduct preflight and post flight reconstruction of flight tests performed and will support simulation formal accreditation process. In addition, will continue trade studies taking into account various regions, targets, environments and countermeasures, identifying alternate variants and critical subsystem requirements to achieve NLOS-LS Objective System performance; will address manufacturing and affordability issues; will conduct excursions to expand the envelope of conditions evaluated by the simulation.	6249	7920	2800
Total	29941	39070	14485

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**550**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
550 COUNTER ACTIVE PROTECTION	17078	16758	12399	15515	15524	8278	5691

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. Current aircraft survivability materiel solutions have limited effectiveness against optically aimed (i.e. "dumb") weapons such as Rocket Propelled Grenades (RPGs) and small arms. The Close-In Active Protection Systems (CIAPS) Phase 1 prototype has been demonstrated on a light armored vehicle. New sensor and interceptor technologies are being matured in CIAPS Phase 2 to enable the system to be mounted on tactical wheeled vehicles for protection against RPGs. A new 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 is being explored. System modeling and simulation conducted with user participation will maximize the opportunities for operator input to survivability system configuration and guide all aspects of technology maturation. Systems approach will ensure 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 IR suppressor, Manned Unmanned Rotorcraft Enhanced Survivability (MURES), Survivability Planner Associate Re-router (SPAR) acoustic signature technologies matured in the Aviation Advanced Technology (PE 63003/313). 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Close-In Active Protection Systems (CIAPS) - In FY06, demonstrate a prototype CIAPS and technology matured under PE 0602303A missile technology, mounted on a HMMWV that defeats RPGs fired from short range with multiple threats; conduct live range testing of system while stationary and on-the-move.	0	5000	0
- Close-In Active Protection Systems (CIAPS) Congressional Add - In FY05, this Congresional add completed the fabrication of the science and technology prototype radar sensor.	5078	0	0
- Integrated Aircraft Survivability Technology - In FY06 evaluate, analyze, and initiate component development of a guided interceptor for active defense of air/ground vehicles against RPGs and other non-traditional threat weapons. Initiate analysis of feasibility to incorporate small arms/RPG indication and warning systems with automated threat avoidance, and active defeat concepts for aircraft. In FY07, will continue development of guided interceptor technology, build components and begin component and subsystem testing for a guided interceptor. Demonstrate initial system breadboard implementations of integrated system solutions capable of enhancing aircraft survivability. Complete analysis of feasibility to incorporate small arms/RPG indication and warning systems with automated threat avoidance, and active defeat concepts for aircraft and develop implementation plan.	0	6000	12399
Close-In Active Protection Systems (CIAPS) on Stryker: In FY05 this Congressional Add funded an integrated CIAPS design for Stryker. Initiated performance and integration testing of the CIAPS system S&T prototype on Stryker vehicle. Began development of both system specific mounting (A-kit) and common active protection system components (B-kit) prototypes for Stryker. In FY06 this Congressional will fund the continued development integration and evaluation of a fieldable CIAPS prototype.	12000	5758	0

Total	17078	16758	12399

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**655**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
655 HYPERVELOCITY MISSILE TD	50863	11895	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program matures and demonstrates hypervelocity missile technology that will enable the Future Force by providing overwhelming lethality with a small, light, fast hypervelocity compact kinetic energy missile. The goal of the Compact Kinetic Energy Missile (CKEM) Advanced Technology Demonstration is to demonstrate enhanced system lethality with a threshold of 60-inch long, 100-lb missile and an objective of 54-inch long, 65-lb missile. Miniature guidance inertial measurement unit (IMU) technology will be demonstrated to survive high-g missile launch and will provide precision guidance to kill targets at ranges of 0.4-5 kilometer. The program will mature and demonstrate advanced component and subsystem and system level technologies in a missile system configuration to achieve next-generation system level performance improvements. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Compact Kinetic Energy Missile (CKEM) - In FY05, provided a detailed design that is traceable to a tactical system; fabricated the missile, and integrated it with a surrogate weapon system for demonstration; conducted testing in a Hardware-in-the-Loop (HWIL) facility and independently evaluated the system simulation of the design to verify performance for the Critical Design Review (CDR). In addition, conducted Design Verifications Tests (DVT) (Umbilical Separation, Fin Deployment & Loads, Nozzle Release Test, Missile Pull Through, Sabot Separation, Missile Bending / Load, Missile Modal Survey, In-Line Fin Deployment, RF Plume Test, RF Range Test) in order to demonstrate sufficiently mature missile flight components (TRL 5) in preparation for flight tests to be conducted in FY06. In FY06, conduct eight flight tests of the CKEM missile from a platform representative of a Future Combat Systems (FCS) vehicle and a launcher with a surrogate fire control. Conduct flight tests against threat armor, buildings, and fortified bunkers.	49904	9367	0
Compact Kinetic Energy Missile (CKEM) Stabilized Mobile Launcher - This one-year Congressional add conducted research in developing a mobile launcher for CKEM. No additional funding is required.	959	0	0
Compact Kinetic Energy - This one-year Congressional add supports additional development and maturation of the Compact Kinetic Energy Missile (CKEM). No additional funding is required.	0	2528	0
Total	50863	11895	0

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**704**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
704 Advanced Missile Demo	7494	6776	2989	3439	0	0	0

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 Future Combat Systems (FCS) and the Future Force. Current planned advanced demonstrations are Fire Control-Node Engagement Technology (FC-NET) and Advanced Multi-Role Miniature Precision Guided Missile (AMMPGM). The FC-NET program objective is to mature a common fire control architecture for combat vehicles. The resulting Fire Control Architecture will enable a platform to host, and a commander to effectively manage, an interchangeable and distributed suite of weapons. The system will recommend Weapon-Target Pairings for multiple weapons (missiles & guns) and is expandable to include future weapon types. The objective of AMMPGM program 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 program uses technology developed under 0602303A Missile Technology. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- FC-NET - In FY05, developed a technical fire control interface to the tactical fire control infrastructure to enable a platform to host a suite of weapons (instead of a single weapon) and a commander to effectively manage and control an interchangeable and distributed suite of weapons. In addition, completed development of Weapon-Target Pairing Algorithms. These algorithms recommend to a platform gunner/commander the optimal weapon/round combination that should be used against an identified target. Demonstrated and tested Weapon-Target Pairing Algorithms in a virtual simulation environment. In FY06, finalize the technical fire control and validate the weapon target paring algorithms and demonstrate the ability to gave a common fire control for both missiles and guns in a live exercise.	3400	3900	0
- Advanced Multi-Mission Precision Guided Munition (AMMPGM) - In FY05, completed static and dynamic warhead testing and limited qualification testing, including insensitive munition (IM) testing. In FY06, mature a common joint Army/Navy smart 2.75 inch launcher; design an advanced insensitive munition rocket motor to improve minimum and maximum range system performance and perform heavywall and static test; and investigate advanced multimode fuzing concepts to increase lethality. In FY07, will build a prototype launcher and demonstrate it in HWIL and bench testing; will perform ballistic flight test of enhanced IM motor to verify aerodynamic and ballistic performance and perform IM requirement testing; and will design and construct breadboard prototype of advanced multimode fuze.	2594	2876	2989
- In FY05, integrated temperature and shock sensors into PAC-3 Missile and evaluated performance. Sensors provide remote monitoring and diagnostic capability to help identify potential missile failure conditions.	1500	0	0
Total	7494	6776	2989

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**G03**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
G03	Army Hypersonics Advanced Technology	0	0	8833	28685	28703	30044	31077

A. Mission Description and Budget Item Justification: This project funds advanced technology development to mature and validate, through experimental testing, the critical technologies required to develop expendable hypersonic/hypervelocity missiles and interceptors of defeat hypersonic threats. Primary focus areas are those deemed critical for hypersonic/hypervelocity weapon maturation to enhance Army operational capability. These focus areas include propulsion components, active and passive thermal management systems, material selection and evaluation, airframe structural analysis and missile subcomponent design and development. Efforts will include experimental model design and fabrication, instrumentation of experimental modes, extensive ground testing of matured component technology and will build on preceding missile and engine component design efforts and will focus on further development, integration and validation through ground test activities at duplicated operational conditions. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Engine and Missile Component Design: In FY07, will transition technology from PE 0602303A G02 to complete component technology designs; validate system design concepts and begin fabrication of components and subsystems for integration and testing.	0	0	8833
Total	0	0	8833

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		37246	30092	25554	28512	32490	32686	32920
608	COUNTERMINE & BAR DEV	21780	21728	22058	24034	27625	27725	27860
64C	COUNTERMINE DEMONSTRATIONS (CA)	12948	5126	0	0	0	0	0
683	Area Denial Sensors	2518	3238	3496	4478	4865	4961	5060

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates the sensor technologies required to detect mines, minefields, improvised explosive devices (IEDs) and obstacles to enable assured mobility for the high operational tempo (OPTEMPO) of the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Project 608 focuses on concepts and technologies that will enable in-stride detection and breaching, close-in detection, area clearance, and neutralization of landmines. This project demonstrates the remote detection of minefields as well as individual landmine detection from handheld, ground, and aerial sensor systems; evaluates detection of both conventional and command detonated types of landmines (including IEDs), metallic and low/non-metallic; 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 mine/IED detection at very low false alarm rates. Efforts within this project assess airborne mine detectors for contingency applications and mature lightweight plug-and-play detectors for use in mission specific applications. Project 64C funds Congressional special interest items. Project 683 explores alternative systems for anti-personnel landmines and innovative concepts for minefield clearance. This PE will conduct modeling and simulation activities to assess the effectiveness of system concepts.

Work in this PE is related to and is fully coordinated with PE 0602712A (Countermine Systems), PE 0603710 (Night Vision Advanced Technology), and the US Marine Corps. 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). The PE contains no duplication with any effort within the military departments. Work in this PE is performed by the Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	33621	25327	29534
Current BES/President's Budget (FY 2007)	37246	30092	25554
Total Adjustments	3625	4765	-3980
Congressional Program Reductions		-131	
Congressional Rescissions		-304	
Congressional Increases		5200	
Reprogrammings	3625		
SBIR/STTR Transfer			
Adjustments to Budget Years			-3980

FY 05 increase of +$3.6 million (after adjustment for Congressional Undistributed Reductions) is attributed to reprogramming of Congressional Add for Advanced Demining Technology from PE 0603607A for proper execution.
FY 07 decrease of -4.0 million attributed to realignment of funding to higher priority requirements.

Two FY06 Congressional adds totaling $5200 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($4200) Advanced Demining Technology
($1000) Electromagnetic Detection and Imaging Transceiver (EDIT) Landmine Detector

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**	**608**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
608 COUNTERMINE & BAR DEV	21780	21728	22058	24034	27625	27725	27860

A. Mission Description and Budget Item Justification: This project matures countermine technologies for integration into future Army systems to enable assured mobility of the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Specific activities include remote detection of minefields by aerial sensor systems and individual landmine detection by handheld and vehicle-based sensor systems and neutralization of individual mines and minefields. The landmines being addressed include conventional and command detonated, including improvised explosive devices (IEDs), metallic and low/non-metallic construction anti-tank and anti-personnel mines. This project will evaluate the potential for wide-area multi-sensor fusion detection systems, coupled with slower small-area confirmation sensors, to yield a high probability of mine detection (Pd) at very low false alarm rates (FAR). This project will evaluate airborne multispectral mine detection sensors and mature them for lightweight plug-and-play use on unmanned aerial vehicles (UAVs) in mission specific applications. The goal is for robust approaches to finding surface-laid and buried mines/IEDs in temporally and spatially varying vegetation, soil, weather, and diurnal conditions. This project has the potential to provide advanced countermine and counter-IED capabilities to the mounted and dismounted soldier by adapting commercial or emerging technologies for standoff detection and neutralization. Detection technologies include, but are not limited to, wide band radar, acoustic, laser, explosive detection sensors, infrared and visual imagery, and radio frequency. Neutralization technologies include chemical reactants, electromagnetic energy, and kinetic energy. The intent is to provide increased operational tempo and survivability for U.S. Forces prior to their entry into harm's way. Efforts are supported by modeling and simulation assessments and defines potential system effectiveness. The Future Combat System (FCS) Standoff Mine Detection System effort will provide standoff mine/IED detection capability for faster rate of advance (ROA) in high threat areas, using sensors on both a ground vehicle and a UAV. The Autonomous Mine Detection Sensors effort will provide the ability to detect anti-personnel mines at faster ROA, by integrating mine detection sensors onto a robotic platform thereby keeping the soldier away from danger. The Ground Penetrating Radar Countermine On The Move effort will provide faster ROA for on-route detection and provide off-route detection capability with high Pd and low FAR. The Airborne IED/Mine Detection effort will demonstrate automated processes and algorithms that improve upon the change detection process that detects mines and IEDs. The Aerial Buried Minefield Detection effort will develop sensors and algorithms for detection of mines that have been buried for a long time.

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). Minefield neutralization efforts are closely coordinated with Navy/USMC. Work in this PE is performed by the Army Research, Development and Engineering.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
FCS Standoff Mine Detection System. In FY05, demonstrated in an arid environment organic aerial vehicle (OAV) sized payload for detection of buried mines in roads; established baseline performance of bolt-on forward looking ground vehicle sensor and fusion aided target recognition (AiTR); initiated prototyping activities; improved fusion AiTR algorithms. In FY06, complete integration and fusion of forward looking sensors on a single platform; test and demo integrated ground vehicle sensor package and AiTR. In FY07, will finish development, testing and evaluation; will demonstrate performance of vehicle mounted forward looking sensors in relevant environment.	5491	4912	4943
Autonomous Mine Detection Sensors (AMDS). In FY05, completed sensor and Automated Target Recognition (ATR)/signal processing studies; demonstrated brassboard sensors and initial ATR/signal processing approach on surrogate platform. In FY06, refine sensor design based on initial studies and increase performance of ATR algorithms in off-road conditions; conduct blind test with improved	4964	4876	2917

sensor and ATR algorithms. In FY07, will complete prototype sensor build and ATR/signal processing implementation on surrogate platform; will conduct tests in relevant environments.			
Ground Penetrating Radar (GPR) Countermine On The Move. In FY05, continued maturation of a faster wideband GPR integrated on a surrogate UGV for use against anti-tank mines; increased antenna scan and data acquisition rates for on-route detection; improved the Automated Target Recognition (ATR) algorithms for improved clutter rejection and tracking of rough terrain; began mobility evaluation via a series of data collections with the improved GPR on rough terrain; began analysis to determine potential capability for off-route detection. In FY06, refine GPR hardware and ATR improvements; continue on and off route mobility demonstrations and evaluation. In FY07, will complete ATR development and GPR integration; will conduct a series of on and off route demonstrations in a variety of operational scenarios and under representative environmental conditions; will complete mobility evaluation.	4055	4344	5000
Mine Neutralization for Assured Mobility. In FY05, conducted industry trade studies of neutralizer darts and shape charges compatible with Army's guided multiple launch rocket system, to breach minefields from the broadest possible range of stand-off delivery; conducted limited physical tests in Army soil environments and developed a comprehensive model; leveraged Navy efforts in modeling and neutralizer dart testing. In FY06, conduct inert dart flight tests of selected approach to verify feasibility of destroying mines in soils other than sand.	2290	2000	0
Airborne IED/Mine Detection. In FY05, developed and validated automated algorithms for the change detection workstation (CDWS); evaluated multiple platforms and emerging sensor options. In FY06, continue algorithm and automation developments; integrate algorithms into the CDWS; integrate sensors for an improved IED/mine detection capability; conduct flight test. In FY07, will upgrade data collection assets to reduce the processing burden and to automate the CDWS to operate with high altitude payload; will complete algorithm development and sensor integration; will conduct flight tests; will perform system demonstrations in military like environments.	4980	5596	5536
Aerial Buried Minefield Detection. In FY07, will begin development of prototype(s) for detection of longer-term buried (greater than 3 days) anti-tank minefields from airborne platforms; will use results from 6.2 phenomenology studies, sensor evaluations, and algorithm development to guide selection of prototype configurations and platform options.	0	0	3662
Total	21780	21728	22058

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**	**683**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
683 Area Denial Sensors	2518	3238	3496	4478	4865	4961	5060

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 will include distributed anti-personnel surveillance systems (autonomous seismic, acoustic, and day/night imaging sensor systems), 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 will use simulation to evaluate new concepts and modify doctrine. This project will also construct and evaluate components and system architectures at the system level in field tests.

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). The PE contains no duplication with any effort within the military departments. Work in this PE is performed by the Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Area Denial Sensors. In FY05, collected imager data; conducted radio and network capacity studies; began modeling study of standoff detection; completed the concept study; concluded an employment study for unmanned ground sensors via an unmanned ground vehicle. In FY06, complete standoff detection study, complete testbed and demonstrate initial personnel detection and discrimination capability. In FY07, will mature ground sensor discrimination algorithms; will demonstrate an unattended ground sensor field working with an intelligent mine system for discriminating combatant from noncombatant.	2518	3238	3496
Total	2518	3238	3496

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603607A - JOINT SERVICE SMALL ARMS PROGRAM**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		5732	7474	7202	7360	7472	7536	7594
627	JT SVC SA PROG (JSSAP)	5732	6488	7202	7360	7472	7536	7594
62D	SMALL ARMS ADVANCED TECHNOLOGY DEV (CA)	0	986	0	0	0	0	0

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 Future Combat Systems (FCS), the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The main effort is the Lightweight Small Arms Technologies (LSAT). The LSAT will offer significantly reduced weight over the currently fielded weapons and ammunition. These technologies will lighten the Soldier's load, provide improved battlefield mobility and reduced logistics burden to maximize operational utility and survivability, while maintaining or improving current levels of performance. 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP) and the Defense Technology Area Plan (DTAP). 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, U.S. Special Operations Command (SOCOM). Project 627 contains Congressional Adds only.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603607A - JOINT SERVICE SMALL ARMS PROGRAM**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	9675	6581	6942
Current BES/President's Budget (FY 2007)	5732	7474	7202
Total Adjustments	-3943	893	260
Congressional Program Reductions		-32	
Congressional Rescissions		-75	
Congressional Increases		1000	
Reprogrammings	-3943		
SBIR/STTR Transfer			
Adjustments to Budget Years			260

FY05 decrease of $3.943 million attributed to reprogramming of Congressional Add for Advanced Demining Technology (after adjustment for Congressional Undistributed Reductions) to PE 0603606A for proper execution.

One FY06 Congressional add totaling $1000 was added to this PE.

FY06 Congressional add with no R-2A (appropriated amount is shown):
($1000) Lightweight Machine Gun and Ammunition

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603607A - JOINT SERVICE SMALL ARMS PROGRAM**	**627**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
627 JT SVC SA PROG (JSSAP)	5732	6488	7202	7360	7472	7536	7594

A. Mission Description and Budget Item Justification: This project 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 Future Combat Systems (FCS), the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The main effort is the Lightweight Small Arms Technologies (LSAT). The LSAT will offer significantly reduced weight over the currently fielded weapons and ammunition. These technologies will lighten the Soldier's load, provide improved battlefield mobility and reduced logistics burden to maximize operational utility and survivability, while maintaining or improving current levels of performance. 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP) and the Defense Technology Area Plan (DTAP). 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, U.S. Special Operations Command (SOCOM).

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Lightweight Small Arms Technologies (LSAT): In FY05, built weapon and ammunition subsystems, performed preliminary integration and functionality testing to assess weapon operation and ammunition lethality and establish reliability baseline; used virtual prototyping (dynamic models) to advance the design and analysis of system level trade offs. In FY06, build integrated weapon prototypes to test weapon and ammunition functionality and human factors and validate/update virtual prototypes; adjust weapon system to incorporate improvements, mature weapon system to increase reliability; modify ammunition as necessary to attain required lethality; assess maintenance and training issues and make modifications as necessary. In FY07, will perform final integration testing to demonstrate lethality and reliability of the lightweight weapons and ammo; will conduct user demonstration to update and complete human factors, maintenance, and training assessment.	5732	6488	7202
Total	5732	6488	7202

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		102002	101690	44307	35808	41685	47849	48309
590	OVERWATCH ACTD	5540	1331	299	0	0	0	0
C65	DC65	5700	6086	4559	3404	3481	3550	3621
K70	NIGHT VISION ADV TECH	19177	22200	17784	20479	25725	27692	27959
K73	NIGHT VISION SENSOR DEMONSTRATIONS (CA)	53996	50667	0	0	0	0	0
K86	NIGHT VISION, ABN SYS	17589	21406	21665	11925	12479	16607	16729

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates critical 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 capabilities to acquire, engage, and destroy 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 funds classified efforts. Project K70 funds efforts related to night vision advanced technologies. This project will develop a system of networked, low-cost, distributed unmanned sensors for battlefield situational awareness, and a cost effective targeting system (CETS) 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°x90° hemispherical view of the area surrounding a stationary or moving vehicle during day and night operations; demonstrate mission equipment packages (MEP) for unmanned air vehicles (UAVs) that enable small, lightweight, interchangeable payloads of varying sizes to support target detection, identification, and location for the Future Combat System (FCS) Brigade Combat Team (BCT); demonstrate the combat overmatch benefits of 3rd Gen IR technology, including benefits such as rapid wide area search, Multi-Spectral 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 3rd Gen IR assembly into an FCS BCT 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 mines and targets in camouflage, concealment and deception; demonstrate sensors for organic unmanned aerial vehicles for beyond-line-of-sight targeting in areas shadowed by terrain features; demonstrate imaging, non-imaging, and active imaging sensors for Class II UAV 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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 & Electronic Sensors Directorate (NVESD), Fort Belvoir, Virginia and the Army Space and Missile Defense Command, Huntsville, Alabama (the Overwatch ACTD).

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	102047	51761	49341
Current BES/President's Budget (FY 2007)	102002	101690	44307
Total Adjustments	-45	49929	-5034
Congressional Program Reductions		-446	
Congressional Rescissions		-1025	
Congressional Increases		51400	
Reprogrammings	-45		
SBIR/STTR Transfer			
Adjustments to Budget Years			-5034

FY 07 decrease of -$5.0 million attributed to realignment of funding to higher priority requirements.
Seventeen FY06 Congressional adds totaling $51400 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($5600) Buster Backpack UAV
($3000) Cerberus Sensor Suite
($2000) Cost Effective Targeting System
($5000) Digital Night Vision (DNV) Systems
($2800) Electron Bombarded Active Pixel Sensor Camera
($2800) Enhanced Digital Electronic Night-Vision for Unmanned Ground Vehicles
($1000) ISC Personal Miniature Thermal Vision System (PMTV)
($1000) Low Altitude Improvised Explosive Device Detection System (LAIDS)
($4200) Night Vision Advanced Technology (UPS Project)
($1000) Night Vision Fusion
($1100) Perimeter Security Technology Program
($4300) Pilot Port Security Sensor Technology Initiative in Tampa Bay
($1000) Portable Infrared Target Detection and Location Reporting System (COBRA-I PLUS)
($1000) Real-Time Geospatial Video Sensor Intelligence for NVESD
($11800)Sensor Technology fro Force Protection/Camera Assisted Monitoring System
($1000) Soldier Mobility and Rifle Targeting System (SMARTS)
($2800) Warfighter Position, Location and Tracking Sensor

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**590**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
590 OVERWATCH ACTD	5540	1331	299	0	0	0	0

A. Mission Description and Budget Item Justification: This project matures and demonstrates technology that will enable real-time detection, location, and typing of small arms, mortars, and rocket propelled grenades (RPGs) in complex terrain. This Advanced Concept Technology Demonstration (ACTD) focuses on assessing the military utility of the technologies for locating enemy activity and real-time reporting of counter targeting information, and developing concepts of operation that address mobile force protection for forces involved in operations across the spectrum of conflict, from close combat to peacekeeping operations. The ACTD will mature and integrate a sensor/processor suite containing mid-wave infrared sensor, Electro-optical infrared imaging sensor, laser rangefinder/designator on a HMMWV with the appropriate C4I interfaces to disseminate information. Final product for the ACTD is a technology demonstrator that can be used to determine operational utility and deliver system performance specifications in support of the Current Force and Future Force requirements. Work in this ACTD is performed by the Space and Missile Defense Command, and the Army Communications-Electronics Research, Development and Engineering Center/Night Vision and Electronic Sensors Directorate. Other agencies participating include the Office of the Secretary of Defense, U.S. Pacific Command, and Program Executive Office Intelligence, Electronic Warfare and Sensors. 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.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Overwatch ACTD. In FY05, completed real time operational software, sensor shooter interfaces and communications hardware integration; demonstrated and evaluated the sensor/processor on a HMMWV; continued hardware/software maturation and conducted initial full-scale functionality tests, including capability to steer the sensor to respond to threats from a full 360 degree region of concern; performed major system demonstration 1 using a HMMWV platform. In FY06, build and integrate a second, more advanced, sensor system on an unmanned ground vehicle and conduct major system demonstration 2. In FY07, will provide system sustainment and technical support to users.	5540	1331	299
Total	5540	1331	299

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K70**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
K70	NIGHT VISION ADV TECH	19177	22200	17784	20479	25725	27692	27959

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 combat 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 Distributed Aperture System (DAS) will provide situational awareness imagery and target identification independently to the commander or multiple crew members for enhanced operations in day/night/adverse weather conditions The Third Generation Infrared (3rd Generation IR) Technology effort will provide superior sensor capability for ground scouts and line of sight (LOS) shooters, ensuring long range target identification on ground platforms; collect Multi-spectral IR data for future Aided Target Detection (AiTD)/Aided Target Recognition (AiTR) development; develop a single 640x480 3rd Generation Integrated Dewar/Cooler Spec for air and ground platforms; collect multi-band infrared data set for 3rd Gen IR Performance Model Development; demonstrate the combat overmatch benefits of 3rd Generation IR technology; and passive long range target Identification (ID beyond threat detection). The 3rd Generation Multi-Spectral Aided Target Recognition (AiTR) Development effort will develop multi-spectral AiTR and Advanced Digital Signal Processing (DSP) algorithms to take advantage of 3rd Generation infrared imagers for insertion into Future Combat System (FCS) Brigade Combat Team (BCT) Medium Range Electro-Optical system. The Digitally Fused Soldier Mobility System will develop a low power prototype system with digitally fused uncooled long wave infrared and image intensified (I2) visible/near infrared helmet mounted vision system for mobility, target detection, and situational awareness in complex terrain. It will include a port to import alternate imagery/data (e.g. from a weapon sight) to the high resolution Helmet Mounted Display (HMD) and to export soldier borne sensor imagery.

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, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
3rd Generation AiTR and Infrared Technology. In FY05, conducted phenomenology studies to help with multi-spectral platform requirement analysis; modified long range advance scout surveillance system (LRAS3) to accept the 640x480 Dual Band focal plane array (FPA) and Dual F# Dewars; completed fabrication of the first tactical Dual Band IR and variable aperture Dewars; completed design analysis to incorporate dual band FPA in Aviation Turret; initiated fabrication of an Aviation Turret control station; initiated the procurement and modification of the Aviation Turret with 640x480 Dual Band FPA and Dual F# Dewar; continued development of long-range air and ground 3rd Generation Focal Plane Array integrated detector cooler assembly requirements. In FY06, complete integration of 3rd Gen LRAS3 prototype sensor and conduct lab and field testing and evaluation; complete vehicle integration of 3rd Gen LRAS3 and conduct initial data collection of Dual Band imagery for Multi-Spectral Aided Target Recognition (MS AiTR) development and training utilizing 3rd Generation prototype sensor; begin initial definition and system modeling for the insertion of Multi-spectral AiTR coupled with 2-color aided target detection (AiTD) processor development; complete fabrication of control station and integration of Dual Band FPA and Dewar into Aviation Turret; complete integration of dual band Aviation Turret into rotary wing aircraft. In FY07, will complete dual band and phenomenology study data collections with the 3rd Gen prototype LRAS3; will complete design and fabrication of mini-	1874	6043	12932

LRAS3 brass-board optics; will begin development and integration of Slim-line Dual Band FPA Dual F# Dewar and Miniaturized Electronics (ie. 3rd Gen prototype sensor) into FCS BCT medium range electro optic (MREO) Turret Sensor and mini-LRAS3 brass-board demonstrator.			
Distributed Aperture System (DAS). In FY05, integrated color TV cameras to represent a DAS-1 type system; integrated prototype DAS-1 on a troop carrying demonstrator vehicle; conducted safety release and technical testing; conducted limited user evaluations. In FY06, integrate color TV, infrared (IR), and image intensification (I2) sensors into a DAS-2; mature pixel level fusion enabling IR/I2 or IR/color TV imager to be separately accessible for each crewmember; devise initial software modifications for automatic cueing of pop-up/moving personnel targets. In FY07, will complete DAS-2 design; will integrate DAS-2 onto troop carrying demonstrator vehicle; will conduct DAS-2 user experimentation in complex and urban terrain.	600	2937	3000
Advanced Soldier Mobility System. In FY06, conduct human factors experimentation with Army Research Laboratory Human Research & Engineering Directorate for initial system design and functionality. In FY07, will begin design and fabrication of an image intensifier and infrared fusion application specific integrated circuit, an 18 month effort.	0	1960	1852
Target Acquisition Sensor Suite (TASS) Technology Maturity Demonstrator. In FY05, conducted imagery data collection at Fort Hunter Liggett and McCoy for training/tuning of algorithms and conducted non-real time evaluation of aided target recognition (AiTR) performance against sequestered imagery sets. In FY06, conduct field test and demonstrate performance of AiTR algorithms at three test sites; demonstrate long range laser target identification capability of high powered laser-gated short wave infrared.	2300	3660	0
Disposable Sensors. In FY05, completed non-imaging data collection testbed units; utilized testbed units to support development of proof-of-principle sensors and measure/predict their performance parameters; developed proof-of-principle sensor hardware and display software and utilized them to conduct tests and demonstration of system; refined system concepts and system performance specifications. In FY06, develop breadboard prototypes and conduct tests to finalize mix of sensor modalities for non-imaging sensor; investigate techniques and designs to extend sensor mission life; develop and test improvements to communications and networking sub-system; improve performance algorithms through integration of sensor components; develop and evaluate alternative sensor employment techniques.	2800	7600	0
Networked Sensors for the Future Force. In FY05, completed integration of objective sensor systems, and integrated sensor management and acoustic/seismic planning tools into surrogate FCS RSTA demonstrator platform; developed and delivered UGS algorithms to demonstrate distributed cluster management capabilities to demonstrate reduced network loading and increased power efficiency; completed cost effective targeting system (CETS) sensor assembly integration, integrated CETS sensor and system control software/electronics into the unmanned ground vehicle, completed system functional/acceptance testing, and delivered system; investigated dismounted reconnaissance team command and control configuration, conducted demonstration with user participation at Fort Knox, and finalized specifications for system transition.	9000	0	0
Head Tracked Sensor Suite (HTSS). In FY05, integrated situational awareness network and high performance forward looking infrared (FLIR) into the HTSS; integrated HTSS onto a combat vehicle and demonstrated HTSS image fusion, coded laser pointing and situational awareness network integration; conducted limited user test and performed analysis of results to verify operability and utility.	2603	0	0
Total	19177	22200	17784

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K86**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
K86	NIGHT VISION, ABN SYS	17589	21406	21665	11925	12479	16607	16729

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 Future Combat System (FCS) Brigade Combat Team (BCT) and future light maneuver forces. The technology efforts focus on improved RSTA and night pilotage sensors, improvised explosive device (IED) detection, 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 vehicles (UAVs). The mission equipment package for the Class II UAV matures and demonstrates small, lightweight, payloads (electro-optical/infrared, laser radar, designator) to support target detection, identification, location, tracking and targeting of tactical targets for the BCT. The 3rd 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. The Panoramic Aviator Situational Awareness (PAS) demonstrates an advanced cost effective sensor package to enhance pilot and aircrew situational awareness. This sensor package will allow multiple users to simultaneously view 360º x 360º outside the aircraft. This new capability can be used for day/night pilotage, situational awareness for dismounting soldiers, and spherical alert for potential attack while on-the-move or in hover. This program leverages technology developed by the Night Vision Windshield program for USSOCOM and will be suitable for a wide range of aircraft including the UH-60, CH-47, ARH, AH-64, and special operations 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 Technology Area Plan (DTAP). Work in this project is performed by the Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Mission Equipment Packages (MEP) for Class II Unmanned Aerial Vehicle (UAV). In FY05, completed trade studies and began maturation of a reconnaissance, surveillance, and target acquisition (RSTA)/laser designation payload; conducted laboratory/field demonstrations of active imaging foliage penetration (FOPEN) target location technologies; and conducted studies to investigate non-imaging FOPEN techniques. In FY06, complete development of imaging and stabilization components; conduct initial flight tests of RSTA/laser designation payload gimbal from manned platform; perform laboratory and field experiments of active imaging FOPEN technologies; and complete non-imaging FOPEN studies and evaluate approaches. In FY07, will complete development and integration of RSTA/laser designation payload; will conduct flight tests/demonstrations from manned aircraft; will begin integration of RSTA/laser designation payload onto surrogate Class II UAV platform; will conduct field experiments and demonstrate recommended active imaging FOPEN technologies and non-imaging FOPEN system concepts for class II UAVs.	8127	10826	11757
3rd Generation Infrared Technology. In FY05, performed a design analysis for integration of 3rd generation infrared technology into the aviation turret, defined Focal Plane Array (FPA) and system interfaces, and completed design and initiated fabrication of the airborne workstation. In FY06, complete modification of prototype sensors with Dual Band FPAs for long range ID test and experimentation; complete Airborne Control Station fabrication; complete procurement and modification of AN/ZSQ-2 system with 640x480 Dual Band	2325	10580	7838

Infrared FPA; perform laboratory and ground system evaluation; modify Blackhawk testbed to accept sensor system and complete integration of aviation turret; continue development of integrated detector cooler assembly specifications. In FY07, will flight test 3rd generation infrared technology and analyze flight data to demonstrate feasibility of target detection and identification in two-colors; flight test a single color Aided Target Recognition (AiTR) system in a rotary wing aircraft to obtain baseline data prior to follow-on two-color AiTR flight testing and data analysis.			
Panoramic Aviator Situational Awareness (PAS). In FY07, will compare and choose an affordable combination of Long Wave Infrared (LWIR), Medium Ware Infrared (MWIR), Near Infrared (NIR), Image Intensified (I2), Low Light Level TV, Short Wave Infrared (SWIR) sensors for aviators; will conduct the preliminary design of the PAS system.	0	0	2070
Hyperspectral Airborne Multi-Mission Exploitation and Reconnaissance (HAMMER) Program. In FY05, continued development and evaluation of countermine and target exploitation algorithms and implement in real time code.	1500	0	0
Networked Sensors for the Future Force ATD. In FY05, conducted flight tests/demonstrations of unmanned aerial vehicle (UAV) countermine payload; demonstrated multiple UAVs as part of a networked system in an operational environment; conducted refinements based on test results; demonstrated multiple UAVs in a final demonstration.	5637	0	0
Total	17589	21406	21665

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	16919	15777	14089	15098	16479	16666	16838
002	ENVIRONMENTAL COMPLIANCE TECHNOLOGY	629	1291	1989	2042	2072	2091	2106
025	POLLUTION PREVENTION TECHNOLOGY	2670	3166	3471	3559	3652	3725	3799
03E	ENVIRONMENTAL RESTORATION TECHNOLOGY	10745	7969	8629	9497	10755	10850	10933
03F	Environmental Quality Tech Demonstrations (CA)	2875	3351	0	0	0	0	0

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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, and the U.S. Army Research, Development and Engineering Command, headquartered at Fort Belvoir, Virginia, execute the project work.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	17933	12606	13659
Current BES/President's Budget (FY 2007)	16919	15777	14089
Total Adjustments	-1014	3171	430
Congressional Program Reductions		-70	
Congressional Rescissions		-159	
Congressional Increases		3400	
Reprogrammings	-1014		
SBIR/STTR Transfer			
Adjustments to Budget Years			430

One FY06 Congressional add totaling $3400 was added to this PE.

FY06 Congressional add with no R-2A (appropriated amount is shown):
($3400) Alternate Power Fuel Cell Demonstration at Ft. Irwin

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**002**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
002	ENVIRONMENTAL COMPLIANCE TECHNOLOGY	629	1291	1989	2042	2072	2091	2106

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 wastes 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Installation Operations - Demonstrate environmentally safe and cost-effective technologies for removing lead-based paint and reducing Hazardous Air Pollutants (HAP) emissions from Army sources to meet National Emission Standards for HAP which will continue under project 025 and to manage and reduce the increase in noise concerns associated with training ranges. In FY05, matured and demonstrated complete emission control system for demil furnaces. Reconfigurable and Joint Training Ranges - In FY06, mature acoustic emission data acquisition techniques and models for various weapon systems. In FY07, will integrate noise prediction and management tools into Army range design protocols.	629	1291	1989
Total	629	1291	1989

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**025**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
025 POLLUTION PREVENTION TECHNOLOGY	2670	3166	3471	3559	3652	3725	3799

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 solid waste resulting from packaging during deployed operations required to meet the operational needs of the Future Force, and (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 Future Combat Systems (FCS) high performance munitions are developed that are compliant with environmental and health laws and meet weapons lethality and survivability stretch goals. 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)and supports the Army Strategy for the Environment. Work in this project is performed by the Research, Development & Engineering Command's (RDECOM) Army Research Laboratory (ARL) located at Aberdeen, Maryland, the U.S. Army Natick Soldier Center (NSC) located at Natick, MA, the Armaments Research, Development and Engineering Center (ARDEC) located at Picatinny Arsenal, NJ, and the Aviation and Missile Research, Development and Engineering Center (AMRDEC) located at Huntsville, Alabama.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Sustainable Painting Operations - In FY05, demonstrated hazardous air pollutant (HAP)-free solvents for de-painting. In FY06, mature and evaluate HAP-free solvents, cleaners and thinners used in coating operations and processes. In FY07, will reformulate HAP-free sealants and adhesives used in weapon system maintenance, production and industrial processes. Solid Waste Diversion - In FY05, characterized and tested multilayered nanocomposite films to be used in Meals Ready to Eat packaging. In FY06, demonstrate solid waste minimization techniques for base camp operations. In FY07, will mature and evaluate advanced nanocomposite packaging technologies to reduce the amount of packaging debris generated during deployed operations. Compliant Ordnance Lifecycle - In FY05, identified potential benign propellant and engine alternatives that eliminate or significantly reduce the environmental impacts associated with the manufacture, maintenance, use and surveillance of rocket and missile propellants. In FY06, select and demonstrate most promising benign propellant alternative that eliminates or significantly reduces their environmental impacts. In FY07, will demonstrate alternatives to perchlorate and hydrazine propellants and non-toxic pyrotechnic compositions.	2670	3166	3471
Total	2670	3166	3471

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**03E**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
03E	ENVIRONMENTAL RESTORATION TECHNOLOGY	10745	7969	8629	9497	10755	10850	10933

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), project 835 that improve the Army's ability to achieve cost-effective environmental restoration of contaminated (unexploded ordnance, military unique compounds, and energetics) sites at its installations, active and inactive ranges, its rework and production facilities, and 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Unexploded Ordnance (UXO) - In FY05, evaluated innovative analysis algorithms and models for next generation multi-axis/multi-sensor unexploded ordnance (UXO) detection systems. In FY06, develop UXO discrimination models for wide-area transmitter sensor systems and for multi-axis sensor systems. In FY07, will develop a model for active range real-time UXO discrimination, and the Management Aid for UXO Detection Efforts (MAUDE) software application for active range remediation.	750	1440	2035
Hazard/Risk Assessment Tools for Military Unique Compounds - In FY05, completed Army Risk Assessment Modeling System (ARAMS) version 2.1, adding tutorials and case studies capable of assessing contaminant transport through multiple soil types and predicting contaminant exposure and toxicity levels; evaluated current practices of the Intelligence Preparation of the Battlefield (IPB) process to include threats, vulnerabilities, and after-action cleanup operations of toxic industrial chemicals and toxic industrial materials. In FY06, assess non-intrusive methods for identification and risk assessment of toxic industrial chemicals and materials and develop conceptual techniques and procedures for incorporation into IPB practices and conduct gap analysis. In FY07, will complete migration of ARAMS to the higher order modeling technique, will initiate adapting ARAMS to live fire range assessment, and continue preparation of geospatial environmental risk visualization techniques for incorporation into the IPB process.	3445	1439	1856
In Situ Remediation Technologies for Contaminated Groundwater and Soils - In FY05, continued to mature capability for in situ reactive barriers and/or reactive barriers coupled with biodegradation for treating explosive materials in groundwater, completed cost-effective ex-situ lead electro-kinetic extraction, physical separation, and stabilization remediation technologies for inorganics with applicable evaluation tools for a wide variety of contaminated soils. Evaluated advanced in situ inorganics treatment methods at small arms training ranges. In FY06, mature in situ physical and biological cleanup processes for explosives in groundwater, and advance in situ chemical and plant uptake treatment methods to immobilize inorganics at small arms training ranges. In FY07, will finalize in situ	2575	1679	1579

physical and biological cleanup processes for explosives in groundwater with process guidance, specifications, and protocols; and will continue to mature in situ chemical and plant uptake treatment methods to immobilize inorganics on berms at small arms training ranges.			
Characterization, Evaluation and Remediation of Distributed Source Contamination on Army Ranges - In FY05, matured predictive model for distributed source contamination impacts on inactive and live fire training ranges; and evaluated base hydrolysis technologies for site restoration on distributed contamination sources. In FY06, mature and initiate early stage demonstration of a real-time detection capability and topical treatment methods for high concentration source zones of explosives and propellants. In FY07, will complete a real-time detection capability for high concentration source zones for explosives and propellants and evolve geo-statistical methods to predict contaminant distribution patterns; will mature in situ explosive treatment processes for distributed contamination on active ranges.	2705	2284	1933
Long Term Monitoring Applications - In FY05, continued development of cost-effective, long term monitoring systems that greatly reduces the frequency of manual sampling and off-site laboratory analysis, and completed standardized analytical methods for nitrocellulose and perchlorate. In FY06, mature adaptations of commercially available direct-push wells for long term monitoring applications, and evaluate field portable sensors, sampling, and analysis methods. In FY07, will integrate direct-push wells coupled to in situ real time sensing and analysis technologies, and evaluate integrated long term monitoring system designs for near real-time sampling, measurement, analysis, and information transmission.	1270	1127	1226
Total	10745	7969	8629

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603734A - Military Engineering Advanced Technology**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		21716	21390	7848	6890	7690	5754	6786
T08	COMBAT ENG SYSTEMS	3701	7196	7848	6890	7690	5754	6786
T13	Stationary Power & Energy Tech Demonstrations (CA)	12745	10153	0	0	0	0	0
T15	MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)	5270	4041	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this advanced technology development program element is to mature and demonstrate advanced military engineering and battlespace environment technologies that support the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Technologies demonstrated within this program element 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. Battlespace environment 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603734A - Military Engineering Advanced Technology**

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	25657	7301	7562
Current BES/President's Budget (FY 2007)	21716	21390	7848
Total Adjustments	-3941	14089	286
Congressional Program Reductions		-95	
Congressional Rescissions		-216	
Congressional Increases		14400	
Reprogrammings	-3941		
SBIR/STTR Transfer			
Adjustments to Budget Years			286

FY05 decrease of $3.941 million attributed to reprogramming of Congressional Adds for Mobile Transformers ($.959 million after adjustment for Congressional Undistributed Reductions) and Mobile and Advanced Mobile Microgrid Program ($2.973 million after adjustment for Congressional Undistributed Reductions) to PEs 0603005A and 0603125A respectively for proper execution.

Nine FY06 Congressional adds totaling $14400 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($2000) Advanced Structure and Composites in Construction for Protective Structures
($1400) Battlefield Production of Hydrogen for Fuel Cell Vehicles
($1500) Defense Applications of Stationary Carbonite Fuel Cells
($1100) Fireproofing/Corrosion Resistant Coating System
($3500) Fuel Cell Hybrid Generating System - Ramgen Technology
($1800) GEDAC Demonstration
($1000) Integration of Commercial GIS capabilities into Army C4ISR
($1000) Real-Time Drinking Water Security Program
($1100) Reforming Technologies for Renewable and Flexible Fuel Sources

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603734A - Military Engineering Advanced Technology**	**T08**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
T08 COMBAT ENG SYSTEMS	3701	7196	7848	6890	7690	5754	6786

A. Mission Description and Budget Item Justification: The objective of this advanced technology development project is to mature and demonstrate advanced military engineering and battlespace environment 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. The Joint-Geospatial Enterprise Services (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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Joint Rapid Airfield Construction - In FY05, integrated performance models into the site selection process and selected lightweight matting systems and all-weather soil stabilizers. In FY06, evaluate select maintenance and repair techniques for contingency airfields and develop integrated site selection tools including integrated advanced site assessment models, terrain analysis technologies and performance prediction modeling to optimize contingency airfield site selection. In FY07, will demonstrate all JRAC technologies for C-17 contingency airfield operations.	3701	3943	2027
Joint-Geospatial Enterprise Services (J-GES) - In FY06, utilize a network-centric architecture to demonstrate basic geospatial information services from multiple locations and develop technology that supports network centric delivery and update of geospatial data and services. In FY07, will expand J-GES capabilities and demonstrate and test these geospatial services across a broader, more complex network to Army programs and other Command and Control /Intelligence, Surveillance, and Reconnaissance systems; and will test and evaluate geospatial data/information flow across multiple echelons to support battle command planning and mission rehearsal.	0	2045	3028
Battlespace Terrain Reasoning and Awareness Demonstrations - - In FY06, establish a terrain reasoning node within the Multi-cell and Dismounted Experimentation Program to measure the benefit of terrain reasoning for informed command and control decision making; conduct initial demonstration of tactical bandwidth compatible situation and threat assessment tools within battlefield functional area processes and battlefield operating systems architectures. In FY07, will demonstrate, test and evaluate spatial and predictive analysis tools in warfighter experiments within battle command and intelligence, surveillance and reconnaissance user tools and experiment within Joint Geospatial Enterprise Service- Army Prototype Program (JGES-APP) as a specific beta evaluation.	0	1208	2793
Total	3701	7196	7848

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Tech**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	51699	44991	64604	65657	32015	30156	32480
101	TACTICAL AUTOMATION	15104	12623	13639	17399	17436	15795	18006
1AA	Tactical Computer Science Demonstrations (CA)	6614	6013	0	0	0	0	0
1AB	SENSOR DEMONSTRATIONS (CA)	13509	4633	0	0	0	0	0
243	SENSORS & SIGNALS PROC	16472	21722	50965	48258	14579	14361	14474

A. Mission Description and Budget Item Justification: This Program Element (PE) supports information dominance 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 more effectively collect, transfer and display digital information around the battlefield. It provides architectures and technologies to enable Command and Control (C2) during rapid, mobile, dispersed operations. It demonstrates technologies necessary for integrated battlefield situational awareness (SA), force synchronization, split-based, and On-the-Move (OTM) C2 operations. Project 243, Sensors & Signal Processing, matures signal processing and fusion technologies for Army sensors; matures and demonstrates ground based radar systems to track and identify enemy forces and personnel; matures and demonstrates multi-sensor control and correlation for improving reconnaissance, surveillance and target acquisition. Projects 1AA and 1AB fund Congressional special interest efforts.

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 PE contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0602270A (EW Technology), PE 0602782A (Command, Control, Communications Technology), and PE 0603008A (Electronic Warfare Advanced Technology), PE 0602120 (Sensors and Electronic Survivability), 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.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	46313	42475	49279
Current BES/President's Budget (FY 2007)	51699	44991	64604
Total Adjustments	5386	2516	15325
Congressional Program Reductions		-7823	
Congressional Rescissions		-461	
Congressional Increases		10800	
Reprogrammings	5386		
SBIR/STTR Transfer			
Adjustments to Budget Years			15325

FY 05 increase of $5.386 million attributed to reprogramming of Congressional Add for Mvmnt Program for Simulation Based Operation (+$4.698 million after adjustment for Congressional Undistributed Reductions) for proper execution and below threshold reprogramming of + $.710 million for Joint Force Protection Advanced Concept Technology Demonstration
FY 07 increase of $15.3 million attributed to Foliage Penetrating (FOPEN) Radar for Unmanned Aerial Vehicles (UAV).

Ten FY06 Congressional adds totaling $10800 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1300) Bi-Directional English-Iraqi Translation System for the Warfighter
($1700) Blast and Damage Assessment Risk Analysis and Mitigation Application (BADARAMA)
($1200) C4ISR Integrated Digital Environment Service Module (DESM)
($1000) Digital Array Radar Technology Development
($1000) Distributed, Scalable C2 Communication System
($1000) Hyperspectral Imaging and Synthetic Aperture Radar for UAVs
($600) MVMT Program for Simulation Based Operations
($1000) Net-Centric Multi-Sensor Enhancements and Support Operations
($1000) Phraserlator
($1000) X-Band Interferometric Radar Development

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Tech**	**101**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
101 TACTICAL AUTOMATION	15104	12623	13639	17399	17436	15795	18006

A. Mission Description and Budget Item Justification: This project provides improved command and control architectures and technologies for Future Force, and where applicable for Current Force, information dominance. For the Army Future Force, the key change in battle command will be in the use of automated information technologies embedded throughout its units that enable it to use information as an element of combat power. This project supplies the tools to provide commanders at all echelons better and more timely information and allow them to command from anywhere on the battlefield, freed from their command posts and while on-the-move. 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: digital transfer and display of horizontal battlefield situational awareness (SA) and a common view of the battlefield; 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. Network Enabled Battle Command (NEBC) matures and demonstrates advanced C2 software services for the Current Force, the Brigade Combat Team (BCT) and echelons above brigade. Command and Control of Robotic Entities (C2ORE) matures and demonstrates software services optimized for unmanned air and ground robotic systems for the Future Combat Systems (FCS) BCT Battle Command System (BCS) and Current Force initiatives. Joint developer/warfighter experiments will be conducted in coordination with PM FCS BCT, FCS Lead System Integrator (LSI), TRADOC and RDECOM partners.

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

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Distributed Command and Control (C2) On-the-Move: In FY05, matured a distributed collaboration software environment for use in complex and urban terrain, and matured lightweight geospatial service-based mapping tools, coupled with mobile software agents for use in a mobile environment. In FY06, demonstrate a set of service-based decision support and C2 modeling and simulation tools for dismounted Future Force commanders to collaboratively plan coalition activities in highly mobile operations.	2471	1965	0
- Network Enabled Battle Command (NEBC): In FY05, matured, demonstrated and transitioned decision support software services for subscription and presentation of plans, tactical graphics, and unit task organizations to Project Manager, Ground Combat Command and Control (PM GCC2); matured, demonstrated and transitioned to PM GCC2 an Unexploded Ordinances (UXO) software injector providing Command and Control Personal Computer/Joint Tactical Common Operating Picture Workstation (C2PC/JTCW) planners the capability to query and display UXO geometry from the Advanced Field Artillery Tactical Data System. In FY06, mature and demonstrate technologies to support the interfacing and information exchange management between the BCT and echelons above brigade C2 software applications and Army, Joint, Coalition and National information systems; mature intelligent search/retrieval technology and blue force predictive analysis tools for execution assessment/adjustment decision support and demonstration at the C4ISR On the Move Experiment at Ft. Dix, NJ; deliver two software enhancements, updates and repairs a year to the Battle Command Battle Lab (BCBL) for experimentation. In FY07, will enhance technologies supporting interface and information exchange management for the BCT and	6300	5690	6129

echelons above brigade C2 software applications and Army, Joint, Coalition and National Information Systems; will demonstrate and transition information search and retrieval technology and execution decision support tools into Joint Command and Control/Joint Tactical Common Operating Picture Workstation architecture; will mature information and advanced decision models; will provide one software delivery to BCBL for experimentation.			
- Command & Control of Robotic Entities (C2ORE): In FY05, demonstrated prototype software to PM FCS BCT and FCS LSI; developed an interface to Force XXI Battle Command Brigade and Below (FBCB2) for sensor planning software and an interface to Textron's unattended ground sensor (UGS) ground control station for participation in the C4ISR On the Move Experiment (Fort Dix, NJ) and Air-Assault Expeditionary Force (AAEF) Experiment (Fort Benning, GA); completed requirements for initial software development and was selected as the sensor planner software for Joint Expeditionary Force Experiment (JEFX06); established integration laboratory and analysis environment; derived and transitioned sensor placement and planning algorithms to FCS LSI. In FY06, prepare for and participate in JEFX06, FCS Experiment 1.1 and Future Force Battle Command Integration Initiative demonstration; design tactical Battle Command services for UGSs and a scenario for experimentation with UAMBL. In FY07, will mature and demonstrate tactical Battle Command services for unmanned aerial vehicles (UAVs); will prepare for and participate in FCS BCT sponsored experiments and execute a live experiment with up to 3 UGSs, 3 unmanned ground vehicles, and 1 UAV; will analyze experimental data and to assess and provide software improvements to the tactical Battle Command services.	2623	3358	7330
- Joint Force Projection (JFP) Advanced Concept Technology Demonstration (ACTD): In FY05, developed technical framework for process driven Mission Capability Package (MCP); matured modeling and simulation support tools for MCP. In FY06, develop and demonstrate an initial Joint Reception, Staging, Onward Movement, and Integration (JRSOI) bridge tool to join strategic & theater deployment and distribution processes that provides Combatant Commanders with enhanced capabilities to analyze, plan, execute, and assess force projection at the strategic and operational levels; integrate JRSOI into MCP. In FY07, will mature the Force Projection MCP within the next generation Joint Command and Control (JC2) environment; will support JFP integration into USCENTCOM, USTRANSCOM, & JFCOM exercises; will finalize transition of JFP technologies to JC2.	710	1610	180
- Networked Sensors for the Future Force: In FY05, enhanced tools for Battle Command applications, designed and implemented an unmanned systems controller, and matured decision aids to support semi-automatic sensor mission planning and management; integrated and tested Battle Command and unmanned systems controller applications with unmanned aerial vehicles containing infrared and electro-optical sensors, unmanned ground vehicles containing Cost Effective Targeting System sensor, and unattended ground sensors containing embedded acoustic, seismic and infrared sensors; conducted experimentations to demonstrate Battle Command for networked sensors at Fort AP Hill, Aberdeen Proving Ground, Fort Knox and Fort Dix; participated in C4ISR experiments with multiple unmanned networked sensors and platforms.	3000	0	0
Total	15104	12623	13639

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Tech**	**243**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
243 SENSORS & SIGNALS PROC	16472	21722	50965	48258	14579	14361	14474

A. Mission Description and Budget Item Justification: This project provides improved ground based radar, sensor fusion and correlation technologies for Future Force information dominance. The Multi-Mission Radar (MMR) program will mature a Multi-mission HMMWV mounted radar technology to support air defense, counter-battery, and air traffic control missions within a single system to enhance Future Force mobility and agility. MMR will be self-contained to process target data, identify aircraft/unmanned aerial vehicles (UAVs), and classify artillery, mortar and rockets. All target data will be distributed to relevant units in the battlefield through network centric channels. The sensor fusion program will demonstrate cross-sensor control and data correlation (fusion) of a multi-function, integrated sensor payload. Sensor suite candidates may include moving-target-indicator (MTI)/synthetic aperture radar (SAR), Night Vision and Electronic Sensors Directorate (NVESD)'s electro-optical/infrared (EO/IR) and signals intelligence technologies. This sensor suite will demonstrate wide area reconnaissance, surveillance, and targeting capability in adverse. Synergistic operation of sensors with on-board sensor management and the correlation of data for an integrated operational picture will be matured with significant leveraging of signal processing achievements from industry, Defense Advanced Research Projects Agency (DARPA) and other services. The Suite of Sense Through the Wall Systems will mature techniques for detection of personnel and objects through multiple wall types.

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

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
- Multi-Mission Radar (MMR): In FY05, matured, built, and demonstrated radar hardware and software for Counterfire Target Acquisition (CTA), Air Defense Surveillance (ADS), Air Traffic Control (ATC)and Active Defense Fire Control (ADFC) functions; conducted systems engineering test to verify hardware and software; conducted initial field tests against targets of opportunity. In FY06, perform system and subsystem test; perform 2 sets of radar CTA system tests against dedicated targets to validate performance; conduct system test demonstration of CTA, ADS, ATC and ADFC capabilities to user community; deliver prototype MMR system and prime item development specification suitable for moving into system development and demonstration phase in support of Future Force MMR development. In FY07, will complete integration and test of 360 Degree CTA capability, demonstrate integration with Extended-Light Weight Counter Mortar Radar, demonstrate cueing to external airborne sensor for mobile shooter location. The effort will culminate in demonstrations of a fully tested MMR system and prime item development specifications suitable for moving into a system development and demonstration phase.	6579	6100	3000
- Sensor Fusion: In FY05, conducted operational concept study for integration of multi-sensor payload; initiated mission management module design and maturation for cross-sensor control and data correlation; established a simulation effort to identify means of autonomous sensor management to capitalize on sensor synergies and identified commercial off-the-shelf/Government off-the-shelf sensors for the multi-sensor payload. In FY06, complete system hardware design and level 1 fusion algorithms/software for automated data correlation, sensor cross-cueing, and target tracking; select architecture, integrate SAR/MTI, EO/IR and SIGINT sensors and conduct limited testing in the Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) On-the-	6024	9766	14280

Move (OTM) experiment at Fort Dix. In FY07, will mature fusion architecture to include non-IMINT sensing systems such as COMINT, ELINT, Counter Mortar radar and blue-force data sources; will mature and demonstrate target patterns recognition software for automatic cross-cueing of sensors; will develop sensor performance analysis tools; will complete integration of sensors to address moving and stationary targets in open/sparse terrain and conduct testing in the C4ISR OTM experiment.			
- Suite of Sense Through the Wall (STTW) Systems for the Future Force: In FY05, integrated prototype STTW systems with emerging network communications architecture and demonstrate transmission of STTW data on a real time basis; evaluated data transmission, dissemination and software tools; provided STTW performance model for incorporation into Battle Lab and FFW operational modeling and simulation; evaluated technology advancements for use in personnel detection, concealed explosive detection and concealed weapons detection. In FY06, conduct lab and user testing of STTW prototypes; utilize experiments to characterize urban and complex terrain phenomenology; mature and demonstrate techniques for the detection of stationary personnel through light construction materials. In FY07, will mature and demonstrate integrated personnel detection/Concealed Weapon Detection (CWD)/Concealed Explosive Detection (CED) systems with greater standoff capability and increase probability of detection; will conduct lab testing of individual STTW sensors against multiple wall types; will develop techniques for detection of stationary personnel through multiple wall types and participate in C4ISR OTM experiment as well as FFW ATD with hand held STTW prototype.	3869	5856	6857
- Cueing Sensor: In FY07, mature and demonstrate focal plane arrays, algorithms, and processing. Perform live-fire test of prototype sensors and systems. Work on this effort is also being accomplished under PE/Project: 62120/H15; 62270/A442; 63270/K16.	0	0	1560
- Foliage Penetrating (FOPEN) Radar for Unmanned Aerial Vehicles (UAV): This effort matures and demonstrates a FOPEN radar capability to meet the size, weight and power requirements for a Class 4 UAV. In FY07, will leverage efforts from the FOPEN Advanced Concept Technology Demonstration (FY03-FY06 in Program Element (PE) 0603750D8Z, and PE/Project 0603762E/SGT-04) capability from manned aircraft to Class 4 UAV; will redesign a compact and modular radar waveform generator; will mature the existing design of the radar transmitter; will redesign the existing radar antenna for the desired pattern, gain, weight and affordability; will mature the design of the receiver; will design a new processor to replace the existing obsolete processor; will mature advanced radar processing algorithms to increase area coverage rates while reducing the volume of processed data; will port existing algorithms to a new processor; will address software and hardware integration issues due to the introduction of new modes to support increased altitude requirements; will mature and demonstrate hardware and software to add an onboard image processing capability for faster processing/exploitation timeline and reduced data volume; will perform subsystem testing in a laboratory environment.	0	0	25268
Total	16472	21722	50965