TOC

Program Element Descriptive Summaries

Exhibit R1

Supporting Data FY 2005 President's Budget
Submitted to OSD – February 2004

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

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS
OF THE
RESEARCH, DEVELOPMENT, TEST AND
EVALUATION, ARMY
FY 2005
PRESIDENT'S BUDGET SUBMISSION
FEBRUARY 2004

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 2005 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), and R-4a (Schedule Detail) Exhibits, which provide narrative information on all RDT&E program elements and projects for FY 2003 through FY 2005.

2. Relationship of the FY 2005 Budget Submission to the FY 2004 Budget Submitted to Congress. This paragraph provides a list of program elements restructured, transitioned, or established to provide specific program identification.

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

OLD PE/PROJECT	NEW PROJECT TITLE	NEW PE/PROJECT
0604645A	Common Components	0604645A/F59
0604645A	Family of Systems, Analysis & Integration	0604645A/F60
0604645A	Government Support Costs	0604645A/F61
0604645A	Mission Equipment Platforms	0604645A/F62
0604645A	Network Software	0604645A/F63
0604645A	Other Contract Costs	0604645A/F64
0604645A	S of S Engineer & Program Management	0604645A/F65
0604645A	S of S Test and Evaluation	0604645A/F66
0604645A	Supportability	0604645A/F67
0604645A	System Integration Management	0604645A/F68
0604645A	Training	0604645A/F69
0604645A	NLOS Launch System	0604645A/F70
0604645A	Joint Military Intelligence Program	0604645A/F71
0604645A/F49	Non Line of Sight Cannon	0604647A/F58
0604808A/443	Close Combat Capabilities Eng Dev	0604808A/016

0203752A/106	Avionics Component Improvement Program	0702239A/C92
0601104A/H59	HBCU/MI Centers – TRADOC Battlelabs	0601104A/H04
0601104A/H59	Institute for Collaborative Biotechnologies	0601104A/H05
0601104A/H59	Robotics Collaborative Technology Alliance	0601104A/H09
0602105A/H84	Nanomaterials Applied Research	0602105A/H7G
0602105A/H16	Biotechnology Applied Research	0602120A/SA2
0602720A/F25	Pollution Prevention	0602720A/895
0604808A/443	Close Combat Capabilities Eng Dev	0604808A/443

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

FROM		TO
PE/PROJECT	**PROJECT TITLE**	**PE/PROJECT**
0603802A/AS3	Objective Individual Combat Weapon PD/RR	0604802A/134
0604770A/202	Army Common Ground Station (CGS) (TIARA)	0604766A/957
0305114A/711	JPALS	0604201A/C97

C. Establishment of New FY 2005 Program Elements/Projects. There are no major system new starts. Minor new initiatives for FY 2005 are shown below with asterisks. The remaining programs listed are outyear initiatives, restructures beyond FY 2005, or were previously funded from other Defense appropriations.

TITLE	**PE/PROJECT**
Range Upgrades	0603308A/988
Integrated Fire Control	0603327A/E88
Non Line of Sight Cannon	0604647A/F58
Avionics Component Improvement Program*	0702239A/C92
Representation of Space Capabilities*	0604760A/C69

D. FY 2005 programs for which funding existed in the FY 2004 President's Budget Submit, but which are no longer funded beginning in FY 2005.

PE/PROJECT	TITLE	BRIEF EXPLANATION
0603305A/TR6	Army Air and Missile Defense	Program transition to 0603327
0604710A/L69	HTI 2d Gen FLIR ED	Program terminated
0604768A/MD6	ATACMS – Penetrator	Program terminated
0604768A/P01	Multi-Mode Seeker Development and Test	Program complete
0604802A/AS5	Artillery Munitions Engineering Development	Program transition to Navy
0604817A/902	Individual Combat Identification System (ICIDS)	Program terminated
0203726A/33C	Improved Position Azimuth Determining Sys	Program terminated
0203735A/718	Ground Combat Vehicle HTI	Program complete
0203802A/785	Longbow Hellfire PIP	Program terminated

3. Classification. This document contains no classified data. Classified and Special Access program elements/projects that are submitted offline are listed below.

0203806A/Z02	0602601A/C84 *	0603020A/B77 */B84/B85/B96
0203808A/E11	0602786A/C60	0603322A/B92
0301359A	0603005A/C66	0603710A/C65/C67 *
0602122A/B72/622	0603009A/B18/B31	0604328A/C71

* Funding ends in FY03

4. Comprehensive Program Review. This year, the Administration undertook a comprehensive review of 20% of the programs of the Executive Branch, including the same portion of programs within the Department of Defense. The Basic Research programs of the Department were reviewed as a whole, including Basic Research programs of the Army. The Basic Research program merited a rating of "Effective". A summary sheet describing the rating from the Basic Research evaluation follows.

Exhibit R-1

Summary

22-Jan-2004

Summary Recap of Budget Activities	Thousands of Dollars		
	FY 2003	FY 2004	FY 2005
Basic research	242,924	381,593	317,506
Applied Research	852,485	1,039,845	651,192
Advanced technology development	1,095,874	1,205,226	814,615
Advanced Component Development and Prototypes	944,163	920,801	734,493
System Development and Demonstration	2,430,934	4,663,567	6,129,313
Management support	954,015	893,813	859,298
Operational system development	1,074,181	1,096,509	929,140
Total RDT&E, Army			

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY 2003	FY 2004	FY 2005
	Basic research					
1	0601101A	01	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	20,255	23,914	23,971
2	0601102A	01	DEFENSE RESEARCH SCIENCES	138,432	156,146	131,206
3	0601103A	01	UNIVERSITY RESEARCH SCIENCES (H)	0	85,242	75,133
4	0601104A	01	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	84,237	99,786	77,658
5	0601105A	01	FORCE HEALTH PROTECTION	0	16,505	9,538
	Total: Basic research			242,924	381,593	317,506
	Applied Research					
6	0602105A	02	MATERIALS TECHNOLOGY	35,041	39,972	15,385
7	0602120A	02	SENSORS AND ELECTRONIC SURVIVABILITY	21,700	25,230	25,629
8	0602122A	02	TRACTOR HIP	6,322	5,649	6,627
9	0602211A	02	AVIATION TECHNOLOGY	39,163	39,172	41,629
10	0602270A	02	EW TECHNOLOGY	17,002	16,471	18,034
11	0602303A	02	MISSILE TECHNOLOGY	52,793	91,560	51,993
12	0602307A	02	ADVANCED WEAPONS TECHNOLOGY	19,785	14,706	16,641
13	0602308A	02	ADVANCED CONCEPTS AND SIMULATION	28,453	30,431	15,041
14	0602601A	02	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	81,562	125,147	69,638
15	0602618A	02	BALLISTICS TECHNOLOGY	61,372	57,197	51,301
16	0602622A	02	CHEMICAL, SMOKE AND EQUIPMENT DEFEATING TECHNOLOGY	15,480	21,722	3,476
17	0602623A	02	JOINT SERVICE SMALL ARMS PROGRAM	5,373	5,649	5,739
18	0602624A	02	WEAPONS AND MUNITIONS TECHNOLOGY	71,917	75,266	44,666
19	0602705A	02	ELECTRONICS AND ELECTRONIC DEVICES	61,510	76,809	41,236
20	0602709A	02	NIGHT VISION TECHNOLOGY	18,707	21,506	22,617
21	0602712A	02	COUNTERMINE SYSTEMS	18,408	26,016	20,547
22	0602716A	02	HUMAN FACTORS ENGINEERING TECHNOLOGY	20,247	23,913	16,899
23	0602720A	02	ENVIRONMENTAL QUALITY TECHNOLOGY	26,461	30,824	17,026
24	0602782A	02	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	20,805	18,115	18,604
25	0602783A	02	COMPUTER AND SOFTWARE TECHNOLOGY	3,931	4,010	3,982

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY 2003	FY 2004	FY 2005
26	0602784A	02	MILITARY ENGINEERING TECHNOLOGY	54,562	51,577	47,152
27	0602785A	02	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	15,130	15,053	15,322
28	0602786A	02	LOGISTICS TECHNOLOGY	35,826	49,349	21,131
29	0602787A	02	MEDICAL TECHNOLOGY	120,935	174,501	60,877
	Total:		Applied Research	852,485	1,039,845	651,192
			Advanced technology development			
30	0603001A	03	WARFIGHTER ADVANCED TECHNOLOGY	55,618	66,855	68,034
31	0603002A	03	MEDICAL ADVANCED TECHNOLOGY	168,093	217,737	38,404
32	0603003A	03	AVIATION ADVANCED TECHNOLOGY	42,388	84,966	69,549
33	0603004A	03	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	61,206	53,737	67,622
34	0603005A	03	COMBAT VEHICLE AND AUTOMOTIVE ADVANCED TECHNOLOGY	304,885	270,656	203,126
35	0603006A	03	COMMAND, CONTROL, COMMUNICATIONS ADVANCED TECHNOLO	8,700	11,339	9,946
36	0603007A	03	MANPOWER, PERSONNEL AND TRAINING ADVANCED TECHNOLO	7,606	8,921	7,288
37	0603008A	03	ELECTRONIC WARFARE ADVANCED TECHNOLOGY	28,662	59,170	41,760
38	0603009A	03	TRACTOR HIKE	16,943	7,686	8,035
39	0603015A	03	NEXT GENERATION TRAINING & SIMULATION SYSTEMS	0	15,658	18,072
40	0603020A	03	TRACTOR ROSE	3,261	4,159	4,736
41	0603103A	03	EXPLOSIVE DEMILITARIZATION TECHNOLOGY	0	24,842	9,706
42	0603105A	03	MILITARY HIV RESEARCH	0	14,059	6,641
43	0603125A	03	COMBATING TERRORISM, TECHNOLOGY DEVELOPMENT FOR	41,822	8,610	3,383
44	0603238A	03	GLOBAL SURVEILLANCE/AIR DEFENSE/PRECISION STRIKE T	29,774	12,505	10,721
45	0603270A	03	EW TECHNOLOGY	18,566	25,360	9,382
46	0603313A	03	MISSILE AND ROCKET ADVANCED TECHNOLOGY	100,616	121,126	92,800
47	0603322A	03	TRACTOR CAGE	2,938	7,499	13,312
48	0603606A	03	LANDMINE WARFARE AND BARRIER ADVANCED TECHNOLOGY	28,075	29,662	25,577
49	0603607A	03	JOINT SERVICE SMALL ARMS PROGRAM	16,396	9,575	5,968
50	0603654A	03	LINE-OF-SIGHT TECHNOLOGY DEMONSTRATION	29,931	8,739	0
51	0603710A	03	NIGHT VISION ADVANCED TECHNOLOGY	77,129	84,066	50,071
52	0603728A	03	ENVIRONMENTAL QUALITY TECHNOLOGY DEMONSTRATIONS	12,694	20,462	14,666

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY 2003	FY 2004	FY 2005
53	0603734A	03	MILITARY ENGINEERING ADVANCED TECHNOLOGY	13,643	13,106	3,865
54	0603772A	03	ADVANCED TACTICAL COMPUTER SCIENCE AND SENSOR TECH	26,928	24,731	31,951
	Total:		Advanced technology development	1,095,874	1,205,226	814,615
			Advanced Component Development and Prototypes			
55	0603305A	04	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION	36,790	108,078	53,509
56	0603308A	04	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION (DEM/VAL)	56,974	35,532	4,871
57	0603327A	04	AIR AND MISSILE DEFENSE SYSTEMS ENGINEERING	0	121,489	91,713
58	0603619A	04	LANDMINE WARFARE AND BARRIER - ADV DEV	9,719	36,563	11,634
59	0603627A	04	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ADV DEV	2,324	10,147	6,249
60	0603639A	04	TANK AND MEDIUM CALIBER AMMUNITION	26,367	26,055	39,697
61	0603645A	04	ARMORED SYSTEM MODERNIZATION - ADV DEV	127,951	0	0
62	0603653A	04	ADVANCED TANK ARMAMENT SYSTEM (ATAS)	150,234	60,692	51,892
63	0603747A	04	SOLDIER SUPPORT AND SURVIVABILITY	19,664	13,833	13,810
64	0603766A	04	TACTICAL SUPPORT DEVELOPMENT - ADV DEV (TIARA)	16,112	16,878	15,441
65	0603774A	04	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	10,984	7,005	14,047
66	0603779A	04	ENVIRONMENTAL QUALITY TECHNOLOGY DEM/VAL	30,980	40,509	9,356
67	0603782A	04	WARFIGHTER INFORMATION NETWORK-TACTICAL - DEM/VAL	48,849	81,393	99,645
68	0603790A	04	NATO RESEARCH AND DEVELOPMENT	4,561	2,747	4,801
69	0603801A	04	AVIATION - ADV DEV	10,660	14,307	9,233
70	0603802A	04	WEAPONS AND MUNITIONS - ADV DEV	35,634	31,500	2,382
71	0603804A	04	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	11,997	12,863	10,485
72	0603805A	04	COMBAT SERVICE SUPPORT CONTROL SYSTEM EVALUATION A	8,275	8,585	6,366
73	0603807A	04	MEDICAL SYSTEMS - ADV DEV	13,280	13,392	10,258
74	0603850A	04	INTEGRATED BROADCAST SERVICE (JMIP/DISTP)	1,928	2,073	4,356
75	0603854A	04	ARTILLERY SYSTEMS - DEM/VAL	306,778	0	0
76	0603856A	04	SCAMP BLOCK II	14,102	27,716	10,221
77	0603869A	04	MEADS CONCEPTS - DEM/VAL	0	249,444	264,527
	Total:		Advanced Component Development and Prototypes	944,163	920,801	734,493

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY 2003	FY 2004	FY 2005
			System Development and Demonstration			
78	0604201A	05	AIRCRAFT AVIONICS	35,971	47,155	68,857
79	0604220A	05	ARMED, DEPLOYABLE OH-58D	1,759	0	0
80	0604223A	05	COMANCHE	865,613	1,068,029	1,229,664
81	0604270A	05	EW DEVELOPMENT	38,291	32,870	16,879
82	0604280A	05	JOINT TACTICAL RADIO SYSTEM	62,892	133,293	121,400
83	0604321A	05	ALL SOURCE ANALYSIS SYSTEM	54,341	19,959	5,346
84	0604328A	05	TRACTOR CAGE	9,304	16,046	14,149
85	0604329A	05	COMMON MISSILE	28,104	93,705	152,381
86	0604601A	05	INFANTRY SUPPORT WEAPONS	0	28,340	28,187
87	0604604A	05	MEDIUM TACTICAL VEHICLES	3,584	4,321	2,854
88	0604609A	05	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ENG DEV	7,521	11,968	3,798
89	0604611A	05	JAVELIN	467	946	944
90	0604622A	05	FAMILY OF HEAVY TACTICAL VEHICLES	13,852	16,875	2,479
91	0604633A	05	AIR TRAFFIC CONTROL	2,161	2,489	2,088
92	0604641A	05	TACTICAL UNMANNED GROUND VEHICLE (TUGV)	1,146	0	0
93	0604642A	05	LIGHT TACTICAL WHEELED VEHICLES	7,900	18,010	0
94	0604645A	05	ARMORED SYSTEMS MODERNIZATION (ASM)-ENG. DEV.	159,175	1,423,146	2,700,455
95	0604647A	05	NON LINE OF SIGHT CANNON	0	260,495	497,643
96	0604649A	05	ENGINEER MOBILITY EQUIPMENT DEVELOPMENT	7,651	0	0
97	0604710A	05	NIGHT VISION SYSTEMS - ENG DEV	31,687	38,816	24,693
98	0604713A	05	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	80,989	98,960	115,093
99	0604715A	05	NON-SYSTEM TRAINING DEVICES - ENG DEV	55,865	70,870	51,694
100	0604716A	05	TERRAIN INFORMATION - ENG DEV	8,092	6,905	3,199
101	0604726A	05	INTEGRATED METEOROLOGICAL SUPPORT SYSTEM	3,359	3,275	2,485
102	0604738A	05	JSIMS CORE PROGRAM	28,759	0	0
103	0604741A	05	AIR DEFENSE COMMAND, CONTROL AND INTEL - ENG	26,983	28,993	27,376
104	0604742A	05	CONSTRUCTIVE SIMULATION SYSTEMS DEVELOPMENT	43,673	16,818	42,869
105	0604746A	05	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	12,647	11,316	4,713
106	0604760A	05	DISTRIBUTIVE INTERACTIVE SIMULATIONS (DIS) - ENGIN	18,087	25,789	26,985

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107	0604766A	05	TACTICAL EXPLOITATION SYSTEM/DCGS (TIARA)	57,229	26,022	21,821
108	0604768A	05	BRILLIANT ANTI-ARMOR SUBMUNITION (BAT)	55,922	9,897	21
109	0604770A	05	JOINT SURVEILLANCE/TARGET ATTACK RADAR SYSTEM	4,509	4,656	0
110	0604778A	05	POSITIONING SYSTEMS DEVELOPMENT (SPACE)	0	1,558	2,048
111	0604780A	05	COMBINED ARMS TACTICAL TRAINER (CATT)	8,162	3,956	23,849
112	0604783A	05	JOINT NETWORK MANAGEMENT SYSTEM	7,673	9,339	10,726
113	0604801A	05	AVIATION - ENG DEV	2,979	3,344	2,378
114	0604802A	05	WEAPONS AND MUNITIONS - ENG DEV	49,830	157,076	125,885
115	0604804A	05	LOGISTICS AND ENGINEER EQUIPMENT - ENG DEV	56,101	87,471	89,151
116	0604805A	05	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ENG DEV	89,465	216,811	219,790
117	0604807A	05	MEDICAL MATERIEL/MEDICAL BIOLOGICAL DEFENSE EQUIPM	18,769	22,615	11,727
118	0604808A	05	LANDMINE WARFARE/BARRIER - ENG DEV	125,024	96,187	51,045
119	0604814A	05	ARTILLERY MUNITIONS - EMD	102,141	122,631	133,297
120	0604817A	05	COMBAT IDENTIFICATION	4,983	11,817	6,994
121	0604818A	05	ARMY TACTICAL COMMAND & CONTROL HARDWARE & SOFTWAR	97,970	101,166	68,110
122	0604819A	05	LOSAT	10,603	30,488	22,628
123	0604820A	05	RADAR DEVELOPMENT	0	0	6,107
124	0604823A	05	FIREFINDER	28,401	26,825	18,516
125	0604854A	05	ARTILLERY SYSTEMS - EMD	30,483	32,289	9,550
126	0604865A	05	PATRIOT PAC-3 THEATER MISSILE DEFENSE ACQ - EMD	0	156,827	64,178
127	0605013A	05	INFORMATION TECHNOLOGY DEVELOPMENT	70,817	63,203	95,261
	Total:		System Development and Demonstration	2,430,934	4,663,567	6,129,313
	Management support					
128	0604256A	06	THREAT SIMULATOR DEVELOPMENT	17,593	19,601	22,101
129	0604258A	06	TARGET SYSTEMS DEVELOPMENT	10,049	13,444	11,017
130	0604759A	06	MAJOR T&E INVESTMENT	47,054	60,141	57,987
131	0605103A	06	RAND ARROYO CENTER	21,163	22,072	20,012
132	0605301A	06	ARMY KWAJALEIN ATOLL	125,327	138,884	143,921
133	0605326A	06	CONCEPTS EXPERIMENTATION	23,330	30,704	22,727

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134	0605502A	06	SMALL BUSINESS INNOVATIVE RESEARCH	179,142	0	0
135	0605601A	06	ARMY TEST RANGES AND FACILITIES	129,665	182,885	181,114
136	0605602A	06	ARMY TECHNICAL TEST INSTRUMENTATION AND TARGETS	41,774	56,899	52,433
137	0605604A	06	SURVIVABILITY/LETHALITY ANALYSIS	34,921	41,860	44,648
138	0605605A	06	DOD HIGH ENERGY LASER TEST FACILITY	16,672	18,299	15,725
139	0605606A	06	AIRCRAFT CERTIFICATION	3,555	2,999	2,985
140	0605702A	06	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	6,792	9,359	8,711
141	0605706A	06	MATERIEL SYSTEMS ANALYSIS	8,978	15,642	18,000
142	0605709A	06	EXPLOITATION OF FOREIGN ITEMS	3,430	3,465	4,740
143	0605712A	06	SUPPORT OF OPERATIONAL TESTING	83,911	66,995	71,239
144	0605716A	06	ARMY EVALUATION CENTER	43,809	46,527	62,209
145	0605718A	06	SIMULATION & MODELING FOR ACQ, RQTS, & TNG (SMART)	0	2,568	1,935
146	0605801A	06	PROGRAMWIDE ACTIVITIES	59,836	62,966	59,368
147	0605803A	06	TECHNICAL INFORMATION ACTIVITIES	54,182	42,122	27,713
148	0605805A	06	MUNITIONS STANDARDIZATION, EFFECTIVENESS AND SAFET	30,002	39,783	14,611
149	0605857A	06	ENVIRONMENTAL QUALITY TECHNOLOGY MGMT SUPPORT	1,794	4,780	4,527
150	0605898A	06	MANAGEMENT HEADQUARTERS (RESEARCH AND DEVELOPMENT)	10,855	11,818	11,575
151	0909999A	06	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS	181	0	0
	Total:		Management support	954,015	893,813	859,298
			Operational system development			
152	0102419A	07	JOINT LAND ATTACK CRUISE MISSILES DEFENSE (JLENS)	33,489	58,397	81,514
153	0203610A	07	DOMESTIC PREPAREDNESS AGAINST WEAPONS OF MASS DEST	2,437	3,956	
154	0203726A	07	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	44,959	28,599	17,994
155	0203735A	07	COMBAT VEHICLE IMPROVEMENT PROGRAMS	81,285	31,336	15,952
156	0203740A	07	MANEUVER CONTROL SYSTEM	40,612	39,145	24,753
157	0203744A	07	AIRCRAFT MODIFICATIONS/PRODUCT IMPROVEMENT PROGRAM	206,500	276,191	224,368
158	0203752A	07	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	6,759	5,339	2,427
159	0203758A	07	DIGITIZATION	27,727	18,049	24,506
160	0203759A	07	FORCE XXI BATTLE COMMAND, BRIGADE AND BELOW (FBCB2	59,887	47,901	23,510

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161	0203801A	07	MISSILE/AIR DEFENSE PRODUCT IMPROVEMENT PROGRAM	39,262	46,055	31,690
162	0203802A	07	OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS	12,229	1,061	4,863
163	0203806A	07	TRACTOR RUT	0	8,754	3,321
164	0203808A	07	TRACTOR CARD	8,495	9,153	9,023
165	0208010A	07	JOINT TACTICAL COMMUNICATIONS PROGRAM (TRI-TAC)	13,281	16,362	18,177
166	0208053A	07	JOINT TACTICAL GROUND SYSTEM	2,811	9,659	9,967
167	0301359A	07	SPECIAL ARMY PROGRAM	12,445	19,737	
168	0303028A	07	SECURITY AND INTELLIGENCE ACTIVITIES	26,182	15,873	
169	0303140A	07	INFORMATION SYSTEMS SECURITY PROGRAM	22,153	20,500	24,725
170	0303141A	07	GLOBAL COMBAT SUPPORT SYSTEM	49,273	55,217	94,215
171	0303142A	07	SATCOM GROUND ENVIRONMENT (SPACE)	67,716	86,389	51,959
172	0303150A	07	WWMCCS/GLOBAL COMMAND AND CONTROL SYSTEM	16,704	16,934	19,204
173	0305114A	07	TRAFFIC CONTROL, APPROACH AND LANDING SYSTEM-FY 19	934	945	
174	0305204A	07	TACTICAL UNMANNED AERIAL VEHICLES	68,650	68,629	27,127
175	0305206A	07	AIRBORNE RECONNAISSANCE ADV DEVELOPMENT	11,433	4,699	5,128
176	0305208A	07	DISTRIBUTED COMMON GROUND SYSTEMS (JMIP)	44,805	37,375	43,254
177	0603778A	07	MLRS PRODUCT IMPROVEMENT PROGRAM	94,584	83,903	97,422
178	0702239A	07	AVIONICS COMPONENT IMPROVEMENT PROGRAM	0	0	997
179	0708045A	07	END ITEM INDUSTRIAL PREPAREDNESS ACTIVITIES	79,066	85,853	67,236
180	1001018A	07	NATO JOINT STARS	503	498	595
	Total:		Operational system development	1,074,181	1,096,509	929,140
Total:	RDT&E, Army			7,594,576	10,201,354	10,435,557

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BALLISTICS TECHNOLOGY	0602618A	15	182
Chemical, Smoke and Equipment Defeating Technology	0602622A	16	193
Combat Vehicle and Automotive Advanced Technology	0603005A	34	371
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DEFENSE RESEARCH SCIENCES	0601102A	2	12
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ELECTRONICS AND ELECTRONIC DEVICES	0602705A	19	214
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LOGISTICS TECHNOLOGY	0602786A	28	292
Manpower, Personnel and Training Advanced Technolo	0603007A	36	398
Manpower/Personnel/Training Technology	0602785A	27	287
MATERIALS TECHNOLOGY	0602105A	6	106
MEDICAL ADVANCED TECHNOLOGY	0603002A	31	337
MEDICAL TECHNOLOGY	0602787A	29	304
Military Engineering Advanced Technology	0603734A	53	488
MILITARY ENGINEERING TECHNOLOGY	0602784A	26	268
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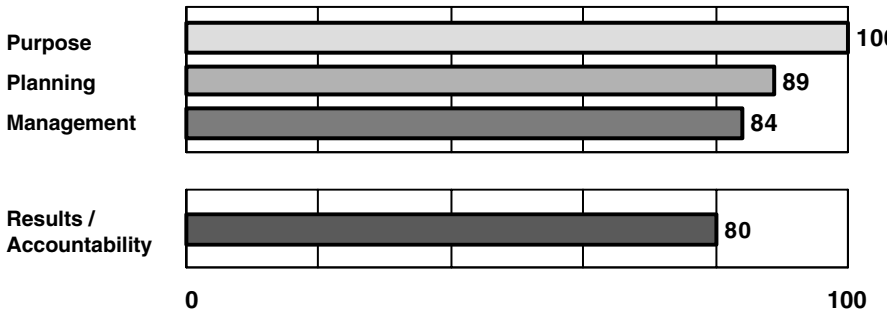
Program: *Basic Research*

Agency: *Department of Defense--Military*
Bureau: *Research, Development, Test, and Evaluation*



☑ Results Achieved
☐ Results Not Demonstrated
☑ Measures Adequate
☐ New Measures Needed

Key Performance Measures	*Year*	*Target*	*Actual*
Certification in biennial reviews by technically competent independent reviewers that the supported work, as a portfolio, is of high quality, serves to advance the national security and is efficiently managed and carried out.	2003 and later	100%	
Long-term Measure: Portion of funded research that is chosen on the basis of merit review Reduce non-merit-reviewed and -determined projects by one half in two years (from 6.0% to 3.0%)	2005	-50%	

****Rating:*** *Effective*

Program Type *Research and Development*

Program Summary:

The Basic Research program includes scientific study and experimentation to increase fundamental knowledge in the physical, engineering, environmental and life sciences and consists of a wide portfolio of projects. The program is carried out primarily through grants to universities and non-profits. The results of this research are expected to improve the country's defense capabilities, although the actual results of any specific project are unpredictable. Notable successes in the past have led to advances in satellite communications and imagery, precision navigation, stealth, night vision and technologies allowing greatly expanded battlefield awareness. Due to the long-term nature of research results, the R&D PART emphasizes assessment of the process of choosing funded projects and independent assessments of how well the research portfolio is managed.

The assessment indicates that the basic research program has clear purposes of providing options for new weapons systems, helping prevent technological surprise by adversaries, and developing new scientists who will contribute to the DoD mission in the future. DoD can document--through its contracts and grants management regulations, public announcements of award competitions and results from independent review panels--the methodical management of its program. Additional findings include:
1. The grants/contract solicitation, review and award processes are competitive.
2. The program is reviewed regularly by technically capable outside reviewers, which recommend improvements they would like to be implemented. They indicate that the work is of overall high quality.
3. The program has competent planning and management.
4. Earmarking of projects in the program has increased in the past decade and contribute less than the typical research project to meeting the agency's mission.

In response to these findings, the Administration will:
1. Continue to emphasize the use of independent review panels in assessing the performance of the program.
2. Work 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.

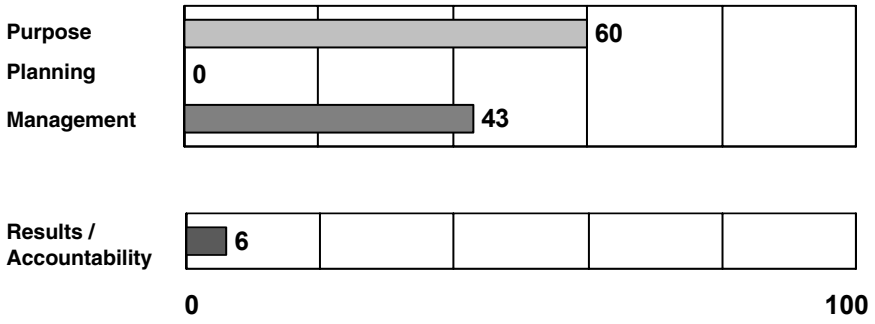
Program Funding Level (in millions of dollars)

* This assessments has not changed since publication in the FY 2004 Budget. For updated program funding levels, see Data File - Funding, Scores, and Ratings.

Program: *DoD Small Business Innovation Research / Technology Transfer*

Agency: *Department of Defense--Military*

Bureau: *Research & Development*



Rating: *Results Not Demonstrated*

Program Type: *Research and Development*

Program Summary:

The Department of Defense's (DoD's) Small Business Innovation Research and Small Business Technology Transfer programs supply funds to small businesses (in the latter case, in conjunction with non-profit research institutions) to develop products that help DoD defend the country.

The assessment found that the program:

- Provides funds to small businesses but has poor controls on unproductive spending
- Continues to provide funding to companies with track records of poor performance;
- Overestimates commercial successes resulting from Federal support by treating additional investment in the same way as product sales.

In response to these findings, the Administration will:

1. Tighten eligibility requirements for accepting proposals from companies and individuals that repeatedly fail to sell resulting products in the marketplace.
2. Change the way companies' past performance is assessed to ensure that it more closely matches the intent of the law.
3. Look for ways to budget explicitly for the program's administrative costs.
4. Seek to get highly successful awardees to enter the mainstream of Defense contracting.

Key Performance Measures	***Year***	***Target***	***Actual***
Long-term Measure: Revise the Commercialization Achievement Index (CAI) to eliminate counting of investments as commercialization no later than three years after receiving the first Phase II support. After that, count competitive sales receipts only.	2004	All	
Long-term Measure: Stop funding companies with more than 5 current or past Phase II awards in the last 5 years if the company is in the bottom quartile in the CAI.	2005	All	
Long-term Efficiency Measure: Emphasize commercialization so overall competitively awarded sales to the government (direct or indirect) from resulting products is at least equal to new R&D investment (Phases I-III), as a portfolio of prior 3-8 year investments (rolling average).	2004	0.15	
	2005	0.2	
	2006	0.3	
	2007	0.5	

Program Funding Level (in millions of dollars)

2003 Actual	2004 Estimate	2005 Estimate
963	1,100	1,133

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601101A - In-House Laboratory Independent Research

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		20255	23914	23971	25052	25302	25841	16925
91A	ILIR-AMC	15187	18615	18197	19017	19163	19597	10571
91C	ILIR-MED R&D CMD	3594	3829	4058	4243	4315	4390	4466
91D	ILIR-CORPS OF ENGR	1181	1470	1414	1476	1502	1527	1556
91E	ILIR-ARI	293	0	302	316	322	327	332

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 technical directors 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 work in this program is performed by the Army Materiel Command, Army Medical Research and Materiel Command, the Army Corps of Engineers Engineer Research and Development Center and the Army Research Institute. 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).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	20608	24121	24256
Current Budget (FY 2005 PB)	20255	23914	23971
Total Adjustments	-353	-207	-285
Congressional program reductions		-207	
Congressional rescissions			
Congressional increases			
Reprogrammings	-353		
SBIR/STTR Transfer			
Adjustments to Budget Years			-285

Projects with no R-2A:

(FY03: $293; FY05: $302) Army Research Institute, Project 91E: The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) provides the Army's basic research in personnel, training, and leader development to ensure that the human component of warfighting keeps pace with the equipment, weapons, and systems changes envisioned for transformation to the Future Force. In FY03/FY04, focused on the ability of people to detect and react to changes in the digital environment, and evaluated theories of situational judgment tests. In FY05, focus on conditional reasoning and performance in the context of decision-making.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
91A	ILIR-AMC	15187	18615	18197	19017	19163	19597	10571

A. Mission Description and Budget Item Justification: This project provides funding for ILIR research in the Army Materiel Command's six Research, Development and Engineering Centers (RDECs) and the Army Research Institute. 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 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 Materiel Command and the Army Research Institute.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Aviation and Missile RDEC Missile Efforts - In FY03, transitioned secure communications link based on chaotic waveform to Unmanned Ground Vehicle Project Office. Transitioned advanced Computational Fluid Dynamics models and designs into future hypersonic missile programs. Transitioned protective coatings based on Photonic Band-Gap materials to applied technology programs for missile sensor protection from laser threats. Tested and evaluated in the laboratory a cost-effective three dimensional display. Established a laboratory for the evaluation of ultra-short (femtosecond) pulsed laser radiation. In FY04, evaluate the propagation characteristics of ultra-short pulsed laser radiation in realistic atmosphere. Analyze and quantify the damage characteristics of ultra-short pulse laser radiation to materials common to missile, aircraft, and UAV structure and components. Investigate techniques to predict and engineer the optical properties of materials to be used for laser-based optical communications and optical information technology. Test and evaluate flat panel display technology capable of providing full frame rate, full resolution stereo viewing to the user and transfer this technology to advanced research programs. In FY05, test and evaluate at the laboratory breadboard level the fundamental operations of a quantum computer. Perform the necessary experiments and/or analysis to allow the transition of ultra-short pulse laser technology to appropriate applied technology programs.	3112	3546	3171
- Armaments RDEC - In FY03, conducted basic research in: higher/tailorable output energetics to include nanomaterial additives; synthesis of amino-Nitroimididazoles insensitive materials; reactive warhead liner materials; mechanical properties of energetics; nanotechnology enhanced energy density capacitance; biometric "grip recognition" to render weapons, grip control, "safe" from unwanted use; and sensitivity of eddy current non-destructive characterization of coatings. In FY04, conduct basic research in: synthesis of new energetic formulations for higher output with lower vulnerability; multi-sensor fusion for smart munitions; nanotechnology enhanced energy density capacitance; and synergistic directed energy effects. In FY05, 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, directed energy target effects.	2280	3179	3272

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Tank-automotive RDEC - In FY03, investigated terrain models for unmanned ground vehicle perception; designed fuzzy logic and neural net control strategies for unmanned ground vehicles; tested and evaluated engine combustion models and materials for laser eye protection; modeled and tested composite materials; and tested active and passive nonlinear suspensions. In FY04, mature fuzzy logic and neural net control strategies and terrain models for unmanned ground vehicle perception; continue maturation and testing of engine combustion models and materials for laser eye protection; modeling and testing of mechanisms for cooling vehicle electronics; and investigations into high speed ballistic impact imaging and modeling. In FY05, continue maturation and testing of fuzzy logic and neural net control strategies, terrain models, engine combustion models, and laser eye protection materials; and modeling and testing of high speed ballistic impacts.	2229	2067	2298
- Natick Soldier Center – In FY03, researched and modeled novel nanomaterials having potential for ballistic and chemical protection; completed 3D scanning of inflated model parachute canopies to understand added air mass effects; developed theoretical model of carbon nanotube periodic array optical properties; performed research on a novel DNA approach with potential for uniquely detecting multiple biological agents. In FY04, model new nanocomposites for use in improved ballistic/optical materials; examine layered nanomaterials for potential optical applications; validate mathematical model of microbial inactivation using high pressure in model foods; research influence of optical properties of textiles on thermal/signature management; model airdrop platform motion and measure unsteady aerodynamic characteristics; quantify nanoparticle-polymer interaction in nanocomposites using electron spin resonance. In FY05, examine parameters for processing nanofilms that could be used in photovoltaic devices; examine proteomics for advanced biosensing; model inactivation of pressure resistant bacterial spores; perform basic research to identify personal characteristics that contribute to claustro-intolerance in warfighters; investigate interaction between movement in complex environments and cognitive processing of information.	1492	1482	1630

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Edgewood Chemical Biological Center - In FY03, conducted basic research that supported chemical and biological defense requirements, as well as biotechnology efforts in support of Objective Force Warrior. Specific accomplishments included studies of a solid-state nanosensor for the detection of nitrate-based explosives, exploration of advanced sensor technologies for the detection of biological, viral, and biologically-derived warfare agents, and the use of enzymes for the bioremediation of concrete surfaces contaminated with militarily significant chemicals. FY04 efforts continue to focus primarily on addressing fundamental scientific questions pertaining to chemical and biological defense technology. These efforts are exemplified by studies of antibody-based magnetic nanosensors in conjunction with nuclear magnetic resonance for the detection of toxic warfare agents, the use of metabolomics as a means to identify biomarkers that can be used to detect soldier exposure to chemical warfare agents, and the verification of computational fluid dynamics modeling that would contribute to the design of aerosol sampling inlets for biological agent detection systems. Efforts will also include biotechnology-based efforts, to include the development of a recombinant protein production and downstream processing protocol for bacteriorhodopin, a light absorbing protein that has potential application in the future development of biologically derived electronic and photonic materials. In FY05, will continue basic research efforts focused on addressing fundamental questions pertaining to chemical and biological defense technology and biotechnology that address Army requirements.	1800	2236	1992
- Aviation and Missile RDEC Aviation Efforts - In FY03, conducted research and applied Stereoscopic Schlieren technique to a full-scale helicopter vortex model to improve rotor blade performance. Conducted low Reynolds number airfoil tests for Unmanned Aerial Vehicle (UAV) application. In FY04, investigate active on-blade control for a swashplate-less rotor concept. Conduct research on semi-active control actuators for vibration control to reduce adverse fuselage aerodynamics allowing for increased speed and range. In FY05, perform research to achieve robust control architecture for UAV missions. Conduct research to measure boundary layer properties in separated-flow regions to construct new turbulence models.	2514	2919	3005

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Communications-Electronics RDEC - In FY03, investigated technologies for prediction of the transport phenomenon of explosive-related chemicals (ERCs) as they are released from buried land mines, for enhanced target acquisition and identification, and for low altitude antenna communication using the Uniform Theory of Diffraction. In FY04, study and monitor ERC levels in surface soils over time and correlate air flux to surface soil ERC concentrations. Perform chemical evaluations to understand the basic solvent/ion interactions of new solutions for determining optimum composition for use in new Lithium Ion Batteries. Investigate a software engine that will convert natural language to a control language and then to eXtensible Mark-up Language (XML) for C2 applications. Investigate a very high order of encryption algorithm for communications networks. In FY05, investigate models for fused sensors and the maturation and training of automatic/aided target recognition algorithms. Identify techniques for practical electrolyte research for Lithium Ion Batteries. Investigate phased array systems that will deliver the necessary energy to cause the perturbation of the index of refraction of the air that the laser beam is traveling through to cause it to scatter and be intercepted.	1760	2747	2829
Small Business Innovative Research/Small Business Technology Transfer Programs	0	439	0
Totals	15187	18615	18197

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
91C	ILIR-MED R&D CMD	3594	3829	4058	4243	4315	4390	4466

A. Mission Description and Budget Item Justification: This project addresses medical and force protection research needs at the six 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 will 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 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 WRAIR, Silver Spring, MD; USAMRICD, Aberdeen Proving Ground, MD; UASMRIID, Fort Detrick, MD; USARIEM, Natick, MA; USAISR, Fort Sam Houston, TX; and USAARL Fort Rucker, AL. This project contains no duplication with any effort within the Military Departments.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03, performed research to further exploit candidate countermeasures against militarily relevant infectious diseases identified through application of microarray technology. Investigated candidate methods of testing for infection. Performed research to further develop models to predict physiological and operational stressors on the battlefield. Exploited use of promising gene therapies to reverse early tissue damage in organs. In FY04, solicit basic research proposals and make awards that focus on militarily relevant research to identify countermeasures against infectious diseases, defense against environmental extremes and operational hazards to health, and mechanisms of combat trauma and innovative treatment and surgical procedures. Monitor progress of research and evaluate scientific results from final reports. In FY05, solicit basic research proposals and make awards that focus on militarily relevant research to identify countermeasures against infectious diseases, defense against environmental extremes and operational hazards to health, and mechanisms of combat trauma and innovative treatment and surgical procedures. Monitor progress of research and evaluate scientific results from final reports.	3594	3720	4058
Small Business Innovative Research/Small Business Technology Transfer Programs	0	109	0
Totals	3594	3829	4058

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
91D	ILIR-CORPS OF ENGR	1181	1470	1414	1476	1502	1527	1556

A. Mission Description and Budget Item Justification: This project supports In-House Laboratory Independent Research (ILIR) in the areas of Battlespace Environments, Military Engineering, and Environmental Quality/Installations within the seven laboratories that make up the Corps of Engineers' Engineer Research and Development Center. 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 Defense Technology Area Plan (DTAP). Work in this project is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Battlespace Environment/Military Engineering/Environmental Quality and Installations - In FY03, explored the chemical phenomena needed to ultimately develop highly selective and sensitive DNA biosensors for detection of explosives (i.e., landmines and unexploded ordnance). Exploited phase profilometry, an optical technique, to accurately measure surface topography and objects, a capability that is critical to sensing for robots maneuvering in complex terrain. Investigated the effects of soils on the strength of ground and air surface waves as input to the design of a short-range ground radiowave communications system for networked battlefield sensors. In FY04, investigate response of human cells to environmental contamination using novel bio-chemical chemistry procedures to potentially develop cell-based analyses for on-site sensing of environmental contamination. Evaluate electrokinetics as a means for rapidly strengthening soils. Explore applications of laws of electromagnetic energy transfer for use in characterizing media reflections. Investigate neural nets as a tool for predicting geologic fracture properties from imagery to enhance weapons effects and penetrability. In FY05, will conduct scientific exploration in promising research areas such as fluorescence and biotechnology. Will obtain a fundamental understanding of energy absorption of metal alloy structures subjected to dynamic loading (explosions). Will formulate a new photocatalyst with selectivity toward energetic compounds to enhance their degradation and reduce their harmful effects on the environment. Will examine in situ soil extraction techniques to more accurately describe biomarkers at the molecular level in surface soils on training ranges for the purpose of environmental restoration and compliance. Will investigate techniques to remotely map soil moisture for Future Combat Systems and unmanned ground vehicles mobility determinations, and for assessing open-field landing sites.	1181	1438	1414
Small Business Innovative Research/Small Business Technology Transfer Programs	0	32	0
Totals	1181	1470	1414

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	138432	156146	131206	141023	143310	144733	157091
305	ATR RESEARCH	1150	1186	1243	1312	1338	1344	1371
31B	INFRARED OPTICS RSCH	2328	2248	2370	2512	2564	2576	2634
52C	MAPPING & REMOTE SENS	2277	2367	2456	2537	2581	2607	2661
53A	BATTLEFIELD ENV & SIG	3694	2564	2839	3011	3020	2959	3059
74A	HUMAN ENGINEERING	2583	2633	2799	2972	3031	3027	3093
74F	PERS PERF & TRAINING	2709	2663	2693	2783	2793	2851	2873
F20	ADV PROPULSION RSCH	2439	1882	2071	2218	2262	2252	2261
F22	RSCH IN VEH MOBILITY	476	497	506	527	538	544	556
H42	MATERIALS & MECHANICS	1913	1947	2076	2205	2249	2247	2295
H43	RESEARCH IN BALLISTICS	5334	6026	6149	6372	6455	6488	16118
H44	ADV SENSORS RESEARCH	0	3846	3950	4160	4244	4237	4338
H45	AIR MOBILITY	2013	2116	2144	2218	2262	2294	2345
H47	APPLIED PHYSICS RSCH	3063	2522	2689	2892	2925	2922	2994
H48	BATTLESPACE INFO & COMM RSC	6614	5261	5565	5858	5962	5991	6050
H52	EQUIP FOR THE SOLDIER	992	995	1073	1145	1163	1158	1179
H57	SCI PROB W/ MIL APPLIC	52128	55718	56045	63055	64047	65082	66270
H66	ADV STRUCTURES RSCH	1415	1426	1541	1651	1683	1670	1704
H67	ENVIRONMENTAL RESEARCH	3250	1403	1532	861	842	814	905
H68	PROC POLLUT ABMT TECH	361	383	379	391	397	409	418
HA4	PERPETUAL ASSAIL & SECURE INFO SYS, RSCH, TNG & ED	2429	0	0	0	0	0	0
S04	MIL POLLUTANT/HLTH HAZ	608	645	643	658	669	685	701
S13	SCI BS/MED RSH INF DIS	8856	9498	9930	10374	10569	10636	10862
S14	SCI BS/CBT CAS CARE RS	3931	4168	4272	4442	4527	4581	4680
S15	SCI BS/ARMY OP MED RSH	5405	5672	5930	6206	6320	6359	6495
S19	T-MED/SOLDIER STATUS	475	661	671	689	702	720	735
S20	SCIENCE BASE EMERGING INFECTIOUS DISEASES	3926	0	0	0	0	0	0

T14	BASIC RESEARCH INITIATIVES - AMC (CA)	0	26969	0	0	0	0	0
T22	SOIL & ROCK MECH	1849	1931	2021	2087	2126	2142	2187
T23	BASIC RES MIL CONST	1550	1634	1664	1712	1747	1775	1812
T24	SNOW/ICE & FROZEN SOIL	1165	1190	1311	1398	1423	1402	1426
T25	ENVIRONMENTAL RES-COE	4357	4608	4644	4777	4871	4961	5069
T30	ANIMAL MODELING GENETICS RESEARCH	952	0	0	0	0	0	0
T56	BIOFILM RESEARCH	952	0	0	0	0	0	0
T57	DESERT TERRAIN ANALYSIS	2667	0	0	0	0	0	0
T58	KNOWLEDGE MANAGEMENT FUSION CENTER	2857	0	0	0	0	0	0
T59	PREDICTION OF LAND-ATMOSPHERE INTERACTIONS	1714	1487	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element sustains U.S. Army scientific and technological superiority in land war fighting 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 in 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 the four primary contributors: 1) the Army Research, Development and Engineering Command (RDECOM); 2) the Army Corps of Engineers Research and Development Center (ERDC); 3) the Army Medical Research and Materiel Command laboratories; and 4) the Army Research Institute. The basic research program is coordinated with the other Services via the Joint Directors of Laboratories panels, the Defense Basic Research Technology Area Review and Assessment (TARA) process and other interservice working groups. This program responds to the scientific and technological requirements of the Department of Defense Basic Research Plan by enabling the technologies that can significantly improve joint war fighting capabilities. The projects in this Program Element involve basic research efforts directed toward providing fundamental knowledge for the solution of military problems related to long-term national security needs and is appropriately in Budget Activity 1. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	140493	128798	129586
Current Budget (FY 2005 PB)	138432	156146	131206
Total Adjustments	-2061	27348	1620
Congressional program reductions		-1352	
Congressional rescissions			
Congressional increases		28700	
Reprogrammings	-2061		
SBIR/STTR Transfer			
Adjustments to Budget Years			1620

Significant Change Explanation:
FY04 - Thirteen FY04 Congressional Adds totaling $28700 were added to this PE.

FY04 Congressional Adds with no R-2As:
($1443) Terrain Atmosphere Interactions, Project T59: The purpose of this one year congressional add is to examine new techniques for measuring ground conditions from remote sensors and assimilating these data with model predictions for terrain state. No additional funding is required to complete this project.

($2890) Advanced Carbon Nanotechnology Program, Project T14: The purpose of this one year Congressional add is to fund Vanderbilt University's basic research program in carbon nanotechnology. No additional funds are required to complete this project.

($1156) Research Center for Advanced Deployable Nano-Sensors, Project T14: The purpose of this one year Congressional add is to fund basic research in nano-sensing capabilities. No additional funds are required to complete this project.

($2984) Advanced Research and Technology, Project T14: The purpose of this one year Congressional add is to fund basic research at the University of Texas, Austin. No additional funds are required to complete this project.

($962) Alternative Energy Research, Project T14: The purpose of this one year Congressional add is to fund basic research into alternative energy sources. No additional funds are required to complete this project.

($2022) Biofilms – Terrorist Agents in Drinking Water, Project T14: The purpose of this one year Congressional add is to fund basic research in biofilms at Montana State University to identify terrorist agents in drinking water. No additional funds are required to complete this project.

($1155) Buffalo Center of Excellence in Bioinformatics, Project T14: The purpose of this one year Congressional add is to fund bioinformatics research at the University of Buffalo, Buffalo, NY. No additional funds are required to complete this project.

($2888) Desert Terrain Analysis, Project T14: The purpose of this one year Congressional add is to fund research on the impacts of Army combat vehicle training on desert ecosystems. No additional funding is required to complete this project.

($962) Knowledge Management Fusion, Project T14: The purpose of this one year Congressional add is to fund basic research on data fusion issues. No additional funding is required to complete this project.

($962) Nano-Materials Research, Project T14: The purpose of this one year Congressional add is to fund basic research in the properties of nano-materials. No additional funding is required to complete this project.

($962) Nano-Photonic Systems Fabrication, Project T14: The purpose of this one year Congressional add is to fund basic research at the University of Alabama in fabricating nano-photonic systems. No additional funding is required to complete this project.

($3370) Optical Technologies Research, Project T14: The purpose of this one year Congressional add is to continue research at Lehigh University supporting growth, processing, and device analysis of semiconductor materials for sensor, display and laser applications. No additional funding is required to complete this project.

($5873) Perpetually Assailable and Secure Information Systems Research, Training and Educations (PASIS), Project T14: The purpose of this one year Congressional add is to provide funding to the Center for Perpetually Available and Secure Information Systems at Carnegie Mellon University investigating the availability and security of information systems. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
305	ATR RESEARCH	1150	1186	1243	1312	1338	1344	1371

A. Mission Description and Budget Item Justification: 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, detecting and identifying targets over extended battlefield conditions, are essential for the war fighter in Future Combat Systems (FCS). The research resulting from this project 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 Automatic Target Recognition (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. Research supports several technology efforts including multi-domain smart sensors, third generation forward looking infrared radar (FLIR), and advanced multi-function laser radar (LADAR). This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Investigate new algorithms to improve unaided target detection and identification. In FY03, quantified results of preliminary algorithm development and reported results to AMRDEC, CERDEC and others; researched the improvement resulting from the formulation; conducted fundamental studies into new detection and clutter rejection techniques and the use of composite classifiers over single classifiers for Automatic Target Recognition. In FY04, determine the minimum number of hyperspectral bands needed for effective target recognition algorithms, and make recommendations for Army applications; investigate and specify the improvement in composite classifiers through the use of enhancing algorithms; investigate relative merits of detection and clutter rejection techniques and document results. In FY05, investigate new methods for feature extraction, including independent component analysis for land warfare applications, to reduce the impact of clutter and lessen the false alarm rate and improve classifiers; make recommendations on use of specific algorithms for land warfare applications, to reduce the impact of clutter and lessen the false alarm rate.	1150	1175	1243
Small Business Innovative Research/Small Business Technology Transfer Programs	0	11	0
Totals	1150	1186	1243

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
31B	INFRARED OPTICS RSCH	2328	2248	2370	2512	2564	2576	2634

A. Mission Description and Budget Item Justification: This project supports the Army's theoretical and experimental research in materials and devices for active and passive infrared (IR) imaging systems. It generates new technologies to obtain unprecedented awareness of the battlefield and to continue to "own the night". To achieve these objectives for the Objective Force, IR Focal Plane Arrays (IRFPAs) and interband cascade lasers 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 IRFPAs and interband cascade lasers. The main efforts are directed towards novel materials for detectors and lasers, and quantum well and dot infrared photon detectors. Develop photonic –bandgap structures to enhance the performance of lasers and IRFPAs. For the compact frequency modulated/continuous wave (FM/CW) LADAR, research has to be performed for some critical component performance, especially for a high frequency detector/modulator array. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Defense technology Area Plan (DTAP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Investigate technologies to enable unprecedented battlefield awareness and the ability to own the night. In FY03 various detector and laser structures were grown, fabricated and tested. Conducted experiments that showed continuous-wave operation for the cascade laser. Increased the operating temperature of IR detectors and lasers through reducing the defects in superlattice materials. In FY04, show new cascade laser packaging techniques for reduced cooling requirements. Fabricate and test near infrared photonic bandgap components. Extend modeling to midwave infrared wavelengths. In FY05, further reduce defects in the superlattice material and incorporate photonic bandgap structures into cascade laser to improve beam quality.	2328	2232	2370
Small Business Innovative Research/Small Business Technology Transfer Programs	0	16	0
Totals	2328	2248	2370

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
52C	MAPPING & REMOTE SENS	2277	2367	2456	2537	2581	2607	2661

A. Mission Description and Budget Item Justification: Basic research in topographic sciences focuses on increasing knowledge of the terrain through improved generation, management, analysis/reasoning, and modeling of geospatial data, including the exploitation of multisensor 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 attribute 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 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 Combat Systems and Army Vision/Joint Vision 2020 concepts. The research provides the theoretical underpinnings for program element 0602784A, project 855. 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 Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Sensor Phenomenology - In FY03, developed a prototype classification using Bi-Directional Reflectance Distribution Function. Developed band and data reduction algorithm software for both hyperspectral image processing and digital evaluation models. In FY04, integrate band resolution and neural network algorithms for hyperspectral image classification. Model soil type, soil compaction and moisture effects on terrain signatures. In FY05, will conduct multi-image manipulation experiments as well as contrast and special feature manipulation experiments. Will compare lineation patterns between panchromatic and hyperspectral imagery. Active and Passive Fluorescence for Remote Sensing - In FY03, developed algorithms for exploiting fluorescence data. In FY04, enhance algorithms for identifying biological hazards. Design polymers/sensor configuration and synthesize polymers using various fluorophores. In FY05, will experiment with prototype algorithms for identifying biological hazards in water. Will test polymer(s) in soil and water for photon recovery and target selectivity. Dynamic Situational Awareness - In FY03, analyzed and compared various approaches to learn region-specific information. In FY04, develop a conceptual framework for Maneuver Course of Action (MCOA) solution space structural specifications. In FY05, will analyze search procedures versus MCOA. Geographic Information - In FY04, collect data to support the initial analysis of predicting understory characteristics using vegetation overstory properties. In FY05, will conduct comprehensive analyses, testing and validation of prediction model(s) for understory identification.	2277	2333	2456
Small Business Innovative Research/Small Business Technology Transfer Programs	0	34	0
Totals	2277	2367	2456

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
53A	BATTLEFIELD ENV & SIG	3694	2564	2839	3011	3020	2959	3059

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 Army of the future will be required to 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 the development of future capabilities and techniques in such areas as the characterization and identification of biowarfare agents, enhanced acoustic and electro-optic propagation modeling techniques for improved target detection and acquisition, and the development 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. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Research in optical and acoustical propagation in the atmosphere for enhanced Intelligence, Surveillance and Reconnaissance (ISR) capabilities for the Future Force and FCS for situational understanding and rapid targeting. In FY03, conducted lab and field polarimetric signature measurements in the infrared (IR) domain and analysis leading to enhanced detection and discrimination of targets to improve identification. Analyzed acoustic characteristics for intermittent turbulence conditions of a stable nocturnal boundary layer and created a neural network for making rapid acoustic propagation predictions for improving the next generation Acoustic Battlefield Decision Aid (ABFA). In FY04, characterize the polarimetric state of reflected thermal radiation on natural and environmentally degraded surfaces to improve target recognition/identification imaging. Investigate techniques to improve performance of battlefield acoustics sensor systems in degraded atmospheric conditions by incorporating self-awareness of their environment. In FY05, improve technologies that better quantify optical turbulence and characterize its different effects on performance of imaging sensors in battlefield environments. Perform research in high-fidelity acoustic signature simulation systems for devising synthetic acoustic signatures.	2035	1750	1732
- Survivability of Future Force and improved 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 FY03, performed field experiments in a specific urban environment that allowed for data analysis and model improvement for an urban area, thereby improving forecast model accuracy and standoff tracking of hazardous aerosols. In FY04, evaluate microscale forecast and transport/diffusion models using real data for urban and complex terrain. Design and perform preliminary investigation of an urban parameterized microscale meteorological model for Army decision aid applications in urban domains. In FY05, investigate new methods to determine the accuracy of small scale/limited domain models. Improve the Army tactical urban meteorology model to include simplified physics and parametric microscale models that can account for mean transport and dispersion around individual structures.	1659	814	1107
Totals	3694	2564	2839

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
74A	HUMAN ENGINEERING	2583	2633	2799	2972	3031	3027	3093

A. Mission Description and Budget Item Justification: This project focuses on research on soldier-system performance in Transformation-relevant 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; humans 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 the ramp-up to Transformation. Accordingly, technical solutions are being pursued in the areas of data generation and algorithm development, given that soldiers have never operated 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. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Research to improve soldier auditory performance: In FY03, determined human capabilities in auditory distance estimation. Determined the effect of reverberation on the Callsign Acquisition Test. Identified baseline effects of whole-head helmet on auditory detection. In FY 04, investigate auditory trade-offs for an acoustically transparent whole-head helmet for improved communications for the Objective Force Warrior. In FY05, mature remotely controlled binaural microphone system for the Future Combat System (FCS) for improved battlefield communications.	1115	1115	1204

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Research to improve soldier cognitive performance. In FY03, investigated cognitive readiness assessment tools to measure war-fighting effectiveness. Investigated soldier performance effects of individual differences and situational characteristics in multi-tasking scenarios. Examined brain and behavioral correlates to feed and validate cognitive models of soldier performance. Created framework for models of perceptual, cognitive, and multi-tasking workload representing Future Force soldier performance. In FY04, provide tools, models, and results to Natick Soldier Center (NSC), Objective Force Warrior (OFW) Integrated Product Teams, and to FCS contractors; field-validate high pay-off predictive models and integrate models and results with large-scale representations of system and unit performance. In FY05, advance error prediction and decision making models to complex Future Force environments for technology design evaluation and design cognitive modeling interface for rapid propagation of cognitive models in Army models and simulations.	1468	1508	1595
Small Business Innovative Research/Small Business Technology Transfer Programs	0	10	0
Totals	2583	2633	2799

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
74F PERS PERF & TRAINING	2709	2663	2693	2783	2793	2851	2873

A. Mission Description and Budget Item Justification: This project covers behavioral science research in areas with high payoff opportunities for improved personnel selection, training, leadership, and performance, including: assessments 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 accelerating leader development; discovering and testing the basic cognitive principles that underlie effective leader-team performance; and improving the match between Soldier skills and their jobs to optimize performance. Research is focused on issues fundamental to transforming the human component of war fighting in synchronization with the transformations in systems, technologies, weapons, and operational requirements to meet the goals of the Future Force. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense 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 2003	FY 2004	FY 2005
In FY03, developed multi-source measure of socially intelligent job performance; developed computerized diagnosis of leadership training needs and assessment of leadership training effectiveness; identified potential training requirements for leaders of electronic-based teams. In FY04, explore practical job knowledge assessment instruments; assess trainability of sense-making (situation awareness) skills; assess trainability of skills for rapid interpretation of large volumes of ambiguous electronic data; determine whether speed of response is an ability factor contributing to the quality of task performance; develop improved electronically delivered instruction; and integrate theories of motivation. In FY05, validate test battery for measuring mental flexibility; assess memory for spatial and temporal events in electronic environments.	2709	2595	2693
Small Business Innovative Research/Small Business Technology Transfer Programs	0	68	0
Totals	2709	2663	2693

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
F20	ADV PROPULSION RSCH	2439	1882	2071	2218	2262	2252	2261

A. Mission Description and Budget Item Justification: The goal of this effort is increased performance of small air-breathing engines and power trains that will support Army Transformation in the areas of system mobility, reliability and survivability, and ultimately serve to reduce the logistics cost burden for the Future Force. Problems include the ability to achieve greater fuel efficiency and reduce weight in these propulsion systems. Technical barriers to advanced propulsion systems are the maximum temperature that today's materials can safely withstand, 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. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- - FY03: Added environmental effects into propulsion material life prediction and performance models; devised, for the first time, analytical capability to predict onset of compressor stall in full axi-centrifugal compressor system; devised advanced lubrication independent thrust bearing concepts in support of oil-free engines for advanced platforms and transition results to Aviation and Missile Research Development and Engineering Center (AMRDEC). FY04: Investigate thrust foil air bearings in support of oil-free engines, e.g. enhanced thrust bearing load capacity; foil bearing hydrodynamic and structural modeling and verification; and high temperature start/stop coatings (tribology). Transition mature oil-free technologies to AMRDEC and industry for use in turbochargers for military diesel engine systems; conduct research into alternative energy conversion processes and energy sources, e.g., advanced constant volume combustion cycles (pulse detonation) and catalytic fuel cell reformation (to leverage NASA's commitment to on-board fuel cell use for flight weight systems). This research will enhance engine systems durability and performance and reduce the logistics burden. FY05: Investigate materials processing and life prediction methods for ceramics. Assess novel concepts for UAVs. Analyze low vibration high load capacity power transmission component, material concepts, and analytical tools.	2439	1882	2071
Totals	2439	1882	2071

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H42 MATERIALS & MECHANICS	1913	1947	2076	2205	2249	2247	2295

A. Mission Description and Budget Item Justification: This project funds the Army's basic research program 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. Technical barrier is that with current materials, to gain added functionality for Army systems, one must use a layered approach whereby each layer provides added capability (i.e. ballistic, chem./bio, signature, etc) but ultimately the system is 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. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03, extended and validated physics-based models and experimental techniques enabling exploitation of composite material interphase design methodologies and transitioned to developers of high-performance, lightweight integral armors; refined structure/property relationships and processing techniques for tailoring performance of advanced polymer systems to be used in integrated materiel systems; devised first-principles ceramic design tool; incorporated analytic model of dynamic penetrator fracture into design codes; and improved analyses capability for inflatable fabric structures.	1913	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- In FY04, explore fundamental concepts that will enable design of advanced composite material-based structures with inherent electro-opto-chemical properties enabling revolutionary multifunctional performance of lightweight armors; conduct basic research to create hierarchically organized materials systems that possess multifunctional attributes that will enable revolutionary survivability in Future Force Warrior systems; validate ceramic design tool with theory critical experiments; and experimentally characterize dynamic fracture response of candidate anti-armor materials under ballistic loads. In FY05, advance electro-opto-chemical integration capabilities of next-generation composite structures for improved multifunctionality (e.g., sensory, communications, power); advance fundamental understanding of structure-property-processing relationships in hierarchical material systems to produce tailored functionality in Future Force Warrior systems; verify micro-structure (including fractography) of armor ceramics that have been subjected to impact and conduct mechanical (fracture, toughness, hardness) and non-destructive test characterization of armor targets containing silicon carbide and boron carbide armor ceramics; and incorporate second generation dynamic fracture model into computational continuum mechanics code to enable development of improved anti-armor concepts.	0	1943	2076
Small Business Innovative Research/Small Business Technology Transfer Programs	0	4	0
Totals	1913	1947	2076

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H43	RESEARCH IN BALLISTICS	5334	6026	6149	6372	6455	6488	16118

A. Mission Description and Budget Item Justification: This project funds the Army's basic research program in ballistics. The goal is to improve the understanding of the chemistry and physics controlling the propulsion, launch, and flight of gun launched projectiles and missiles, and to understand the interaction of these weapons with armored targets. This research results in the science base 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. Effort supports OSD Advanced Energetics Initiative to mature the fundamental technologies required to transition the next generation of energetic materials into field use. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- In support of the National Advanced Energetics Initiative, expand and validate physics based models and experimental techniques to devise 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 FY03, expanded first principles design tools that can be employed to tailor chemical formulations and validated model relating sensitivity of bulk energetic materials to molecular structure of notional energetic materials. In FY04, characterize/model the chemical and physical properties of novel energetic materials to establish the relationship between particle-size, energy density and release rate for insensitive high-energy propellants and explosives. Explore influence of these parameters on controlling mechanisms for initiation of combustion and detonation. In FY05, employ fundamental and advanced propulsion/detonation models and experimental techniques to understand tailored energy release of insensitive high-energy propellants and explosives, including multiple-mode applications for energetic materials.	3008	3625	3812

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 FY03, validated first generation ceramic micro mechanical model using theory critical experiments and integrated model into numerical code; refined adiabatic shear model based on micro mechanical experiments of alloy materials under consideration for use in advanced penetrators; and incorporated structural flight vehicle response, aerodynamics, propulsion, guidance, navigation and control behavior into models to enable a comprehensive design and evaluation capability for smart munitions. In FY04, correlate ballistic performance of armor ceramics with fundamental material properties and material behavior using non-ballistic evaluation methods; investigate shear band velocity as influenced by material imperfections found in anti-armor devices and validate refined shear model in computational continuum mechanics code to support improved analysis of armor/anti-armor interactions; and devise algorithms to model fully-coupled roll controlled maneuver employing coupled Computational Fluid Dynamics(CFD)/ Structures and non-axisymmetric aerodynamics CFD to enable design of complex precision munitions for the Future Force. In FY05, prove ability to model penetration through advanced ceramic armor and accurately capture the observed material response for each phase of penetration; incorporate adiabatic shear model into computational continuum mechanics code and validate; and prove capability to model fully coupled roll controlled pitch up maneuver and validate full high performance computational capability of coupled models employing multiple processors.	2326	2298	2337
Small Business Innovative Research/Small Business Technology Transfer Programs	0	103	0
Totals	5334	6026	6149

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H44	ADV SENSORS RESEARCH	0	3846	3950	4160	4244	4237	4338

A. Mission Description and Budget Item Justification: This project exploits the basic sciences to enable new sensing capabilities for the Army's Future Force. This work will 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 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 involves fundamental science and engineering principles that support 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, improved language translation, biological and chemical environmental sensing and improved sensor protection. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Research is focused on investigating and evaluating image-processing techniques for large arrays of opto-electronic feedback circuits and adaptive optics for optical communications and active imaging to improve battlefield awareness and communications. In FY03, conducted experiments using various ARL testbeds, tested outdoor laser communication, and laser imaging circuit with advanced analytical techniques; conducted characterizations of atmospheric propagation path for laser communications for improved situational awareness and C2 decision making; matured liquid crystal and MEMS adaptive systems to remove atmospheric distortions in imaging systems, and reduce signal fading in free-space laser communications; and investigated adaptive optical control systems and algorithms to enhance the delivery of tactical directed energy weapons. Optical communications provide covert, high bandwidth communications for the Future Force Warrior. In FY04, investigate wave division multiplexing in a free-space laser communication system; expand the atmospheric laser optics test bed to include a network of laser communication systems; research adaptive coding techniques for optical communications; and conduct research into the characterization and mitigation of atmospheric effects on tactical directed energy weapons systems with a view toward transitioning to the RDECs. In FY05, complete laboratory experiments for imaging for missile and weapons systems applications and transition to RDECs.	0	1508	1935

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Research focused on future generations of sensors improving capabilities to create more survivable/secure sensor systems, displays, and improved environmental monitoring. In FY03, using electromagnetic modeling tools, identified unique aspect angle-dependent signature of tactically sized targets at UHF frequencies; utilized Surfaced Enhanced Raman Spectroscopy (SERS) to develop novel techniques to detect potentially harmful biological agents; investigated time frequency signal processing techniques for detection and classification of time-varying targets for applications in networked sensors, and benchmark quantum information processing experiments were identified. In FY04, establish capabilities to model multiple targets embedded in distributed clutter through L-band frequencies; continue to develop SERS techniques to increase number of detectable biological agents; improve efficiency and optimization of processing techniques for networks of sensors and perform quantum cryptographic analyses. In FY05, quantify improvement in the performance of passive millimeter wave cameras through the application of video enhancement algorithms; mature a chemometric algorithm capable of discriminating among several selected bacteria; explore efficient signal processing algorithms for data fusion and networks of sensors of various modalities; and make recommendations for applications of quantum information processing; use codes to optimize optical designs for nonlinear material placement in the optical train.	0	2284	2015
Small Business Innovative Research/Small Business Technology Transfer Programs	0	54	0
Totals	0	3846	3950

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H45 AIR MOBILITY	2013	2116	2144	2218	2262	2294	2345

A. Mission Description and Budget Item Justification: This project provides funding for aviation 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 and Joint Vision 2020 by providing research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotarywing aircraft. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work 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 2003	FY 2004	FY 2005
- In FY03, designed and fabricated a high lift 2D airfoil for low Reynolds number flow, CFD code development for ducted-fan and co-axial rotor, conducted 2D airfoil test with Gunny flap to increase lift and reduce drag. In FY04, conduct wind tunnel test to reduce drag force of mast mount sensor (MMS) shape and fuselage drag, conduct performance test for co-axial and ducted-fan UAV, conduct interactional aero tests of diverse UAV fuselage shapes. In FY05, conduct rotor test to study the off-axis stability to increase helicopter handling quality. Conduct test to measure the Reynolds stress of the synthetic jet for blunt body drag reduction.	2013	2072	2144
Small Business Innovative Research/Small Business Technology Transfer Programs	0	44	0
Totals	2013	2116	2144

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H47	APPLIED PHYSICS RSCH	3063	2522	2689	2892	2925	2922	2994

A. Mission Description and Budget Item Justification: The objective of this project is to investigate electronic semiconductor 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; and advanced batteries and more efficient fuel cells for hybrid power. A further objective is to mature and understand techniques for the manipulation of cold atoms in an atom chip environment for application to very sensitive sensors and ultra stable clocks. Applications 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. Investigate electronic materials and structures to improve wide band gap semiconductor performance in electric vehicles and advanced radar systems. Technical barriers affecting performance, weight, cost, and power consumption will be addressed. These investigations will support the development of power sources and specialty electronic materials for the Army's Future Force. The cited work is consistent with Strategic Planning guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense technology Area Plan (DTAP). The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- 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 FY03, synthesized new nanophase catalyst with good thermal stability for hydrocarbon fuel reformers leading to improved energy production; fabricated low-defect gallium nitride (GaN) films for high power, high temperature electronic applications. In FY04, evaluate solid electrolytes for rechargeable high-energy batteries; examine silicon carbide (SiC) structures and ohmic contacts for transition to efficient device designs; and develop a general-purpose laser cooling test system for the study of various cold atom chips with potential for application to ultrasensitive sensors and miniature atomic clocks. In FY05, provide fire-retardant electrolyte for batteries & catalysts for fuel cells; examine GaN structures and ohmic contacts for transition to efficient device designs; and fabricate and test basic cold atom chip devices such as gyroscopes and accelerometers for inertial navigation as well as gravimeters for basic underground facility detection applications.	3063	2522	2689
Totals	3063	2522	2689

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H48	BATTLESPACE INFO & COMM RSC	6614	5261	5565	5858	5962	5991	6050

A. Mission Description and Budget Item Justification: This project addresses fundamental research in technologies that will 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. The goal of this research is to address the areas of information assurance and the related signal processing for wireless battlefield communications along with 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 multipath 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 reduce the cognitive load on the commander, improve the timeliness, quality and effectiveness of actions and in the long run speed the decision-making process and reduce the size of tactical operation center (TOC) staffs. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- 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 of networked nodes. In FY03, investigated, identified, and transitioned to CERDEC a suite of signal processing techniques to provide bandwidth on demand in interference and jamming scenarios, including challenging urban and foliage scenarios. In FY04, devise signal processing techniques to work under severe interference and poor channel conditions to maintain wide network coverage for disparate soldier, sensor, and airborne networks. In FY05, enhance signal processing for smart radios, coupled with network protocols, to provide intelligent multiple radio coexistence and radio frequency spectrum reuse to enable rapid deployment and networked information dominance in future threat scenarios.	2521	2413	2560
- 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 FY03, explored and devised scalability of information processing techniques and natural human interfaces with software agents to reduce soldier cognitive load in maintaining situational awareness on the battlefield, where hundreds to thousands of computer objects and human operators interact constantly. Enhanced automatic language translation capabilities in support of translingual capability to provide the capability for field translation of documents for intelligence gathering. In FY04, incorporate mathematical and statistical techniques to accommodate uncertainty factors both in data and information during the aggregation process to create ready knowledge for the soldier to enhance decision making. Extend language translation capabilities to include posting translations to databases. In FY05, devise analytical techniques to interface soldiers and robotic elements in a seamless manner in the battlefield information system. Extend language translation capabilities from printed text to voice capability.	2289	1363	1391

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 FY03, identified intelligent agent and mobile code techniques to address emerging and evolving information attacks by potential adversaries on sensor networks on the future battlefield to protect data input to situational awareness systems. In FY04, incorporate analytical and protocol techniques into mobile communication devices and systems to enhance robustness to unattended network intrusion and sensor spoofing for deployable sensor networks when operating under severe energy constraints. In FY05, evaluate and implement selected best of breed security services embedded authentication services for unattended static and mobile sensor networks deployable on the battlefield.	1804	1468	1614
Small Business Innovative Research/Small Business Technology Transfer Programs	0	17	0
Totals	6614	5261	5565

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H52	EQUIP FOR THE SOLDIER	992	995	1073	1145	1163	1158	1179

A. Mission Description and Budget Item Justification: This project supports basic research required to achieve technologies for the of the future and the Army Transformation. The research is focused on six core technology areas critical to systems: mathematical modeling, physical performance measurement, polymer science/textile technology, nanotechnology, biotechnology and food safety. Research is targeted on enhancing the mission performance, survivability, and sustainability of the by advancing the state of the art in defense against battlefield threats and hazards such as ballistics, chemical agents, lasers, environmental extremes, and rations shortfalls. This program supports the Future Force transition path of the Transformation Campaign Plan (TCP). The cited work is consistent with the Transformation 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 US Army Natick Center, Natick, MA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03, quantified fiber interaction behavior in hybrid yarns, providing a basis for prototype advanced yarn designs for body armor. Formulated and implemented a novel biomechanics model to assess gait and muscle control in carrying loads. Evaluated the effect of nanoparticle geometry on nanocomposite mechanical properties for ballistic protection applications. Conducted research on cognitive performance enhancement under severe stress. Conducted laboratory studies and modeling to examine the relationship among comfort, fit, and perceived fit on form-fitting military textiles. Verified and transitioned mathematical model for understanding tear propagation in airbeam shelter fabrics. In FY04, transition nanocomposite technology to warrior protective gear S&T efforts in PE 0602786. Examine cognitive performance as function of nutrient and fluid intake under stressful conditions. Evaluate water distribution in intermediate moisture foods using magnetic resonance spectroscopy to enhance food safety and stability. Model the relationship between perceived clothing fit and objective expert assessment of clothing fit. Identify peptide-based recognition elements for detecting food pathogens. In FY05, will determine effects of distribution and location of backpack loads and moments on the biomechanics of gait and performance. Will conduct basic research in combining nanomaterials with other materials for advanced applications. Will complete data analysis of nutrient effects on cognitive performance during severe cold stress.	992	995	1073
Totals	992	995	1073

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H57	SCI PROB W/ MIL APPLIC	52128	55718	56045	63055	64047	65082	66270

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 Transformation needs in the physical sciences (physics, chemistry, biology, and materials science), the engineering sciences (mechanical sciences, electronics, and mathematical, computer and information sciences), and environmental sciences (atmospheric and terrestrial sciences). Targeted research programs in nanotechnology, smart structures, multifunctional and microminiature sensors, intelligent systems, countermine, compact power, and other mission-driven areas will lead to an Future Force that is more strategically deployable, more agile, more lethal and more survivable. The breadth of this basic research program covers approximately 900 research grants and contracts with leading academic researchers and approximately 1,600 graduate students yearly, and supports research at over 200 institutions in 50 states. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Basic research in environmental and biological sciences for revolutionary advances in sensors, electronics and information processing, and for soldier survivability. In FY03, produced quantum dot wires for next generation fast accurate information processing; devised a fast algorithm for feature extraction, and constructed a neural network for real-time recognition of 2D objects; designed de nova beta sheet proteins for the fabrication of novel biologically-derived materials with self-assembly and multifunctional capabilities for protective materials; and devised a new supercomputer approach for modeling proteins with extremely high resolution, enabling the rapid identification of therapeutic agents for countering CB weapons. In FY04, direct macromolecular evolution of biological electron transfer components for microsystems with application to power and energy management and logistics footprint minimization, biologically design and construct nanometer scale electronic and photonic structures for application to precision strike weapons. In FY05, understand mechanisms of pathogenicity to combat terrorism and to aid in chemical-biological detection (CBD) through intervention of organisms that cause disease; and use molecular genetics to identify the molecular signals that affect soldier performance and endurance.	7336	7590	8075
- Basic research in chemical sciences for advanced power generation and CBD. In FY03, devised nanostructured polymer gels for sensors able to detect threat agents, devised a polyphosphazene-based membrane for direct methanol fuel cells that are easier to fabricate; advanced the understanding of thermal run-away events in batteries for safer battery systems in munitions; explored a new class of materials (azulenes) for protection of eyes and sensors from lasers; synthesized molecular rotors for applications including laser protection, molecular memory and electronics; and explored the potential for single walled carbon nanotubes to be used as sorbents for chemical agents. In FY04, devise new approaches to build molecular machines for CBD, signature management and laser protection. In FY05, expand research in computational electrochemistry for electrochemical power sources; explore the physics of operating molecular machines for CBD, signature management and laser protection; and devise polymers, fibers and devise novel architectures for materials with superior protection from all environments.	8436	8790	8865

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Basic research in physics for precision guidance, superior signature management properties and secure communications. In FY03, devised and applied for a patent for the first compact and tunable X-ray laser which has enormous scientific and practical applications in the material and health sciences for direct 3D visualization with the molecular scale spatial resolution to faithfully reveal full molecular architectures; devised photoconductive semiconductors which adaptively compensates for atmospheric turbulence effects in ground-to-ground laser communication links; and devised unique radiation scattering surfaces for IFF, target acquisition and countermeasures. In FY04, devise high frequency superparamagnetic dot arrays to increase the area density of information storage. In FY05, devise tools in the Terahertz frequency regime for interrogation of CB agents.	9245	9884	10480
- Basic research in communications and electronics for unmatched networked C4ISR capabilities. In FY03, first ever 3D evasion-pursuit model involving Unmanned Aerial Vehicles (UAV) and Unmanned Ground Vehicles (UGV); designed a more energy efficient digital circuit for longer battery life; devised high quality deformable micro mirror array for adaptive optics; devised a protocol to work with mobile ad hoc network protocols in conjunction with compression and beam steering with the ultimate goal of live video transmissions; devised an advanced physics-based modeling algorithm for molecular electronics; and devised retrodirective arrays for low power/low noise wireless electronics and for “smart antennas”. In FY04, use rare earth doped materials for photonic applications and apply quantum dot intersub-band photo detectors for night vision devices and to create a new class of quantum-dot lasers for Army laser designators. In FY05, research advanced countermine techniques to enable faster and more accurate detection of mines; integrate seismo-acoustic and chemical sensors with electro-optics and x-ray imaging for advanced landmine detection.	8640	9685	9765

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Basic research in mechanical and material sciences for survivable armor, improved mobility, C4ISR components, and flexible display initiative for soldier systems. In FY03, fabricated micro-layered polymeric materials for hardened optical components; devised a procedure for making a nanocrystalline aluminum alloy that retains stable structure at elevated temperatures and that can be shaped while retaining desirable properties such as high strength and toughness; showed glassy carbon phonic band gap materials from polyarylenes for use as optical filters and as very sensitive chemical sensors; and devised a new method for microstructure-sensitive materials design which can predict the fatigue life of various combinations of material microstructures. In FY04, understand active flow control for projectiles and air vehicles to improve precision strike; understand high impact dynamics of composite materials; and synthesize new hybrid biomimetic materials for high-performance structural, mechanical, optical and electronic materials thereby improving a wide range of Army components. In FY05, devise wafer-scale fabrication techniques to manufacture microturbines at reduced costs; fabricate micro-rocket engines from previous advances in microturbine research; and conduct research in transparent conductive and emissive materials.	8357	9146	9195
- Basic research in mathematical and computer sciences as the backbone for complex, multisystem analysis, modeling and simulation, and information systems. In FY03, devised a mathematical theory of zonal function networks for the analysis of multi-source direction finding with degraded antennas and intelligent sensor fusion; devised multivariate analysis techniques which allows for the extraction and reconstruction of objects with no specific boundaries of objects for greatly improved target recognition; and produced a mathematical model based on complex dynamical systems and dynamic game theory for safe maneuver of multiple aircraft. In FY04, translate statistical shape analysis to computer programs for improved target classification; self-organizing, self-healing-mobile ad-hoc networking algorithms in order to facilitate rapid force deployment and reduce the logistics footprint; conflict resolution architectures for multi-agent hybrid systems for robotics and unmanned aerial vehicles (UAVs). In FY05, devise low-order mathematical models of hysteresis nonlinearity to improve the performance and real-time control of smart materials to create micro electro-mechanical (MEM) actuators for rotor-blade surface flow control; and integrate research in mathematics, electrical engineering and signal processing to create digital communications based on principles of nonlinear dynamics and chaos for uninterrupted digital communications.	8802	9290	9665
- Optical Technologies. This congressional add supports research on growth, processing, and device analysis of semiconductor materials for sensor, display and laser applications to upgrade Army capabilities in sensing and signal processing. No additional funding is required to complete this project.	1312	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1333	0
Totals	52128	55718	56045

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H66	ADV STRUCTURES RSCH	1415	1426	1541	1651	1683	1670	1704

A. Mission Description and Budget Item Justification: The goal of this effort is to provide 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 for the Future Combat Systems (FCS) and Unmanned Combat Armed Rotorcraft (UCAR) supporting Army Transformation. 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 and aeromechanical stability; 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 in: 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 Unmanned Rotorcraft specific 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 structures basic research within the DoD. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03, performed residual strength predictions for composite sandwich panel damage due to low velocity impact; established new industry test standards for hybrid composite delamination; evaluated methodologies to incorporate small crack effects in predicting the fatigue life for aging Army vehicles; conducted preliminary analysis of "on-blade" actuation for vibration and flight attitude control and evaluated advanced actuators; validated an innovative rotor system model to improve tilt rotor stability; studied biological system structures and materials as improved models for future rotorcraft wing designs; and validated new vehicle crash model and simulation data for all-composite fuselages. In FY04, assess unmanned aerial vehicle (UAV) utility of innovative wing designs inspired by naturally based morphologies; analyze potential of actively-controlled rotor stability augmentation model for tilt rotor UAV; evaluate soft soil and water impact effects on crash occupant survivability; and evaluate durability, damage tolerance, and failure mechanisms for embedded sensors/actuators in flexible structure. In FY05, investigate static/dynamic characteristics of naturally based morphologies for vehicle wing designs using finite-element modeling; and evaluate advanced concepts for UAV primary flight control and vibration reduction.	1415	1426	1541
Totals	1415	1426	1541

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H67**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H67	ENVIRONMENTAL RESEARCH	3250	1403	1532	861	842	814	905

A. Mission Description and Budget Item Justification: The objective of this project is to focus basic research on innovative technologies for both industrial pollution prevention (P2) that directly supports the Army production base and weapon systems as well as non-stockpile chemical warfare (CW) site remediation. The pollution prevention work invests in next generation manufacturing, maintenance, and disposal methods that will result in significantly reducing the usage of hazardous and toxic substances and their associated costs. The goal is to decrease the overall life-cycle costs of Army systems by 15-30% through the application of advanced pollution prevention technologies. The CW remediation efforts concentrate on the application of biotechnology in the characterization and physical clean up of agent contaminated soils and groundwater and reduced corrosive and more environmentally benign decontamination of biological warfare (BW) agents on field equipment and weapon systems. The goal is to reduce the cost of remediating a site by at least 50% versus the use of conventional methods. CW thrusts include establishing the ecotoxicity of CW compounds, environmental fate and effect of CW compounds in soils and biodegradation of CW compounds. Pollution prevention thrusts include: environmentally acceptable, advanced, non-toxic processes to manufacture lightweight alternative structural materials to enhance weapon system survivability; clean synthesis of more powerful and improved energetic compounds to eliminate the use of hazardous materials and minimize the generation of wastes; and surface protection alternatives to hazardous paints, cadmium, chromium, and chromate conversion metal and composite surfaces. This project is linked to the Army Environmental Requirements Technology Assessment (AERTA) requirements. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the defense Technology Area Plan (DTAP). Work is under the direction of the U.S. Army Armament, Research, Development and Engineering Center.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03, assessed advanced high-nitrogen gun propellant formulations to reduce erosion on gun barrel coatings. Completed spectroscopic investigations, designed initiator simulator and validated modeling on laser ignition system for medium caliber munitions. Determined whether direct propellant ignition is feasible. Conducted meals-ready-to-eat injection molding and biodegradation studies with new barrier coatings. Characterized variables affecting spin solution fiber properties. Continued longer-term measurement of element migration to chrome and tantalum steel interfaces at higher temperatures. Evaluated adhesion of ion beam assisted deposition coatings applied to depleted uranium (DU) coupons. Assessed supercritical fluids crystallization of CL-20 particles. Conducted instrument measurements on actual contaminant samples. Identified enzymatic alternatives in membrane research. Investigate use of carbon nanotubes in energetic thermoplastic elastomers to eliminate hazardous materials and VOCs in propellant manufacture. In FY04, will scale-up prototype nanocomposite materials processes for new MRE barrier coating. Model impact of new nitrogen-rich propellant gases on gun barrel coatings and ability to eliminate chrome. Broaden decontamination studies to include viral surrogates and additional bacterial enzymes. Down-select candidate molecular recognition elements and test components for electrical and ionic conductivity. Develop liquid and vapor phase natural products decontaminants. In FY05, will investigate alternative coating systems capable of depositing tantalum onto more complex geometries. Conduct nitration studies on intermediates derived from ethylene diamine. Isolate and assess variety of bacteriocins. Incorporate improved detector strains into gel compounds for VX and food and water monitoring. Test polyelectrolytes for energy storage for lightweight, flexible batteries.	3250	1379	1532
Small Business Innovative Research/Small Business Technology Transfer Programs	0	24	0
Totals	3250	1403	1532

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
S13	SCI BS/MED RSH INF DIS	8856	9498	9930	10374	10569	10636	10862

A. Mission Description and Budget Item Justification: This project supports focused research 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. Work in this project is managed by the U.S. Army Medical Research and Materiel Command. The Army is the lead service for infectious disease research. This project contains no duplication with any effort within the Military Departments. This project supports the Future Force transition path of the Transformation Campaign Plan. The cited work is consistent with Transformation 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 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 2003	FY 2004	FY 2005
In FY 03, adapted DNA microarray technology to rapidly screen potential antimalaria drugs and vaccine targets. Screened nearly 800 compounds for antimalarial activity and will mature one drug into the optimization process; identified new malaria drug targets and mechanisms of the parasite's drug resistance; and assessed the presence of malaria drug resistance in different regions of the world. Completed, with partners, the genomic sequencing of Plasmodium vivax, the second major human malaria parasite; and used gene chip technology to identify previously unexamined correlates of protection in vaccinated and challenged humans. In FY 04, identify, using genomic technology, promising new targets to develop for inclusion into new vaccines against P. falciparum and P. vivax and develop a better understanding of host/parasite interactions. Develop new models for high throughput screening and new drug discovery. In FY 05, enhance and integrate techniques to exploit genomic information for vaccine and drug discovery efforts; continue to maintain a pipeline of new drug candidates for optimization and animal testing.	4827	5377	4584
In FY 03, investigated new vaccine additives for enhanced protection by antidiarrheal vaccines, and defined additional components for a more protective Campylobacter vaccine. In FY 04, conduct studies to assess the incidence and types of diarrhea-causing agents in areas of deployment to determine suitability as vaccine test sites. In FY 05, refine field site assessment for suitability for vaccine testing and select best sites. Incorporate new genomic information into vaccine discovery efforts and assess discoveries for incorporation into diarrheal disease vaccine program.	1035	863	1027
In FY 03, conducted studies on dengue disease progression; conducted studies to design a combined vaccine against several lethal viruses; identified a candidate Lassa fever DNA vaccine. In FY 04, identify alternative approaches to create an effective and safe dengue fever vaccine. Identify genes from other lethal viral diseases such as Rift Valley for incorporation into DNA vaccines. In FY 05, develop field sites for testing dengue and hemorrhagic fever vaccines.	647	795	924
In FY 03, evaluated insect-borne disease risk exposure in Central Command region of responsibility. In FY 04, develop tests to detect, in insects, insect-borne diseases in areas of deployment. In FY 05, evaluate effectiveness of integrated dengue vector preventive medicine control system in Central and South America and Thailand.	1237	1590	2287

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
In FY 03, conducted necessary basic research to define, acquire, and evaluate approaches to provide infectious disease diagnostics to the battlefield; identified microbial DNA sequences of selected agents that are adaptable to the first-generation military common diagnostics system. In FY 04, identify infectious disease diagnostic components compatible for use in a joint services biological agent identification and diagnostic system. In FY 05, develop approaches to supplement infectious disease diagnostics not compatible with joint system.	1110	779	1108
Small Business Innovative Research/Small Business Technology Transfer Programs	0	94	0
Totals	8856	9498	9930

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
S14	SCI BS/CBT CAS CARE RS	3931	4168	4272	4442	4527	4581	4680

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. This project contains no duplication with any effort within the Military Departments. This project supports the Future Force transition path of the Transformation Campaign Plan (TCP). The cited work is consistent with Transformation 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, Silver Spring, MD, and the U.S. Army Institute of Surgical Research, Fort Sam Houston, TX.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03, conducted basic research to enhance resuscitation capabilities of combat medics; defined mechanisms of organ injury associated with blood clotting and bleeding; identified and characterized candidate additives to enhance resuscitation fluids and other means to improve patient response to resuscitation fluids; demonstrated naturally occurring host factors (auto-antibodies) that induce tissue injury in the presence of severe blood loss and that can be inhibited or blocked, potentially useful to protect soldiers in shock. In FY04, study potential chemical compounds that may block effects of severe blood loss on vital organs and tissues; define measurable combat casualty parameters that can be used as indicators of need for immediate medic intervention vs. delayed intervention. Begin basic research in collaboration with the National Institutes of Health (NIH) and conduct conceptual development, technology discovery, and early studies to significantly mitigate or eliminate the impacts of battlefield injury, including severe hemorrhage and other body fluid losses, penetrating head injury, and mutilating soft-tissue and skeletal injury. In FY05, conduct early preclinical screening studies to select candidate compounds that may block effects of severe blood loss; define the impact of stabilizing body potassium concentrations on casualty survival. Continue basic research collaboration efforts with NIH.	2685	2805	2906
In FY03, explored conceptual means and devices for medics to exploit Land Warrior/Objective Force Warrior capabilities to remotely diagnose, triage, and treat casualties; explored new candidate drugs to preserve brain tissue after penetrating head injury; established consortium with National Heart, Lung, and Blood Institute (NHLBI) to pool resources to study the occurrence of brain injury and its treatment in the presence of severe blood loss (shock), 12 proposals are pending award. In FY04, define measurable indicators of brain injury severity for use in directing treatment. In FY05, further define indicators of brain injury severity; evaluate brain cooling as a means to preserve brain tissue and function after penetrating head injury.	1246	1292	1366
Small Business Innovative Research/Small Business Technology Transfer Programs	0	71	0
Totals	3931	4168	4272

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
S15	SCI BS/ARMY OP MED RSH	5405	5672	5930	6206	6320	6359	6495

A. Mission Description and Budget Item Justification: This project supports research for healthy, medically protected soldiers for the Future Force, focused on developing medical countermeasures to sustain performance when the opportunity for adequate rest is impaired or impossible due to combat conditions. 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. 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. Specific tasks include delineation of injury and sustainment and enhancement of the physiological and psychological capabilities of military personnel under combat operations in all environments. The six main thrust areas include nervous system regulation of stress and cognition, metabolic regulation, control of regional blood flow, oxidative stress interventions, tissue remodeling/plasticity, and biomechanical/biodynamic mechanisms of injury. This project contains no duplication with any effort within the Military Departments. This project supports the Future Force transition path of the Transformation Campaign Plan (TCP). The cited work is consistent with Transformation 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, Silver Spring, MD; U.S. Army Research Institute of Environmental Medicine, Natick, MA; U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03, developed a simple eye model to study real-time photoreceptor changes during laser exposure, evaluated models of water requirements, and developed biomedical strategies to reduce water requirements for soldiers in operational environments. In FY04, explore the benefits of nutritional supplements to enhance metabolic rate for weight management, cold survival, and cognitive functions. In FY05, apply DNA chip technologies to mechanisms and treatment responses to laser eye injury.	1886	1879	1982
In FY03, explored brain imaging to determine whether increased mental activity aggravates brain changes associated with sleep deprivation. In FY04, explore the relationship between sleep restriction (partial sleep loss) and need for recovery sleep in humans. In FY05, investigate the changes in gene expression (activation and deactivation) following sleep deprivation.	1783	1863	2030

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
In FY03, explored heart rate variability as a predictor of cold injury and identified molecular markers related to altitude adaptation. Explored the effects of prolonged cold exposure on the immune system to determine soldiers' susceptibility to illness. In FY04, perform cold injury epidemiology study for U.S Army. In FY05, identify performance-enhancing nutritional supplements for incorporation into rations for various altitudes.	1736	1872	1918
Small Business Innovative Research/Small Business Technology Transfer Programs	0	58	0
Totals	5405	5672	5930

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T22	SOIL & ROCK MECH	1849	1931	2021	2087	2126	2142	2187

A. Mission Description and Budget Item Justification: This basic research creates the fundamental knowledge for new construction materials that provide greater ballistic and penetration protection, improved control of the visual, infrared, and radar signatures, and more rapid soil stabilization. This research will improve the physics-based understanding of geologic and structural materials due to dynamic loading. These technologies provide the basis for applied research that supports the civil engineering technologies for deployment, sustainment, mobility, and survivability of the Future Force in program element 0602784A, project T40. 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 Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Multi-Spectral Technologies for Fixed Facilities - In FY03, evaluated multispectral characteristics of experimental quantities of electro-chromic camouflage, cover, and deception material. Structural Materials - In FY03, conducted simulations of mechanical property tests on concrete specimens by modeling the mortar and aggregate independently. In FY04, conduct simulations of dynamic experiments using both homogeneous and heterogeneous modeling techniques. Produce technique for mapping dynamic deformation and cracking in quasi-brittle materials. Produce model for predicting material response due to dynamic loading events. Pavements Research - In FY03, completed asphalt dynamic model. Near Surface Soil Behavior - In FY03, produced physics-based generalized soil theory for large deformations in soil from maneuver operations. In FY04, provide first-generation reinforcement models describing the interaction between soil particles and nontraditional stabilizers. Conduct laboratory experiments on size effect in compacted soils. In FY05, will mature concept for low-velocity probe that could provide capability to remotely determine soil properties, determine mechanics of pressurized fabric structures for military logistics, and delineate a continuum mechanics theory critical to predictive models of vehicle-terrain interaction.	1849	1910	2021
Small Business Innovative Research/Small Business Technology Transfer Programs	0	21	0
Totals	1849	1931	2021

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T23	BASIC RES MIL CONST	1550	1634	1664	1712	1747	1775	1812

A. Mission Description and Budget Item Justification: This project supports facilities research initiatives: (1) forming an explicit and mathematically robust set of algorithms for geometrical reasoning, (2) understanding failure mechanisms of complex structural systems subjected to large displacements, and (3) assessing the conceptual feasibility of real-time sensors and agent derived models to simulate terrorist threat scenarios. These efforts provide basic research leading to improved design capability for a range of facilities that optimize facility mission performance, reduce design and construction errors and omissions, reduce resource requirements, and reduce the environmental burdens over the facility's life. The project will lead to leap-ahead technologies to solve military-unique problems in the planning, programming, design, construction, and sustainment of deployed facilities and energy and utility infrastructure. This project supports exploratory development efforts in program element 0602784A, projects T41 and T45. 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 Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Infrastructure Optimization and Performance – In FY03, investigated algorithms to optimize facility planning/design processes to improve transformation requirements match and increase throughput. Formulated moisture/temperature material property transport models for long-term performance modeling of structural composite materials. In FY04, investigate fundamental thermodynamics and material properties that describe microencapsulated phase change material performance as it affects heat transfer of thermal fluids. Investigate underlying factors affecting the attenuation of electromagnetic fields under intense transient field conditions and develop models for the non-linear response. In FY05, will determine fundamental aspects of multi-agent computational modeling as a next generation approach to facility threat protection. Will formulate optimization algorithms suitable for rapid and flexible design of the continuum of facilities needed by the future force. Will develop new model for agent transport and biocide kinetics.	1550	1602	1664
Small Business Innovative Research/Small Business Technology Transfer Programs	0	32	0
Totals	1550	1634	1664

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T24	SNOW/ICE & FROZEN SOIL	1165	1190	1311	1398	1423	1402	1426

A. Mission Description and Budget Item Justification: This basic research focuses on two interrelated topic areas, 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 thus provides the knowledge base for understanding and assessing environmental impacts critical to battle space 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 Defense Technology Area Plan (DTAP). Work in this project is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Terrain State and Signature Physics – In FY03, investigated details of terrain-atmosphere interaction in close proximity to the surface at short space and time scales. Investigated new modeling approaches for soil, snow and other materials to formulate a physics-based theory in support of conceptual vehicle mobility design and performance evaluation. Explored a groundwave antennae approach as a low-detectability, wireless alternatives to traditional airwave and wire communications for short-range needs such as those for elements of an unattended sensor array. Determined the physical property dynamics of natural surfaces related to environmental transitions of electromagnetic signatures to improve predictions of sensor performance in complex terrain. Investigated sensor fusion strategies to measure aerosolized endospores in complex natural environments in support of remote detection and identification. In FY04, extend theory of near surface meteorological variables at the micro scale and complete theory for distribution of energy components associated with 3-dimensional discontinuous canopies providing new capability for detection of partially obscured targets. In FY05, will establish effects of buildings and barriers on acoustic-seismic propagation in urban settings and define the turbulence and topographic roughness interaction for acoustic signals. Will establish understanding of pavement mechanical properties and pavement degradation processes as a function of soil, pavement type, and moisture-temperature variations. Will investigate methods to remotely extract or infer soil, moisture, temperature at depth, and vegetation attributes.	1165	1190	1311
Totals	1165	1190	1311

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T25	ENVIRONMENTAL RES-COE	4357	4608	4644	4777	4871	4961	5069

A. Mission Description and Budget Item Justification: Environmental quality basic research investigates fundamental scientific principles and phenomena necessary to ensure efficient development of the technologies needed to address Army 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 rendering harmless waste in water, soil and sediments 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; and reducing pollution associated with military activities. The project supports applied research under program element 0602720A, projects F25, 048, 835, and 896. 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 Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Environmental and Ecological Fate of Explosives, Energetics, and Other Contaminants – In FY03, determined the effects of soil physical and chemical properties on the uptake, accumulation, and toxicity of explosives for soil invertebrates forming an improved baseline for risk-based assessments of explosive contaminated sites. Determined that explosive vapors diffuse up through frozen soil as a complex function of soil moisture and temperature such that improved site characterization can be made on a site-by-site basis. Benchmarked pharmaceutical models/approaches as the technical basis for predicting risk of chemical mixtures. Established a new soil toxicity assay for obtaining the major factors affecting the availability of explosives contaminants. In FY04, determine the effects of microbial and geochemical processes associated with manganese oxides on the environmental fate of metals and inorganics in groundwater and soil to model the transport of contaminants and to improve treatment processes. Establish the means to determine the toxicology of selected explosive compounds in mammals using gene expression data. In FY05, will establish the premise in using molecular spectral characteristics correlated with computation chemistry to determine the affinity of contaminants to produce fast forming less toxic chemical byproducts.	1481	1709	1997
Remediation of Explosives, Energetics, and UXO – In FY03, identified/characterized the types of micro-organisms in the ground in a variety of military sites aiding in the development and use of biological in-place treatment processes. Described the fundamental behavior of micro-organisms applicable to chemical contaminant destruction processes. Determined how TNT and its transformed products (nitroaromatics) bind to the organic and mineral fractions of the soil and identified mechanisms for how these contaminants can be extracted. Used electrokinetic processes to describe the chemical behavior and transport of explosive compounds and specialized treatment additives under various site conditions to enhance in-place cleanup. Determined electromagnetic induction sensors response to UXO composed of composite materials enabling improved UXO detection. In FY04, determine the chemical, physical, and biological transformation of crystalline explosive residues on firing ranges for improved cleanup alternatives and risk-based assessments. Describe the microbial physiology, biochemistry and genetics of explosives contaminants on military ranges for tailored in-place site cleanup. In FY05, will describe propellant attenuation on ranges via the management of natural soil cycles. Will pursue in situ explosive biodegradation mechanisms and direct analysis methods to identify explosives degradation mechanisms of contaminated soils.	1307	1575	1765

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Training Land Natural Resources – In FY03, evaluated the physiological response and habitat characteristics of endangered bird species to military training disturbances for improved design and maintenance of Army ranges. In FY04, determine genetic traits and differences in specific native grasses to enhance resilience for military land rehabilitation. Determine the effects of military training noise on the feeding, roosting, and flight behaviors of endangered bats for improved design/maintenance of Army ranges. In FY05, will describe physical, chemical, and biological phenomena impacting ecosystem maintenance, mitigation, and rehabilitation for Army lands. Will evaluate changes in endangered bats' hearing sensitivity due to shock wave pressure associated with Army test and training ranges.	1569	1215	882
Small Business Innovative Research/Small Business Technology Transfer Programs	0	109	0
Totals	4357	4608	4644

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
D55	UNIVERSITY RESEARCH INITIATIVE	0	64093	75133	70413	66450	67935	69099

A. Mission Description and Budget Item Justification: In FY03 and prior years, the Office of the Secretary of Defense University Research Initiative (URI) PE 601103D8Z contained funds for several university research, education and infrastructure programs. Starting in FY04, a portion of these OSD funds were transferred to the Army in support of the Multidisciplinary University Research Initiative (MURI) and the Defense University Research Instrumentation Program (DURIP). The MURI program supports 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 Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY04, continue supporting the 54 MURI awards made in prior years. A few key continuing MURI research topics include: National Nanoscience Initiative, Critical Infrastructure Protection, Fundamental Issues Underlying Infrared Detection; Ultrawide-band Communications; New Adaptive, Reconfigurable RF Radio/Sensor Concepts; Biological and Chemical Sensing at terahertz Frequency. Continue supporting those PECASE investigators begun in prior years. In FY05, continue an estimated 56 MURI awards made in prior years. A few key continuing MURI research topics include: Integrated Control and Communication for Networked Systems; Mathematics of Failures in Complex Systems; Fundamental Theoretical/Experimental Molecular Science for Design of Fuel Cell Systems. Continue supporting those PECASE investigators begun in prior years.	0	45401	50646
In FY04, establish 8 new MURI awards. Topics for the FY04 MURI research competition will be selected in strategic basic research areas related to transformational and high-priority Army Force Operating Capabilities such as sensor fusion, beyond-line-of-sight lethality, countermine, deployability and survivability. Potentially, new multidisciplinary topics could include Control of Biologically Inspired Mobile Networks (swarms) of Autonomous and Semi-Autonomous Vehicles; or Modeling the Effects of Training on Performance and Readiness. Two new competitive awards will be made under the PECASE program. In FY05, establish approximately 10 new MURI awards. Topics for the FY05 MURI research competition will be selected in strategic basic research areas related to transformational and high-priority Army Force Operating Capabilities such as sensor fusion, beyond-line-of-sight lethality, countermine, deployability and survivability. Two new competitive awards will be made under the PECASE program.	0	6001	9487
In FY04, competitive grants will be awarded for the acquisition of research instrumentation under the Defense University Research Instrumentation Program (DURIP). Emphasis is on instrumentation vital to the discovery of new scientific knowledge and the advancement of Army transformational technologies. Research instrumentation awards average approximately $150K each. In FY05, competitive grants will be awarded for the acquisition of research instrumentation. Emphasis is on instrumentation vital to the discovery of new science and the advancement of Army transformational technologies.	0	10831	15000
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1860	0
Totals	0	64093	75133

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601104A - University and Industry Research Centers

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	84237	99786	77658	76705	80157	82034	83816
H04	HBCU/MI CENTERS - TRADOC BATTLELABS	0	0	2509	2540	2574	2624	2677
H05	INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES	0	0	4824	4885	4949	5045	5149
H09	ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)	0	0	2509	2541	2574	2624	2677
H50	COMMS & NETWORKS COLLAB TECH ALLIANCE (CTA)	7476	8135	8102	8887	9633	9864	10085
H53	ADV DIS INTR SIM RSCH	2431	2541	2468	2650	2694	2757	2820
H54	ADVANCED SENSORS COLLAB TECH ALLIANCE (CTA)	5789	6374	6393	7202	7969	8160	8342
H56	ADV DECISION ARCH COLLAB TECH ALLIANCE (CTA)	5659	6164	6108	6584	7035	7204	7366
H59	UNIV CENTERS OF EXCEL	11972	21583	6561	6673	6753	6920	7045
H62	ELECTROMECH/HYPER PHYS	8213	5819	5591	5864	6081	6181	6276
H64	MATERIALS CENTER	2727	3156	2385	2495	2644	2707	2767
H65	MICROELECTRONICS CTR	922	964	936	958	1044	1069	1092
H73	NAT AUTO CENTER	5119	8069	2992	3077	3134	3208	3277
HA6	ARMOR MATERIALS DESIGN - LASER-BASED MATERIAL PROC	1191	0	0	0	0	0	0
HA7	DENDRIMER NANOTECHNOLOGY RESEARCH	3335	0	0	0	0	0	0
HA8	FERROELECTRIC MATERIALS NANOFABRICATION	952	0	0	0	0	0	0
HA9	JIDOKA PROJECT	1430	0	0	0	0	0	0
HB3	IMMERSIVE ENVIRONMENTS BASIC RSCH INITIATIVES (CA)	0	1388	0	0	0	0	0
J08	INSTITUTE FOR CREATIVE TECHNOLOGY	12230	11998	11046	7184	7173	7389	7597

J09	POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	5644	5901	5739	5716	5697	5835	5966
J12	NANOTECHNOLOGY	9147	10753	9495	9449	10203	10447	10680
J13	UNIVERSITY AND INDUSTRY INITIATIVES (CA)	0	6941	0	0	0	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 supporting enabling technologies for Future Force capabilities. Broadly, the work in this project falls into three catagories: Collaborative Technology Alliances (CTAs), University Centers of Excellence, and paradigm-shifting centers - University-Affiliated Research Centers (UARCs).

CTAs are innovative alliances among government, industry and academic organizations to exploit scientific and technological breakthroughs and to transition these breakthroughs to exploratory development and applied research. 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 Centers of Excellence, which 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 materials science, electronics 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 Institute for Advanced Technology (IAT), Institute for Soldier Nanotechnologies (ISN), the Institute for Collaborative Biotechnologies (ICB) and the Institute for Creative Technologies (ICT). The IAT funds basic research in electromagnetics and hypervelocity physics. The ISN will emphasize revolutionary materials research for advanced soldier protection and survivability. The Institute for Collaborative Biotechnologies will broaden the Army's use of biotechnology to the development of materials, sensors, and information processing. The ICT is a partnership with academia and the entertainment and gaming industries to leverage innovative research and concepts for training and design. 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 program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	83310	84816	79750
Current Budget (FY 2005 PB)	84237	99786	77658
Total Adjustments	927	14970	-2092
Congressional program reductions		-856	
Congressional rescissions			
Congressional increases		15826	
Reprogrammings	927		
SBIR/STTR Transfer			
Adjustments to Budget Years			-2092

Significant Change Explanation:
FY04 - Eleven FY04 Congressional Adds totaling $15826 were added to this PE.

FY04 Congressional Adds with no R-2A:
($1348) Institute for Creative Technologies, Project HB3. The purpose of this one year Congressional add is fund basic research supporting an enhanced simulation capability at Fort Sill. No additional funding is required to complete this project.

($2890) Ferroelectric Electronic - Photonic Nanodevices, Project J13. The purpose of this one year Congressional add is to perform research in ferroelectric and photonic devices. No additional funding is required to complete this project.

($963) Data Analysis and Conversion, Project J13. The purpose of this one year Congressional add is to perform research in data analysis and conversion. No additional funding is required to complete this project.

($962) Eye and Sensor Protection Against Laser Source, Project J13. The purpose of this one year Congressional add is to perform research in eye and sensor protection against lasers. No additional funding is required to complete this project.

($481) Nanotubes Optimized for Lightweight Exceptional Strength, Project J13.

The purpose of this one year Congressional add is to perform research in nanotubes. No additional funding is required to complete this project.

($962) Rapidly Deployable Visualization for Training and Simulation, Project J13. The purpose of this one year Congressional add is to perform research supporting deployable visualization for training and simulation. No additional funding is required to complete this project.

($481) Small Trailer Corrosion Prevention Program, Project J13. The purpose of this one year Congressional add is to fund basic research in corrosion prevention. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H04	HBCU/MI CENTERS - TRADOC BATTLELABS	0	0	2509	2540	2574	2624	2677

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 TRADOC Battlelabs to gain first hand perspective of the end-user's needs. Through these Centers, to be established in July 2004, 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 vital to 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 Defense Technology Area Plan (DTAP).

NOTE: This project was previously funded in PE 611104A Project H59 and is a restructuring of ongoing research into a distinct project for visibility and management.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- This program was initiated in FY04 in this PE under Project BH59. In FY05, continue the five HBCU/MI Centers of Excellence for Battlefield Capability Enhancements focused on one of the following topics: sensor fusion; Integrated Analysis for Vertical Take-Off and Landing Vehicles; Lines of Sight/Beyond Line of Sight Lethality, Lightweight Fuel Efficient Heavy Fuel Engines for UAVs; Flexible Extremities Protection; Mounted/Dismounted Maneuver; Human Engineering research in Cognitive Strategies: "Sense Making" and "Modeling in Effects of Training on Performance and Readiness. Continue to forge close collaborative working relationships with TRADOC Battle Labs and accelerate technology transitions to Army labs/centers and industry.	0	0	2509
Totals	0	0	2509

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H05	INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES	0	0	4824	4885	4949	5045	5149

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 the latest developments in bio-inspired routes to advanced sensors; new electronic, magnetic and optical materials; and new routes to information processing. The objective is to perform 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 for Army Transformation. ICB has many industrial partners such as IBM and SAIC, and it is has strong collaborations with six National laboratories, the Army's Institute for Soldier Nanotechnologies, the Institute for Creative Technologies, and Army materiel and medical research laboratories. 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 611104A Project H59 and is a restructuring of ongoing research into a distinct project for visibility and management.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Institute for Collaborative Biotechnologies: In FY03 and FY04, this program was funded in this PE under Project BH59. In FY05, identify photodynamic protein-based molecular memory for rapid and accurate information processing and storage, and biologically derived and biologically inspired synthesis and processing for enhanced performance materials properties; network effort(s): investigate mathematical approaches to the design and characterization of battlefield networks by leveraging network science based on biological networks.	0	0	4824
Totals	0	0	4824

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H09	ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)	0	0	2509	2541	2574	2624	2677

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. Research will be conducted in perception, including the exploration of sensor phenomenology and the maturation of basic machine vision algorithms, intelligent control, including maturation of artificial intelligence techniques for robot behaviors, and understanding the interaction of humans with machines. The program will conduct both analytic and experimental studies. Research products will be transitioned to the companion applied research program, 62618 H03, for integration and evaluation in testbed platforms. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

This project was previously funded in PE 601104A H59 and is a restructuring of on-going research into a distinct project for visibility and management.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Robotics Collaborative Technology Alliance: Explore new opportunities to enable revolutionary autonomous mobility for the Future Force. Research conducted as an integral part of the larger Army Robotics Program. In FY05, prove promising technologies in the areas of advanced sensors for autonomous mobility, models of human-robot interaction, and tools for the analysis of robotic vehicle survivability and transition to semi and near autonomous robotic technology programs.	0	0	2509
Totals	0	0	2509

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H50	COMMS & NETWORKS COLLAB TECH ALLIANCE (CTA)	7476	8135	8102	8887	9633	9864	10085

A. Mission Description and Budget Item Justification: This project supports a competitively selected university/industry consortium, the Collaborative Technology Alliance (CTA) that was formed 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; tactical information protection. The results of this work will significantly affect Future Force communications/networking development efforts. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- 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 FY 03, investigated and assessed routing, media access control, and auto configuration algorithms to enable energy-efficient communications for mobile networks. In FY 04, integrate self-organizing and auto configuring subnet protocols that enable persistent on-the-move communication sessions in highly mobile conditions. In FY 05, validate self-organizing and auto configuring subnet protocols that enable persistent on-the-move communication sessions in highly mobile conditions.	2533	2682	2787
- 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 FY 03, investigated and assessed multiple access and advanced modulation schemes that enable communications under dynamic wireless conditions. In FY 04, conduct analytical and experimental studies investigating high performance multiple access techniques and high spectral efficiency modulation schemes for communications on the move. In FY 05, conduct analytical and experimental studies validating high performance multiple access techniques and high spectral efficiency modulation schemes for communications on the move.	1882	1966	2048

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 FY 03, investigated and assessed low probability of detection waveforms and interference mitigation techniques. In FY 04, conduct analytical and experimental studies investigating low probability of detection waveforms, interference mitigation techniques, and anti-jam modulation to enable survivable communications and spectrum reuse. In FY 05, conduct analytical and experimental studies validating low probability of detection waveforms, interference mitigation techniques, and anti-jam modulation to enable survivable communications and spectrum reuse.	1560	1653	1643
- Tactical Information Protection: perform research in scaleable, efficient, adaptive, and secure information protection for very resource-constrained and highly mobile ad hoc networks. In FY 03, investigated and assessed trust establishment, key management, and intrusion detection techniques for very resource-constrained and highly mobile ad hoc networks. In FY 04, conduct analytical and experimental studies investigating a highly efficient and noise robust security suite with distributed trust, distributed key management, and intrusion detection. In FY 05, conduct analytical and experimental studies validating a highly efficient and noise robust security suite with distributed trust, distributed key management, and intrusion detection.	1501	1598	1624
Small Business Innovative Research/Small Business Technology Transfer Programs	0	236	0
Totals	7476	8135	8102

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H53	ADV DIS INTR SIM RSCH	2431	2541	2468	2650	2694	2757	2820

A. Mission Description and Budget Item Justification: This project supports a long-term collaboration between the Army Research Laboratory and a competitively selected Army Center of Excellence in Information Sciences (ACEIS). The objective of the center is to perform research in information technology in support of mobile command and control for the Future Force. Implementation and integration of future command and control system Commander/User requirements with architectures which utilize distributed enterprise database methodologies are the most significant technical barriers. Areas of emphasis include interactive and intelligent systems, database and information systems, and distributed and parallel processing systems. A major portion of the work of the ACEIS is performed at the Clark Atlanta University, a HBCU institution. This project also supports Army critical research at the Army High Performance Computer Research Center focused on the Future Force, including: structural response of armored vehicles to perforating and nonperforating 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. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Perform research into information exchange and retrieval systems that enhance information fusion on the battlefield to improve knowledge management for mobile command and control. In FY03, evolved analytical database techniques to query different databases for pertinent information. In FY04, perform experiments on distributed databases using intelligent agent technologies; and in FY05, evaluate information retrieval agent techniques on databases used in battlefield situations.	739	803	839

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 FY03, applied computational tools, such as data mining for intrusion detection and to test data and extract patterns useful for identification of possible intrusions; matured dynamic partitioning methods and numerical approaches for the design of Army vehicles and other structures subjected to contact and penetration; evaluated computational approaches for chemical-biological defense, Army meteorology computational models, and explored computational nano-sciences for relevant Army applications. In FY04, create interdisciplinary tools and validate integration of chem-bio defense propagation with Army meteorology models to include data mining approaches for chemical-biological models and weather models; integrate intrusion detection software into Army systems; create algorithms for computational nanomechanics; validate computational fluid dynamics and structural mechanics approaches with relevant Army applications. In FY05, create novel computational algorithms for chemical-biological defense at the nano-cell level; explore algorithms at nano-level and mechanics towards multifunctional nano-material; explore coupled approaches for integrating Army meteorology models with electromagnetics; investigate new scalable higher order techniques in mechanics and electromagnetics; explore scientific visualization approaches to meet new hardware, software, and user requirements.	1692	1664	1629
Small Business Innovative Research/Small Business Technology Transfer Programs	0	74	0
Totals	2431	2541	2468

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H54	ADVANCED SENSORS COLLAB TECH ALLIANCE (CTA)	5789	6374	6393	7202	7969	8160	8342

A. Mission Description and Budget Item Justification: This project supports a competitively selected industry/university consortium, the Collaborative Technology Alliance (CTA), for the purpose of leveraging world-class research relevant to the needs of the Future Force and Army Transformation needs. This CTA links a broad range of government technology agencies and industry/academia partners with ARL. The CTA conducts innovative research focusing on three main technical areas: micro-sensors, electro-optic smart sensors, and advanced radar concepts to support the Future Force's requirement for advanced sensing technologies. The technical areas addressed under this project include overcoming technical barriers associated with: autonomous calibration and management of micro sensor networks; multidomain smart sensors (includes multispectral 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 program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Perform microsensor research focused on sensors, algorithms, low-power signal processing, and autonomous sensor/network management for the unattended sensor network component of FCS, resulting in technology transfer and delivery of sensor nodes to applied research. In FY03, improved signal processing algorithms for better detection of slow-moving vehicles and personnel, and validated these algorithms in outdoor tests. In FY04, evaluate 100x reduction of sensor network power budget to increase sensor operational lifetime. In FY05, complete self-calibrating sensor fields to increase system performance with reduced user interaction.	2273	2480	2565
- Perform electro-optics research focused on infrared sensors, laser radar, hyperspectral imaging, and automatic target recognition algorithms for improved situational awareness and targeting by FCS platforms. In FY03, achieved first-ever crystal growth and quantified new material for high-performance infrared hyperspectral imager. In FY04, devise and characterize separate passive infrared imager and active laser radar imager. In FY05, devise prototype integrated active/passive imager.	2039	2165	2223

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 FY03, fabricated and devised a prototype lens/filter array for radar beam steering. In FY04, complete the electronically-scanned antenna subsystem comprised of low-cost phase control modules. In FY05, verify low-power MEMS phase shifters for electronically-scanned antennas.	1477	1544	1605
Small Business Innovative Research/Small Business Technology Transfer Programs	0	185	0
Totals	5789	6374	6393

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H56	ADV DECISION ARCH COLLAB TECH ALLIANCE (CTA)	5659	6164	6108	6584	7035	7204	7366

A. Mission Description and Budget Item Justification: This project supports a competitively selected industry/university consortium, the Collaborative Technology Alliance (CTA), for the purpose of leveraging world-class research relevant to the needs of the Future Force and Army Transformation needs. This CTA links a broad range of government technology agencies and industry/academia partners with ARL. The CTA conducts innovative research focusing on the following technical areas: state-of-the-art information technology applications for responsive situational awareness, distributed commander-staff-subordinate collaboration, and planning and execution monitoring in a high tempo, high stress environment. The objective of the CTA is human-centered, automated support of individual and distributed team information processing and decision-making to achieve information dominance and decision supremacy. 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 program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Modeling and measurements of cognitive processes of Army commanders and staffs (decision makers. In FY03, identified key effects on the military decision process of transitioning from plan-centric to intent-centric command and control. In FY04, devise basic architecture for allowing the actions of intelligent agents to be influenced by commander's critical information requirements and Operational Tempo (OPTEMPO). In FY05, establish guidelines for Command and Control (C2) of intelligent agents to allow the Army to perform C2 functions better and faster than our opponents in conflicts of any intensity under any conditions.	1961	2178	2260

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 FY03, created guidelines and tools to support collaboration and decision making in co-located and distributed teams. In FY04, evaluate cognitively based methods and procedures for improved situation awareness and team collaboration and decision making in a distributed environment. In FY05, extend this evaluation to include effective collaborations among human team members and between these teams and intelligent system aids designed to support Future Force command and control.	1186	1208	1195
- User-adaptive interfaces: explore ideas, frameworks, and technologies which assist the soldier in understanding, problem solving, planning and decision-making. In FY03, improved methods of displaying relevant information in different modalities (visual, auditory, and haptic). In FY04, evaluate prototype display architecture for enhancing situation awareness among co-located and distributed teams. In FY05, provide solutions for identification and fusion of information necessary to make and control decisions from generally distributed and disparate databases with varied data uncertainties.	1540	1580	1647
- Auto-adaptive information presentation: investigate how to make autonomous machines team players with their human partners or supervisors in war fighting operations. In FY03, determined new forms of feedback in response to priority information requirements in a RSTA (Reconnaissance, Intelligence, Surveillance, and Target Acquisition) tasks. In FY04, evaluate cross adaptation architecture in which all agents contribute information, test, update and correct a common picture or understanding about intentions, assessments and future activities. In FY05, validate baseline system for improving the flexibility of FCS through dynamically reconfigurable software agent systems.	972	1019	1006
Small Business Innovative Research/Small Business Technology Transfer Programs	0	179	0
Totals	5659	6164	6108

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H59	UNIV CENTERS OF EXCEL	11972	21583	6561	6673	6753	6920	7045

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 in Army Transformational areas. Army Centers supported within this project are the Rotorcraft Center of Excellence, a Collaborative Technology Alliance in Robotics, an Institute for Collaborative Biotechnologies established in FY03, and in FY04 HBCU/MI Center of Excellence focused on countermine research. This program element funds 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. This project supports Army Transformation by providing research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles; by advancing perception and intelligent control research for robotics, and by raising the visibility of the Army's commitment to America's youth and their pursuit of science and mathematics. The project also 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 soldiers and civilians for the Army workforce of tomorrow. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
eCybermission national competition to stimulate interest in science, math and technology in middle and high schools. In FY03, launched eCYBERMISSION for seventh and eighth grade students nationwide. In FY04, conduct full-scale launch of competition to all middle school (grades 6-8) and 9th grade high school students across the country. In FY 05, sustain eCYBERMISSION and implement enhancements as necessary based on previous years' lessons learned.	4434	4771	4729

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
In FY04, establish five HBCU/MI Centers of Excellence for Battlefield Capability Enhancements. The centers' focus areas will be selected from the following topics: sensor fusion; Integrated Analysis for Vertical Take-Off and Landing Vehicles; Lines of Sight/Beyond Line of Sight Lethality, Lightweight Fuel Efficient Heavy Fuel Engines for UAVs; Flexible Extremities Protection; Mounted/Dismounted Maneuver; Human Engineering research in Cognitive Strategies: "Sense Making" and "Modeling in Effects of Training on Performance and Readiness . Each center will establish a close collaborative working relationship with one or more TRADOC Battlelabs, industry and Army labs. The Battlelabs will provide a hands-on real-world operational perspective to the centers' researchers. In FY05, continue the centers' research and, working in collaboration with the TRADOC Battlelabs, accelerate technology transitions to Army labs/centers and industry. In FY05 this effort will be restructured into Program Element 0601104 Project H04 for increased visibility and management oversight.	0	2384	0
Robotics Collaborative Technology Alliance: Explore new opportunities to enable revolutionary autonomous mobility for the Future Force. Research conducted as an integral part of the larger Army Robotics Program. In FY04, conduct research in advanced sensors for autonomous mobility, modeling of human-robot interaction, and creation of tools for the analysis of robotic vehicle survivability. In FY05, this effort will be transferred to project H09 for increased visibility and management oversight.	0	2384	0
Institute for Collaborative Biotechnologies: In FY03, established an Army University Affiliated Research Center, the Institute for Collaborative Biotechnologies, to harness the enormous new opportunities that exist among the biological, information, physical and engineering sciences. The research focus is in biotechnology for sensors, electronics and information processing. In FY04, identify novel biocomputation approaches to information processing, using information content of macromolecules and their interactions, self-assembly processes for molecular manufacture of ultra-high density electromagnetic optical materials. In FY05, this effort will be transferred to project H05 for increased visibility and management oversight.	2294	8109	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Rotorcraft Centers of Excellence. In FY03, established semi-active damping control concepts for rotor systems. Devised innovative concepts for micro-rotorcraft or small UAV. Investigated aeromechanical stability and whirl flutter using blade-embedded elastomeric mass dampers. Conducted simulations of unsteady flow rotor interactions to predict dynamic loading in a turbulent environment. Devised passive noise reduction blade design concepts using Computational Fluid Dynamics. In FY04, investigate elastically tailored smart composite rotor blades. Investigate innovative design, and conduct fundamental analysis of micro-rotorcraft and UAVs. Devise a smart materials based actively conformable rotor airfoil. Investigate passive and semi-active reduction concepts of gearbox vibration and noise. Investigate active rotorcraft blade tip concepts for tip vortex core modifications using smart structures. In FY05, investigate limit detection and limit avoidance methods for carefree maneuvering. Devise experimental and computational analysis capabilities on rotor wakes and tip vortices.	1988	1865	1832
Institute for Soldier Nanotechnologies: In FY03, conducted research in seven technical areas including mechanically active materials, devices and exoskeletons to enhance soldier performance, sensors and CB agent protection, soldier medical technology, materials and fabrication, modeling and simulation and outreach and teaming. This effort has been transferred to project J12 for increased visibility and management oversight.	563	0	0
University Countermine Research Center: Undertake a broad spectrum of fundamental research into the environmental phenomenology of landmine detection. The center collaborates with existing and emerging Army R&D efforts to develop comprehensive geophysical and environmental characterization capabilities that can be integrated with sensor predictive models to detect the signature of landmines.	2693	0	0
Army Centers of Excellence. The purpose of this one year Congressional add is to fund basic research at an Historically Black College and University/Minority Institution (HBCU-MI) in cooperation with TRADOC Battle Laboratories. No additional funding is required to complete this project.	0	1444	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	626	0
Totals	11972	21583	6561

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H62	ELECTROMECH/HYPER PHYS	8213	5819	5591	5864	6081	6181	6276

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 Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Pulsed Power - In FY03, established prime pulsed power option and matured high power silicon carbide (SiC) switch approach using existing technology. In FY04, perform experiments to establish utility of inductive pulsed power systems and perform experiments to establish performance of high power switches. In FY05, experimentally validate improved high strength, high conductivity field coil material.	1704	2050	2180
Launcher - In FY03, established a launcher rail configuration that eliminates launch package armature transition to a plasma, thus proving feasibility of maintaining launch package integrity. In FY04, establish performance of non-transitioning EM launch package armatures and investigate improved materials to solve technical barriers to EM launch. In FY05, provide complete model of electromagnetic, structural, and thermal processes in EM launch.	2165	1500	1286
Launcher Package (Projectile) - In FY03, showed ability of hypervelocity novel kinetic energy penetrators to defeat selected heavy armor threats. In FY04, launch a robust novel kinetic energy penetrator from an EM gun against one half scale heavy armor targets. In FY05, numerically establish optimal EM novel kinetic energy penetration concept and provide results to EM Gun Technology Program.	2132	2100	2125

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
EM Gun Concepts - Define integration approaches for EM gun technologies on future platforms. In FY03, constructed a mobile hybrid electric test bed to examine EM gun power sharing.	2212	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	169	0
Totals	8213	5819	5591

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H64	MATERIALS CENTER	2727	3156	2385	2495	2644	2707	2767

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 program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03, devised new material formulations that significantly enhance ballistic performance of lightweight fabrics and composites for personnel and vehicle survivability and established new theoretical basis for failure of boron carbide ceramics at ballistic rates. In FY04, devise techniques to exhibit improved electrical, optical, and power-generating properties from composite materials to enable multi-functional capabilities for Future Force platform survivability; devise theory and design criteria for generating hybrid materials and conduct experimental studies to verify models and show benefits for Objective Force Warrior applications; and devise processing of nano-scale metallics and ceramics envisioned for use in Future Force. In FY05, devise electro-optical composite structural materials; explore practical strategies to scale-up synthesis and processing of hierarchical polymers and polymer-inorganic hybrid materials; and devise physics based models to predict the effects of microstructure on the behavior of metallic and ceramic material systems under dynamic loading conditions.	1936	2269	2385
Composite Materials Research. The objective of this Congressional Add is to enhance the fundamental composite materials research ongoing at the University of Delaware. In FY03, developed novel concepts for energy storage in multifunctional composite materials. FY04, mature energy storage materials and explore options for incorporation into load bearing structures. No additional funding is required to complete this project.	791	795	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	92	0
Totals	2727	3156	2385

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H73	NAT AUTO CENTER	5119	8069	2992	3077	3134	3208	3277

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 at 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 advanced vehicle technologies. This goal will be accomplished through the insertion of leap ahead technologies in phased improvements over the next several decades. The research performed in this project contributes to formulating and establishing the basic principles for these leap ahead technologies. Selected university partners include: University of Michigan, University of Wisconsin, Wayne State University, University of Alaska, University of Tennessee, and Clemson University, while key industry partners include the major U.S. automotive manufacturers and suppliers. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by TARDEC, Warren, MI.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Automotive Research Center (ARC) - The goal of this effort is to advance state-of-the-art simulation and modeling of future Army automotive technologies, with strong emphasis on targeting the Army's Future Combat Systems (FCS) program. The ARC will also formulate and evaluate future advanced automotive technologies relative to future FCS vehicular platforms. In FY03, completed final validation and implementation of future FCS mobility and propulsion predictive algorithms, and optimized the overall Army ground vehicle simulation network. In FY04, complete final optimization of the Army's overall ground vehicle simulation network and implement a mathematical framework capable of accepting modular subroutines in all generic automotive areas. Evaluate and analyze systems for intelligent remote monitoring, guidance, and control to be used for unmanned autonomous and semi-autonomous FCS ground vehicles. Integrate newly matured advanced automotive technology algorithms within the overall simulation network. In FY05, evaluate and analyze 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, including piston engines, alternate fuels, hybrid vehicles, and fuel cells. Advanced and unique concepts in these areas will be researched and optimized for future Army vehicle implementation in programs like the FCS effort.	2504	2925	2992
This one year Congressional Add conducted basic research in the area of military and commercial ground vehicle modeling and simulation. The eight university consortium consisted of Michigan, Wayne State, Oakland, Alaska, Iowa, Wisconsin, Clemson and Tennessee. No additional funding is required to complete this project.	2615	0	0
University Based Automotive Research. The purpose of this one year Congressional add is to develop modeling and simulation tools and leverage commercial technologies for potential application in Army vehicle systems through on-going and new programs in auto research. No additional funds are required to complete this project.	0	2023	0
TACOM Automotive Research Center University Research. The purpose of this one year Congressional add is to focus on alternative propulsion systems during development of modeling and simulation tools and leveraging commercial technologies for potential application in Army vehicle systems. No additional funds are required to complete this project.	0	2889	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	232	0
Totals	5119	8069	2992

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
J08	INSTITUTE FOR CREATIVE TECHNOLOGY	12230	11998	11046	7184	7173	7389	7597

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 will serve 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 in order to adapt their concepts of story and character to increasing 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. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- 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 FY03, designed the constructs for the test beds and specified content media including photo-realistic structures, primary and background sound cues, and odors, and tested the integration techniques and media for proper synchronization and identified shortfalls. In FY04, complete the specification of algorithms and architecture constructs for the proof of concept test beds and address computational efficiency and stability issues, devise new techniques to enhance the immersiveness of the prototypes. In FY05, investigate 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.	5361	5512	5901
- Conduct basic research in the two most 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 FY03, improved fidelity of rendering techniques for compositing real objects into virtual environments and achieved matching lighting effects including shadows and bounced light, and extended audio processing algorithms to permit two participants in a given training setting to experience proper sound cues based on their positions relative to the sound sources. In FY04, devise computationally efficient techniques for applying global illumination to synthetic objects. Extend research into second order effects of natural lighting on real persons in synthetic environments. In FY05, extend the concept of virtual loudspeakers to address multiple participants in a given mixed reality setting. Examine sound cancellation techniques to improve auditory cues in noisy environments. Combine new lighting techniques and sound algorithms to make preliminary assessment of their combined impact on immersion.	1666	2623	2533

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Conduct research on intelligent avatars for virtual environments to enhance realism of interactions with trainee(s) and increase training effectiveness. In FY03, investigated the synchronization of speech and gesture in virtual characters to address non-verbal aspects of communications, and advanced speech understanding and text-to-speech processing to permit human to computer interactions in noisy environments. In FY04, complete draft specification of data elements and parameters to permit synchronized verbal communications techniques for virtual characters to interact with soldiers in education and training situations. Conduct research on the impact that modeling the emotional aspects of verbal and non-verbal communications for virtual humans will have on interaction with human participants. In FY05, complete draft specification of data elements and parameters for non-verbal communications techniques. Integrate emotional models and timing constraints into the draft specification.	1867	3515	2612
- The objective of this one-year Congressional Add was to conduct basic research in immersive environments to achieve efficient and affordable training and modeling simulation solutions at Fort Sill. No additional funding is required to complete this project.	3336	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	348	0
Totals	12230	11998	11046

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
J09	POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	5644	5901	5739	5716	5697	5835	5966

A. Mission Description and Budget Item Justification: This project supports a 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 research relevant to Army needs. Power and energy research supporting 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 Combat Systems (FCS) vehicles and robotic platforms. Technical barriers include overcoming energy density limitations of traditional electrochemical portable power sources, reforming of 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 program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Research, investigation and characterization of a micro electro mechanical system (MEMS) based micro-gas turbine generator for producing electricity for the dismounted soldier of the Future Force. In FY03, the MEMS processing to build 3D compressor geometries was created and a more efficient magnetic generator design was devised. In FY04, test the micro gas turbine using hydrogen as fuel. In FY05, design 2nd generation engine with non-magnetic generator, turbine film cooling and test hydrocarbon-fueled turbojet.	2148	2204	2280

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Research, investigation and characterization of novel fuel cells/components and logistic fuel reformation techniques for producing electricity for the dismounted soldiers of the Future Force as well as producing electricity for vehicle prime power and accessory power for the Future Combat System. In FY03 created a 1-2 W prototype of a reformed hydrogen fuel cell integrated with a methanol fuel processor. In FY04, mature a 20 watt fuel cell using reformed-methanol as fuel for soldier power applications. In FY05, integrate 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.	1835	1846	1869
- Research in support of the FCS program by reducing the size and weight of the electronic components and increasing their efficiency by replacing silicon semiconductor devices in the electronic systems and subsystems with those made from silicon carbide. In FY03 determined the benefits of replacing silicon diodes with silicon carbide diodes in DC - DC converter circuits used for electromagnetic armor and electro-thermal chemical guns, and in matrix converters for on-vehicle power conversion and conditioning. In FY04, test and evaluate hybrid Silicon/Silicon Carbide switch modules in DC-DC converters for hybrid electric vehicle mobility applications. In FY05, research, develop and characterize of Silicon Carbide devices and switches while working to implement these in various types of converters/invertors needed for mobility, survivability and lethality applications within the Future Combat System and the Future Force.	1661	1680	1590
Small Business Innovative Research/Small Business Technology Transfer Programs	0	171	0
Totals	5644	5901	5739

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
J12	NANOTECHNOLOGY	9147	10753	9495	9449	10203	10447	10680

A. Mission Description and Budget Item Justification: This project supports nanotechnology research for the soldier at Massachusetts Institute of Technology Institute for Soldier Nanotechnologies (ISN). The ISN emphasizes revolutionary materials research toward advanced soldier protection and survivability. ISN works in close collaboration with several major industrial partners including DuPont and Raytheon, the Army Research Laboratory (ARL), the Army's Natick Soldier Center (NSC), and other Army Research Development and Engineering Centers (RDECs) in pursuit of its goals. The institute is designated as a University Affiliated Research Center (UARC) to support the Army Future Force war fighter through research to devise nanometer-scale science and technology 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, chameleonic color changes, biomedical monitoring, and extremities protection. The objective is to lighten the soldier's load through system integration and multifunctional devices while increasing his survivability and lethality. Computational models will be created that predict the soldier's performance with the new technologies. The new technologies will be compatible with the other 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 program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- In FY03, performed research to devise mechanical behavior models of high performance fabrics to provide fundamental understanding of energy absorbing materials. In FY04, conduct research on nano-based materials and membranes for individual climate control. In FY05, devise innovative processes and techniques to construct high performance fabrics and multi-layered composite materials.	1782	1895	1950
- In FY03, performed research to devise high power, high force nanostructures polymer actuators utilizing promising properties exhibited by carbon nanotube technology. In FY04, integrate actuators with sensors with the goal of improving upon force achieved by human muscle. In FY05, investigate biomimetic muscle behavior with potential to provide new approaches to outperform natural systems.	3606	3740	3873

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- FY03 was the first full year of operation. Formed seven research teams to conduct research in mechanically active materials, devices and exoskeletons, sensors and chemical-biological (CB) agent protection, soldier medical nanotechnology, materials processing and fabrication and other areas. Formalized collaborative research agreements with industry partners. In FY04, continue research in 40+ research projects begun in FY03. Investigate techniques and membranes for water purification/filtration. Establish innovative methodology to transition breakthroughs to Army labs/centers and industrial partners. In FY05, devise variable stiffness materials with goal of 100-fold change in stiffness for use in physiological protection (e.g. field applied splints).	3759	4806	3672
Small Business Innovative Research/Small Business Technology Transfer Programs	0	312	0
Totals	9147	10753	9495

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601105A - Force Health Protection**	**D52**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
D52	FORCE HEALTH PROTECTION	0	9763	9538	9680	10367	10518	10725

A. Mission Description and Budget Item Justification: In FY03 and prior years, the Office of the Secretary of Defense provided Force Health Protection Research funding, (PE 0601105D8Z) to Army to enhance the overall health status of Service members. Starting in FY04, OSD funds were transferred to the Army under Force Health Protection Research. Force Health Protection Research seeks to enhance protection of Service members against health threats in military deployments both by increasing our understanding of military health issues 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 program is conducted in close coordination with the Department of Veterans Affairs. The program is divided into 5 thrust areas: (1) global health monitoring, (2) health behavior interventions, (3) health risk communication, (4) health risk assessment methods, and (5) medical materiel safety. This project contains no duplication with any effort within the Military Departments. This program supports the Future Force transition path of the Transformation Campaign Plan (TCP). 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 U.S. Army Research Institute of Environmental Medicine, Natick, MA; the Naval Health Research Center, San Diego, CA; and the U.S. Army Center for Environmental Health Research, Fort Detrick, MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY04, conduct second survey of the Millennium Cohort Study, similar to the classic Framingham heart study, as well as study predictors that lead to “chronic multisymptom illness.” Explore relationship between physical activity and prevention or treatment of the psychological and physiological symptoms for the chronic condition described as “chronic multisymptom illness.” In FY05, evaluate effectiveness of current and state-of-the-art programs for weight management in the military environment. Validate research findings linking the condition described as “chronic multisymptom illness” with specific functional neuroimaging-based neurochemical changes in soldiers.	0	3719	4249
In FY04, evaluate 12-month follow-up results for recruit smoking cessation study. In FY05, complete smoking study and revise the Recruit Assessment Profile survey instrument to include the most valid predictors of wellness and warfighter resilience.	0	2463	1888

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
In FY04, demonstrate likely mechanisms of interaction of chemicals used for medical prophylaxis (treatment/disease prevention) in deployments (e.g., DEET, permethrin, pyridostigmine bromide) on the basis of key enzyme systems responsible for metabolism of toxic chemicals. Additionally, evaluate the association between squalene antibodies and chronic multisymptom illnesses based on pre- and post-deployment studies. FY05 explore relationships between military exposures and health outcome measures for the 4 year time point in the military cohort millennium study of 80,000 service members.	0	3298	3401
Small Business Innovative Research/Small Business Technology Transfer Programs	0	283	0
Totals	0	9763	9538

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602105A - MATERIALS TECHNOLOGY

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		35041	39972	15385	14701	15464	15336	15587
H7B	ADVANCED MATERIALS INITIATIVES (CA)	7431	25269	0	0	0	0	0
H7D	ELECTRONICS COMPONENTS RELIABILITY	2381	0	0	0	0	0	0
H7E	MATERIALS JOINING FOR ARMY WEAPONS	2857	0	0	0	0	0	0
H7F	PRECISION MAGNETORHEOLOGICAL FLUIDS	3240	0	0	0	0	0	0
H7G	NANOMATERIALS APPLIED RESEARCH	0	0	4755	4006	4092	4014	4056
H84	MATERIALS	19132	14703	10630	10695	11372	11322	11531

A. Mission Description and Budget Item Justification: This program element (PE) provides materials technology for armor and armaments to enable US dominance in future conflicts across a full spectrum of threats in a global context, by increasing the survivability and lethality of Future Combat Systems (FCS) and Future Force systems and, where feasible, exploit opportunities to enhance Current Force capabilities. Project H84 is directed toward devising materials technology that will make our heavy forces lighter and more deployable, and our light forces more lethal and survivable. It provides the technology base, including a focused thrust in nanomaterials, required for solving materials-related problems in individual soldier support equipment, armor, armaments, aircraft, ground and combat vehicles and combat support. 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 602782 (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), and PE 0603008 (Command, Control, Communications Advanced Technology). The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Note: In FY05, the ongoing effort in nanomaterials previously funded in Project H84 has been restructured into a separate project for heightened visibility and management (Project H7G – Nanomaterials Technology).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	33621	15186	14881
Current Budget (FY 2005 PB)	35041	39972	15385
Total Adjustments	1420	24786	504
Congressional program reductions		-351	
Congressional rescissions			
Congressional increases		26100	
Reprogrammings	1420	-963	
SBIR/STTR Transfer			
Adjustments to Budget Years			504

Significant Change Explanation:
FY04 - Eleven FY04 Congressional Adds totaling $26100 were added to this PE.

FY04 Congressional Adds with no R-2As:
($2349) Advanced Material for Mine Detection and Blast Mitigation, Project H7B: The purpose of this one year Congressional add is to fund research in developing advanced materials for mine detection and blast mitigation. No additional funding is required to complete this project.

($5638) Advanced Material Processing, Project H7B: The purpose of this one year Congressional add is to fund applied research in advanced material characterization and processing technologies for composite and metallic materials. No additional funding is required to complete this project.

($939) Ballistic Shields, Project H7B: The purpose of this one year Congressional add is to fund research in ballistic shields. No additional funding is required to complete this project.

($939) Center for Innovative Material for Infrastructure Study, Project H7B: The purpose of this one year Congressional add is to fund research in innovative materials for infrastructure. No additional funding is required to complete this project.

($1879) Composite Multifunction Material Technology for Future Combat Systems, Project H7B: The purpose of this one year Congressional add is to

fund research in advanced lightweight materials processing technologies. No additional funding is required to complete this project.

($4039) Future Affordable Multi-Utility (FAMU) Materials for the Army FCS, Project H7B: The purpose of this one year Congressional add is to fund research in advanced lightweight materials processing technologies. No additional funding is required to complete this project.

($1315) Low Cost Enabling Technologies, Project H7B: The purpose of this one year Congressional add is to fund research in affordable processing of advanced multi-functional materials for a wide range of Army applications. No additional funding is required to complete this project.

($1691) Materials Joining for Army Weapons Systems, Project H7B: The purpose of this one year Congressional add is to fund research in affordable joining technologies, including friction stir welding and laser hybrid welding, to provide capability to join complex shapes, dissimilar materials, and out of tolerance parts (wide gaps). No additional funding is required to complete this project.

($939) Molecular Design of Polymer Nanocomposites, Project H7B: The purpose of this one year Congressional add is to fund research in the molecular design of polymer nanocomposites. No additional funding is required to complete this project.

($3193) Precision Polishing of Large Optics, Project H7B: The purpose of this one year Congressional add is to fund research to develop new approaches to affordably polishing large-scale optics three meters or greater in diameter. No additional funding is required to complete this project.

($1597) Titanium Powder Alloy Production, Project H7B: The purpose of this one year Congressional add is to fund research in titanium powder alloy production. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H7G	NANOMATERIALS APPLIED RESEARCH	0	0	4755	4006	4092	4014	4056

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 survivability, lethality, and sustainability. This project funds a collaborative research effort in nanomaterials technology between the Army Research Laboratory (ARL) and the Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute for Technology, MA. The ISN program and associated nanomaterials research transitioned from PE 0602105A H84 beginning in FY05. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

The work in this project was previously funded in PE 0602105A project H84. It has been restructured into a separate project to heighten visibility and management.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- 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 survivability, lethality, and sustainability. Research conducted by ARL in collaboration with ISN Industry Partners. In FY05, validate multiple protective materials designs that incorporate at least three functions (e.g., ballistic, blast and fire/flame protection) with reduced weight within single integrated system and exploit selected processing methodology to fabricate prototype nanomaterials-based, functionally integrated specimens for evaluation with improved survivability and lethality.	0	0	4755
Totals	0	0	4755

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H84 MATERIALS	19132	14703	10630	10695	11372	11322	11531

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), Objective Force Warrior (OFW) and other Future Force platforms. In order to meet the challenge of the Army Vision, new systems must be significantly lighter, more deployable, and more sustainable. A barrier to this challenge is the requirement for 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, 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. The work is conducted at the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD and Hampton, VA 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. This project also funds a collaborative research effort in nanomaterials technology between the ARL and the Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute for Technology, MA, which will transition to 0602105A H7G beginning in FY05. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Optimize lightweight armor materials/structures, processing methodology, and modeling and simulation tools to enable formulation of lightweight frontal and structural armors that will revolutionize FCS and Future Force platform survivability. In FY03, optimized lightweight composite and ceramic armor materials/structures and transitioned technology to FCS vehicle designers for formulation of FCS Increment 1 armors. In FY04, provide and evaluate improved materials and processes to include multispectral and transparent ceramics that increase performance of FCS armor systems and create computational methodologies for design of blast and impact-resistant multifunctional (e.g., power, communications, propulsion, sensory) composite structures for FCS enhancement. In FY05, prove low cost processing of enhanced structural armor, metallics, and ceramics to enable advanced armor technology formulation and validate computational methodologies for design of blast and impact-resistant multifunctional (e.g., power, communications, propulsion, sensory) composite structures critical for full-spectrum survivability of FCS/Future Force platforms.	4155	4005	4111
- Optimize lightweight armor materials and defeat mechanisms against emerging threats and provide advanced processing techniques to enable affordable design of future multifunctional ballistic protective systems for the Future Warrior. In FY03, matured physics based design tools and provided novel lightweight materials solutions capable of defeating existing ballistic threats to Natick Soldier Center for use in Objective Force Warrior (OFW) protective systems; and employed advanced models and processing techniques to optimize performance of promising nano-structured materials and multi-functional coatings that will provide improved protection and sustainability for the Future Force. In FY04, optimize lightweight armor materials and defeat mechanisms against emerging threats and provide prototype armors that incorporate advanced processing techniques to enable affordable design of future multifunctional ballistic protective systems for the Future Warrior. In FY05, validate computational models and investigate armor materials and processing techniques that will enable the fabrication of an ensemble with integrated warrior electronic devices and multi-functional ballistic protection.	3128	1575	2292

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Design, validate, and optimize advanced materials (ceramic, composite, polymers, lightweight metals) and processing techniques for smaller more lethal penetrators/warheads and affordable, lightweight high performance armaments for revolutionary Future Force lethality. In FY03, synthesized candidate penetrator/warhead alloys (Bulk Amorphous Materials, Nano-grain Tungsten, etc), evaluated their ballistic performance against threat armors, and established transition of promising medium caliber penetrator materials to ammunition designers; characterized and down-selected candidate ceramics and designed gun barrel sheathing technology required for improved armaments; and designed, fabricated, and experimentally validated prototype metal matrix composite projectile shell and transitioned design methodology to ammunition designers for application to lightweight, lethal FCS/Future Force munitions. In FY04, characterize failure mechanisms in emerging anti-armor materials and investigate effects of processing variables and constituents for improved design of penetrators/warheads; and prove thermally robust sheathing techniques capable of inducing a multi-axial compressive stress to insure structural integrity of sheathed ceramics subjected to internal pressure loading to enable improved armaments for the Future Force. In FY05, transition improved anti-armor materials and ceramic gun barrel technology to ARDEC/AMRDEC.	5059	3790	3727
- 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 FY03, designed and fabricated new electro-ceramic materials (thin film acceptor doped BST films) for discrete and integrated microwave applications including fire control radar, smart munitions, and point-to-point communications. In FY04, validate affordable processing methods to improve performance and integration into communication systems for FCS. In FY05, transition technology to CERDEC.	500	500	500

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 Objective Force Warrior survivability and lethality. Research conducted by ARL in collaboration with ISN Industry Partners. In FY03, exploited material breakthroughs to design and fabricate flexible materials concepts for individual ballistic and stab protection based on shear-thickening nanomaterial fluids and nanostructural fiber coatings; matured polymer nanocomposites for transparent armor and scratch resistant coatings; fabricated nanostructured polymer membranes which exhibit selective permeability for use in chem/bio protective garments; devised and implemented unique methods to characterize and model the ballistic response of nanomaterials and fibers; and proved novel lightweight energy absorbing nanomaterials for experimental evaluation and scale-up. In FY04, design and devise scalable processing/synthesis methods and show improved physics-based materials property models. In FY05, validate multiple protective materials designs that incorporate at least three functions (e.g., ballistic, blast and fire/flame protection) with reduced weight within single integrated system and exploit selected processing methodology to fabricate prototype nanomaterials-based, functionally integrated specimens for testing and evaluation with improved survivability and lethality.	5321	4761	0
Advanced Coatings Research to Extend the Service Life of Vehicles and equipment: This one year congressional add focused on providing novel coatings to improve the reliability/durability, and significantly reduce life-cycle costs, of Army Materiel. No additional funding is required to complete this project.	969	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	72	0
Totals	19132	14703	10630

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		21700	25230	25629	31703	34843	35232	31255
140	HI-POWER MICROWAVE TEC	2718	2805	3009	3680	3745	3749	3816
H15	GROUND COMBAT ID TECH	3617	4678	4782	5829	5901	5972	7889
H16	S3I TECHNOLOGY	15365	14552	15083	18498	19644	20083	19550
SA1	SENSORS AND ELECTRONIC INITIATIVES (CA)	0	3195	0	0	0	0	0
SA2	BIOTECHNOLOGY APPLIED RESEARCH	0	0	2755	3696	5553	5428	0

A. Mission Description and Budget Item Justification: The objective of this program is to enhance the capabilities of the Future Combat Systems (FCS) and the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities by: 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. Critical technologies to be addressed to increase the combat effectiveness of tactical Army forces include: high power, solid-state/vacuum, power/RF component technology; combat identification technology; and sensors, signatures, signal and information processing (S3I) technology. 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), and PE 0603008 (Command, Control, Communications Advanced Technology). The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed by the Army Research Laboratory (ARL) and the Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	21820	22765	25510
Current Budget (FY 2005 PB)	21700	25230	25629
Total Adjustments	-120	2465	119
Congressional program reductions		-226	
Congressional rescissions			
Congressional increases		3300	
Reprogrammings	-120	-609	
SBIR/STTR Transfer			
Adjustments to Budget Years			119

Significant Change Explanation:
FY04 - Two FY04 Congressional Adds totaling $3300 were added to this PE.

FY04 Congressional Adds with no R-2A:
($1127) Disposable Sensors for Battlefield and Urban Warfare, Project SA1: The purpose of this one year Congressional add is to fund research on disposable sensors for use on the battlefield and in urban warfare. No additional funding is required to complete this project.

($1973) Portable Chemical-Biological Agent Detection System, Project SA1: The purpose of this one year Congressional add is to fund research on technologies to develop a portable chemical-biological agent detection system. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
140	HI-POWER MICROWAVE TEC	2718	2805	3009	3680	3745	3749	3816

A. Mission Description and Budget Item Justification: This project has a dual focus: researching, developing and evaluating Directed Energy Weapon (DEW) technology as well as high power components that will significantly enhance the survivability and lethality of Army Future Combat Systems (FCS) platforms and related systems. The DEW effort includes studying both radio frequency microwave and laser system capabilities and effects against various threats, including improvised devices, electronically guided and fuzed missiles/munitions and electronic off and on route mines. Realizing DEW capabilities for diverse targets at a variety of lethality levels and operational ranges on FCS requires both optimizing the DEW system as well as developing compact, high density power systems meeting stringent FCS weight and volume restrictions. System optimization relies on determining the most effective Directed Energy (DE) 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, Defense Threat Reduction Agency, National Labs, university consortia and relevant industry and foreign partners. This work is also done 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). The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work on this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Research and develop high power converters and enabling technology, such as high-temperature devices to achieve high-power and temperature operation for high power demand capabilities, including Directed Energy Weapons, while meeting the stringent weight/volume requirements for Future Combat System and related platforms for the Future Force. In FY03, lab demonstrated the world's first 100 kilowatt (kW) silicon (Si) based matrix converter at 130% of full power for alternating current (AC) motor control; designed and fabricated a compact 10 kW Si modified matrix converter (MMC) for mobile electric power; investigated/identified pulse charger design to support distributed electromagnetic armor survivability systems. In FY04, show 10 kW Si MMC (400 Hz input frequency) in a generator-set with variable motor control that is fault-tolerant to unbalanced loads; scale MMC power modules to FCS power levels for direct current – alternating current (DC-AC) conversion for motor control; show next-generation digital signal processor and control software for MMC power modules for high-efficiency low – interference power converters. In FY05, investigate and mature high-temperature silicon carbide (SiC) power modules for >100 kW-level power conversion at 150 Celsius (C) for motor control, for vehicle power bus and for vehicle survivability and lethality systems. This is in support of TARDEC work on power generation, conditioning and control for hybrid electric vehicle and pulse power for Future Combat Systems.	1290	1380	1083

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Investigate the feasibility and effectiveness of radio frequency (RF) DEW concepts by determining the power/energy requirements to defeat threats, such as electronically guided and/or fuzed munitions and mines. Analytically and experimentally determine the RF field strength/power density required on the targets to produce functional kill. Determine the most effective DE frequencies/wavelengths and modulations (duty cycles/pulse widths/repetition rates) to defeat the target's performance. Use the measured effect levels to develop power and system requirements for the concepts. Support Research Development and Engineering Centers (RDECs) in development of breadboard/brassboards to show proof of principal. In FY03, investigated the effects of RF and Laser DE sources on four threat electro-optic/infrared (EO/IR) sensors in support of ARDEC's Agile Target Effects Systems (ATES) Science and Technology Objective (STO) synergistic effects. Used the data to refine power/energy requirements for RF ATES. Also developed probability of failure estimates for air delivered RF warhead concept. (Off Board RF ATES). For CERDEC, investigated the effects on RF DE on off route mines/booby traps to investigate feasibility of a counter booby trap system. Conducted experiments on commercial receivers as surrogate trigger devices. In FY04, plan to continue investigating the effects of RF energy on threat anti-tank guided missiles (ATGMs) and representative booby traps to measure their effect levels. Also conduct lab/field experiments to demonstrate ATES concept and transition requirements to ARDEC. In FY05, use DE effects data to develop power/energy and system requirements for a counter booby trap and/or countermine and related devices and transition to CERDEC/ARDEC.	1036	1034	1083
- Investigate electronic warfare (EW) survivability, lethality, EW tools technology, and methodology research. In FY03 completed theoretical design analysis of a narrow band filter (Faraday Anomalous Dispersion Optical Filter (FADOF)) that provides a multi-spectral approach in identification of extremely low signature missile propellants. Conducted theoretical studies and devised algorithms for atmospheric propagation of this phenomenology. These technology efforts support the Full Spectrum Active Protection (FSAP) effort for TARDEC in support of the Future Combat Systems (FCS). In FY04, investigate integration of the FADOF onto FCS platforms, and devise Electronic Warfare (EW) methods and technologies for countering/defeating improvised explosive devices (IEDs). In FY05, investigate a methodology, tool set, and EW models for EW survivability analysis of military vehicles confronted with IEDs.	392	371	843
Small Business Innovative Research/Small Business Technology Transfer Programs	0	20	0
Totals	2718	2805	3009

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H15	GROUND COMBAT ID TECH	3617	4678	4782	5829	5901	5972	7889

A. Mission Description and Budget Item Justification: Joint fires provide the ability for joint forces to locate, identify, track, and engage targets as necessary. As stated in the Joint Transformation Roadmap, this capability is to be available throughout the full range of military operations. In order to enable a joint fires capability, positive identification of the target as non-friendly by or for the shooter is critical, prior to engagement. At this time, US and Allied Forces lack a comprehensive combat identification (CID) system to prevent fratricide and enable a joint fires capability. The objective of this project is to mature and demonstrate emergent CID systems for joint, allied and coalition air-to-ground and ground-to-ground mounted, dismounted, forward observer and forward air controller mission for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This program provides the technologies for the Coalition Combat Identification Advanced Concept Technology Demonstrations (ACTD) that is exploring and demonstrating CID with the UK, France, Germany, Canada, and Australia. The program provides maturation of the enabling technologies to demonstrate common identification (ID) standard agreements (STANAGs), reduce weight and cost, and evaluate radio frequency (RF) tags as a CID enabler. This program will set the baseline for the Future Force to enable fratricide reductions through CID concepts to include blue force tracking via RF Tags scanned by synthetic aperture radar/moving target indicator (SAR/MTI) radar. This program increases the survivability and lethality of Coalition Forces by providing a matured capability to identify friend from foe, thereby, reducing fratricide incidents across the battlefield. CID must be software functional, portable across a family of platforms, tied to the future tactical internet, over-the-horizon capable and highly resistant to countermeasures. The system must operate successfully in all weather environments and must not be impacted by smoke, fog, dirt and other obscurants. The Future Force CID capability will fuse situational awareness (SA) and Point-of-Engagement Target Identification into a common "through sight" picture. The future CID architecture will necessitate the integration of a network composed of diverse reconnaissance, surveillance and target acquisition (RSTA) sensors that include non-cooperative capabilities in the sensor suites and a cooperative ID capability that will be realized as part of the future network centric, real-time, red and blue SA for both combat vehicles and unit of action/unit of employment (UA/UE) Commander. Coordination will be accomplished with other services, allies and coalition partners. MANPRINT will be addressed in all activities. Future CID will operate with the Objective Force Warrior System providing a seamless boundary with vehicle CID.

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 2003	FY 2004	FY 2005
- Coalition Combat Identification ACTD: In FY03, coordinated allied participation in the Coalition Combat Identification ACTD (GE, UK, FR, CA, AUS). Shared technical approaches to mature hardware and implemented the Battlefield Target ID (BTID) and Dismounted Soldier CID (DSCID) STANAGs. Matured Radio Based Combat Identification (RBCID) using the ASIP SINCGARS. In FY04, mature a smaller, lighter, more efficient and less costly version of the Battlefield Combat Identification System Millimeter Wave system with a NATO STANAG approved waveform. Coordinate establishment of a NATO standard for DSCID for a US/NATO common system to increase protection to the dismounted soldier. Plan/conduct a CID Military Operation in an Urban Terrain exercise. In FY05, will mature modeling and simulation capability to conduct international virtual operational exercise to evaluate technologies and test or establish new tactics, techniques, and procedures. Will conduct technical, operational, and simulated test and evaluation.	3617	3878	4056
- Network Centric Combat Identification Technologies: In FY04, evaluate the use of Ku and X - Band Digital Radio Frequency (RF) Tags for Blue Force Tracking and air-to-ground Combat Identification (CID). In FY05, will conduct operational testing and assess military utility of RF Tags in conjunction with a Synthetic Aperture Radar/Moving Target Indicator radar to provide passive CID. Will mature ground integrated target identification system for ground-to-ground CID for the Future Force. This will integrate CID data from cooperative and non-cooperative target identifiers (FLIR, EPLRS, RF Tags, Radar, tactical internet, etc.) and situational awareness sensors to display CID results through the sight. This will mitigate engagement latency and provides beyond line-of-sight capability.	0	684	726
Small Business Innovative Research/Small Business Technology Transfer Programs	0	116	0
Totals	3617	4678	4782

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H16	S3I TECHNOLOGY	15365	14552	15083	18498	19644	20083	19550

A. Mission Description and Budget Item Justification: This project is focused on advanced sensor, signal processing and information technologies to provide the Future Combat Systems (FCS), technologies for the future Soldier and other emerging thrusts with decisive new capabilities to locate, identify, and engage battlefield targets. The ultimate 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, movement of sensors on military vehicles, etc. Cost reduction is a key focus. Significant areas of research include: 1) 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. Research is conducted in fusion of diverse sensors such as acoustic, seismic, magnetic, radar, infrared (IR), visible imagers, etc. Technical barriers are: diverse, low-power sensors, autonomous networks, and sensor fusion. Applicable Algorithms and concepts are transitioned to Communications-Electronics Research, Development and Engineering Center (CERDEC) Disposable Sensors Program. 2) Low cost acoustic, seismic and magnetic sensors that can passively detect and track battlefield targets such as tanks, helicopters, etc. and locate gun fire. 3) Sensor technologies for the detection and tracking of humans, especially in urban terrain. Technical barriers: effective fusion of many diverse sensor types and innovation of high reliability, low cost approaches. 4) High performance multi-function radio frequency (RF) systems which allow target acquisition, combat identification (ID), active protection, surveillance, and communications systems consolidated into a single system, reducing system cost and size. Technical barrier: maintaining performance of each function in the combined system. 5) 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. Technical barriers include real-time signal processing and false alarm rate. 6) Aided/automatic target recognition (ATR) to allow sensors to autonomously locate and identify targets. Algorithms will minimize the workload on the soldier in combat to find and identify targets using laser radar (LADAR), multi-band infrared cameras, and hyperspectral imagers. 7) 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. Sensor processing, analysis, and displays will provide soldiers with clearer, higher resolution images from their targeting systems. 8) Advanced battlefield sensor and information processing to conduct a dynamic and real time situation assessment to present a common picture of the battlespace. Technical barriers: fusion of data from dissimilar sensors, coherent display of complex information, and human factors. 9) Advanced information processing methods to provide automatic information technologies which utilize widely dispersed sensor and legacy information sources. Technical barrier: development of autonomous networks. 10) Sensor and eye protection against laser threats. Technical barrier: optical designs and materials that can respond fast enough and large enough over the bandwidth of the detector. . 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 supports the following Army Programs: FCS, OFW, Networked Sensors for the Objective Force (NSfOF) Advanced Technology Demonstration (ATD), Multi-Function Starting Sensors Suite (MFS3), Disposable Sensors, Cave and Urban Assault Advanced Concept Technology Demonstration (ACTD),

Warrior's Edge, command, control, communications and computers (C4) on the Move, Anti-Personnel Landmine Alternatives (APLA), 3rd Generation forward-looking infrared (FLIR), Full Spectrum Active Protection (FSAP), and Quicklook.

The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- 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. In FY03, completed coding of the Army Acoustic Algorithms for multi-target vehicles recognition and localization; continued implementation of an acoustic / seismic database for ground vehicles and transient signatures and established new effort for a web application interface to ease accessibility; devised and evaluated transient algorithms for mortar detection; and conducted field exercises for experimentation, technology characterization, and capability determination. In FY04 implement acoustic / seismic sensor fusion algorithm for multi-target tracking and ID in support of Networked Sensors for the Objective Force ATD; and design low-cost magnetic sensor for the Cave and Urban Assault ACTD and the CERDEC Disposable Sensors Program. In FY05, provide mature sensor nodes and algorithms along with RF, magnetic, electric field, and acoustic technology required for providing baseline personnel detection capability to CERDEC for use in Networked Sensors for the Objective Force ATD and transition to CERDEC Disposable Sensors Program.	5042	4738	3986

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Implement new target recognition and image understanding techniques to detect and ID targets in clutter for implementation on manned and unmanned systems. Mature low cost LADAR and target recognition techniques for 3rd Generation FLIR in support of CERDEC program for FCS sensors. In FY03, FLIR moving target indicator (MTI) algorithms to detect moving targets were transitioned to CERDEC customers and multi/hyperspectral image processing algorithm for target recognition applications of mine detection and camouflaged target detection were shown; devised improvements in performance of dual color FLIR algorithm over single band FLIR algorithms that were shown in a series of field experiments; and conducted field experiments using line array LADAR. In FY04, expand moving target techniques to include sensor effects and multiple sensors. In FY05, implement new target recognition algorithms in multi-sensor experiments, mature eye-safe staring array LADAR and conduct extensive field experiments.	1851	2054	2012
- Using models and measurements, determine effectiveness of ultra wideband (UWB) radar for detecting complex obstacles for robotic perception. Assess and remediate image formation artifacts that may limit the potential of UWB Synthetic Aperture Radar (SAR) to detect buried mines. In FY03, used improved imaging techniques to generate SAR imagery on positive (wire fence, tree stumps, and concertina wire) and negative obstacles (ditches). In FY04 devise radar-imaging techniques to assess the value of three dimensional (3D) resolution for detecting negative obstacles. In FY05, devise and evaluate physics-based mine detection algorithm.	1219	836	1072
- Complete enhanced RF signature measurement and hybrid electromagnetic (EM) modeling capabilities to enable prediction of tactical vehicle signatures through millimeter wave (MMW) frequencies for integrated survivability. Building on results from other work units, use enhanced models and measurements on tactical vehicles and clutter to produce improved target detection, tracking and classification algorithms for FCS tactical radars. In FY03, used exact electromagnetic solvers to assess the signature prediction performance of x-patch modeling software; characterized issues such as the vehicle computer aided design (CAD) accuracy, geometry complexity and material composition. In FY04, using facet files generated from CAD, model an FCS-like vehicle at X-band and Ka-band and assess accuracy of prediction. In FY05, evaluate hybrid approaches to model complex targets. Compare hybrid approaches to x-patch.	849	1480	1153

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Multifunction RF and optical interconnects 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 and track, active protection, and munition command guidance for use on small ground and air vehicles. Mature optical data links and optical data processing architectures to accept massive raw data streams from multiple FCS sensors and efficiently produce real-time battlespace information for commanders and the future Soldier. Mature models and evaluate networked sensor concepts in support of netted fires to allow dynamic updating of weapons in-flight. In FY03, characterized RF multi-function and communication waveforms in a testbed and generated location errors for various sensor types and mixes. Showed dense two dimensional (2D) arrays of flip-chip OE interconnects with increased bandwidth and identified specific Army platforms needing such high throughput OE networking capabilities. In FY04 devise refined multi-sensor tracking techniques, assess monopulse tracking errors of kinetic energy (KE) penetrators, and devise beam scheduling techniques and complementary detection algorithms for a multi-function tactical radar. Demonstrate integrated OE digital-halftone image compression. Work with RDECs and commercial off-the-shelf (COTS) vendors to insert OE interconnects and networking into Army missile, helicopter, and tank platforms. Devise deep-ultraviolet (UV) semiconductor emitter technology for bio-detection and non-line-of-sight ground sensor coms. In FY05, determine the utility of polarimetric MMW imaging for aircraft navigation, landing, and obstacle avoidance in limited visibility conditions. Establish improvement in munition lethality available through dynamic updating. Transition UV emitter technology into ARL ground sensor technology demonstrations.	3768	2488	2205
- Improve 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 FY03, provided agent architecture to enable information fusion from diverse databases. In FY04, devise analytical and computing techniques to present information to soldiers and commanders in an easily understood and perceived form. In FY05, transition Web enabled enhanced service-based tools with integrated organizational capability from autonomous asset management and tactical decision aids that reduce both cognitive load and uncertainty to CERDEC Network Centric Warfare C2 Program (follow on to CERDEC Agile Commander Advanced Technology Demonstration).	2281	2270	2625

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Research, develop and demonstrate optical limiting to protect sensors and eyes from threat laser sources on the modern battlefield. Redesign of optical devices and exploration of new nonlinear optical materials. In FY03, designed and fabricated sacrificial novel mirrors. In FY04 characterize mercury mirrors. In FY05 design fast switches and nonlinear photonic band gap devices.	355	630	2030
Small Business Innovative Research/Small Business Technology Transfer Programs	0	56	0
Totals	15365	14552	15083

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
SA2	BIOTECHNOLOGY APPLIED RESEARCH	0	0	2755	3696	5553	5428	0

A. Mission Description and Budget Item Justification: This project supports maturing biotechnology, which is being conducted at the Army's Institute for Collaborative Biotechnology (ICB). The ICB is focused on advancing the survivability of both the soldier and weapons systems through fundamental breakthroughs in the area of biotechnology. 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 effort will be conducted collaboratively by the Army Research Laboratory, the ICB and industry partners. 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 two areas of emphasis: (1) sensors, electronics and information processing and (2) 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. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Exploit breakthroughs in biotechnology basic research transitioning from the Institute for Collaborative Biotechnology (ICB), a University Affiliated Research Center, to enable revolutionary Future Force capabilities in sensors, electronics and photonics. Devise, fabricate, and show novel “sense and respond” systems based on biological and biologically-inspired materials, devise novel biologically-inspired routes to fabricate electronic, optical, and magnetic materials, devise the tools to examine these materials, and design and perform the multi-scale dynamic and predictive modeling to understand the biologically-inspired “sense and respond” systems and their components. In FY05 mature emerging opportunities in areas such as biomolecular based detector arrays for new sensors, biological photovoltaic power sources for reduced logistics demand, and biomimetics and biomimetics processing leading to new electro-optic materials, chemical detectors and structural multifunctional smart materials. Applied research will be conducted by ARL in collaboration with ICB industry partners.	0	0	2755
Totals	0	0	2755

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602211A - AVIATION TECHNOLOGY

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		39163	39172	41629	40127	40057	44645	38746
47A	AERON & ACFT WPNS TECH	35533	34553	37716	35935	35793	40412	34436
47B	VEH PROP & STRUCT TECH	3630	3650	3913	4192	4264	4233	4310
47C	ROTORCRAFT COMPONENT TECHNOLOGIES (CA)	0	969	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 in the area of manned and unmanned rotary wing vehicle (RWV) technologies in support of the Future Force and Joint Vision 2020, and, where feasible, exploits opportunities to enhance Current Force capabilities. Based on the Army transformation, this PE is focused to investigate technologies applicable to unmanned systems, while providing opportunities for technology insertion into the Current Force manned systems. Unmanned RWVs bring unprecedented agility, maneuverability, and lethality to the Future Force, while providing improved survivability and reduced logistics costs. Emphasis is on maturing rotary wing platform technologies to support unmanned combat, reconnaissance, and communication relay capabilities. 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. This PE supports Phase I and II of the Unmanned Combat Armed Rotorcraft (UCAR) and unmanned technologies for the A-160 Hummingbird, the Organic Air Vehicle (OAV), the Micro Air Vehicle (MAV) and the Unmanned Cargo Lifter. This PE also supports the National Rotorcraft Technology Center (NRTC), a partnership of government, industry and academia, and adds a major focus to mature organic air vehicles designs and other unmanned rotorcraft technologies. Efforts under this PE transition to projects supported by PE 0603003A (Aviation - Advanced Technology). Upgrade activities of DoD systems such as the AH-64 Apache, UH-60 Black Hawk, Navy SH-60 Seahawk, CH-47 Chinook and USMC AH-1 Cobra 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.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	39693	39459	41886
Current Budget (FY 2005 PB)	39163	39172	41629
Total Adjustments	-530	-287	-257
Congressional program reductions		-343	
Congressional rescissions			
Congressional increases		1000	
Reprogrammings	-530	-944	
SBIR/STTR Transfer			
Adjustments to Budget Years			-257

FY04 Congressional Adds with no R-2A:
($964) Advanced Control Technology, Project 47C. The purpose of this one year Congressional add is to integrate advanced engine controls technology into an engine control for improved engine response and embedded diagnostics. No additional funds are required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
47A	AERON & ACFT WPNS TECH	35533	34553	37716	35935	35793	40412	34436

A. Mission Description and Budget Item Justification: The Aeronautical and Aircraft Weapons Technology project develops Rotary Wing Vehicle (RWV) technologies for unmanned and manned Army / 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 and Joint Vision 2020 by providing technology to improve capabilities in Dominant Maneuver, Precision Engagement and Focused Logistics. Areas of research are focused on technology application to unmanned aerial vehicles (UAV) systems, manned and unmanned teaming, and selected opportunities for manned systems. These system technologies will provide enhanced rotor efficiencies, improved survivability, increased structure and airframe capability, improved engine performance, improved sustainability, and reduced cost of unmanned and manned aerial vehicles. This project supports research for the Unmanned Combat Armed Rotorcraft (UCAR), a lethal, survivable Vertical Takeoff and Landing (VTOL) UAV capable of autonomous operations. UCAR is a joint program with the Defense Advanced Research Projects Agency (DARPA) and is planned to transition to Program Executive Officer Aviation at the completion of its 6.3 funded phases. UCAR will be capable of performing mobile strike operations; reconnaissance; target acquisition and identification; suppression of enemy air defense (SEAD); and teaming with the manned air platforms, and will bring unprecedented lethality to the Army's Future Force. This project supports the National Rotorcraft Technology Center (NRTC), a partnership of government, industry and academia, and adds a major focus to mature organic air vehicles designs and other unmanned rotorcraft technologies. 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, such as the UCAR and A-160 Hummingbird, with up to a 50% endurance increase and 30% payload increase over currently available turbine engines. These component technologies also will enable engine demonstrations for manned systems, providing a 33% increase in payload and a 50% reduction in fuel consumption for CH-47 Chinook; and an 80% payload increase and a 20% combat range increase for future rotorcraft. Advanced active controls, aerodynamics, handling qualities, acoustic signature attenuation 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. Unmanned/manned system interface, autonomous collaborative flight control, flight simulation, weapons and sensor integration, and pilot-vehicle interface technologies and advanced mission equipment packages that provide full spectrum engagement, precision and selectable lethality, suitable for the target and engagement scenario are being pursued. This project also supports work accomplished in collaboration with the National Aeronautics and Space Administration (NASA) and work done under the auspices of the NRTC. Technologies researched within this project will transition to advanced development technology demonstration 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 Aeroflightdynamics Directorate of the Aviation and Missile Research, Development and Engineering Center (AMRDEC), located at the NASA Ames Research Center, Moffett Field, CA and the Aviation Applied Technology Directorate located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Unmanned Combat Armed Rotorcraft (UCAR)- In FY03, completed Phase I and started Phase II Preliminary Design with two industry teams. Industry teams conducted Preliminary Design of UCAR System to include vehicle systems / subsystems, survivability features, weapons / sensors integration, and system of systems architecture. Advanced Technology Development for the UCAR is funded in FY04 and beyond in PE 0603003A Aviation Advanced Technology.	10000	0	0
National Rotorcraft Technology Center (NRTC) - In FY03, conducted component research in the areas of rotorcraft aerodynamics, limited authority flight control technology, crashworthiness and advanced structures, and advanced low-cost composite manufacturing. Performed NRTC applied research efforts in improved bevel gear design concepts and Health and Usage Monitoring (HUM) smart transducer data bus research. In FY04, conduct component research in the areas of crashworthiness and advanced structures, advanced low-cost composite manufacturing, structural joining technologies, and rotorcraft transmission technologies. Perform NRTC applied research efforts in composite durability and damage tolerance, and integrated helicopter design technology. In FY05, will conduct research and component testing in technologies that enable rotorcraft performance improvement, limited authority flight control, damage tolerance, and rotorcraft transmission advances.	6519	6984	7192
Rotor Technology [Includes Low Cost Active Rotor (LCAR) program.] - In FY03, established loads and affordability baselines for the swashplate-less rotor geometry and design rotor for the swashplate-less concept. In FY04, design and begin fabrication of model rotor to demonstrate 40% vibration reduction and control system weight savings. In FY05, will complete fabrication of a swashplate-less rotor model and will start model scale testing.	3911	4288	3906
Survivability [Includes Manned / Unmanned Rotorcraft Enhanced Survivability program.] - In FY03 fabricated and ground tested prototype reactive engine infrared (IR) suppression system that reduces thermal signatures by 75% over currently suppressed aircraft, while eliminating engine performance penalties during non-threat operations. In FY04, begin the maturing of the real-time Survivability Associate Re-router (SAR) tailored to small unit manned / unmanned team operations. Mature a family of intelligent sentinel agents to monitor threat warning sensors. In FY05, will construct a database of threat sensors, multi-spectral signatures, clutter and jammer effects. Will demonstrate real-time threat lethality predictor, wet & dry, in 3-D terrain environment.	3631	3692	3795

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Structures and Airframe [Includes Survivable, Affordable, Repairable Airframe Program (SARAP).] - In FY03, conducted hardware testing to substantiate a 5% reduction in airframe weight for multi-mission rotary-wing UAV with adaptive payload vibration control. Evaluated the design and certification standards and methods specific to rotary-wing UAVs. In FY04, design and fabricate smart re-configurable airframe and rotors structures for bench tests. Design and evaluate multifunctional structures for reduced signature, weight, and enhanced survivability. Investigate technologies for affordable, low weight, reparable structures that enhance ballistic and crash survivability. In FY05, will validate and disseminate improved loads determination tools that are 25% more accurate. Will conduct bench tests on smart re-configurable airframe and rotors structures. Will standardize (Joint Service) test methods for durability and damage tolerance certification / qualification of composite structures. Will demonstrate field and depot level advanced composite airframe inspection and repairs. Will evaluate conceptual reconfigurable panels, blades and self-healing structures.	2316	2624	2446
Propulsion [Includes the Integrated High Performance Turbine Engine Technology (IHPTET) program.] - In FY03, fabricated and rig tested advanced inlet particle separator providing increased separation efficiency and reduced engine losses and operations and support (O&S) costs. Designed 700 horsepower class ceramic turbine providing increased cycle efficiency and reduced engine weight and production cost. In FY04, conduct initial rig test and aero redesign of advanced power turbine providing increased cycle efficiency and reduced engine weight. Complete fabrication of 700 horsepower class compressor for improved full- and part-power performance. Complete fabrication of 700 horsepower class ceramic turbine. In FY05, will conduct final rig test of advanced power turbine providing increased cycle efficiency and reduced engine weight. Will conduct rig test of 700 horsepower compressor for improved performance. Will conduct rig test of 700 horsepower class ceramic turbine.	1641	1379	1431

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Networked Operations and System Integration [Includes the Precision Automated Landing Adaptive Control Experiment and the Unmanned Aerial Vehicle (UAV) Autonomous Collaborative Operations program.] - In FY03, researched autonomous control laws and operator interface for small scale UAV rotorcraft. Researched control system/handling qualities criteria for Future Force rotorcraft, to include tilt-rotor. Defined display research / evaluation methodology for associated unmanned aerial vehicle aeronautical design guide. Defined control law architecture, performance criteria, and simulated precision autonomous landing of UAVs. Conducted research for candidate autonomous modes of operation for UAV. In FY04, conduct requirements analysis and concept definition studies for multi-UAV control to handle multiple integrated mission operations. Evaluate control law and sensor optimization in simulation for precision autonomous landing of UAVs. Modify RMAX rotorcraft surrogate UAV for precision autonomous landing experiments. Produce UAV aeronautical design guide. In FY05, will conduct preliminary design of UAV "swarm" control for vehicle, mission equipment, and flight management architectures. Will evaluate system performance, effectiveness, and risk. Will prepare specification for control law and sensor optimization for precision autonomous landing of UAVs. Will conduct precision autonomous landing experiment with RMAX rotorcraft surrogate UAV. Will research autonomous control laws and operator interface for UAV cargo rotorcraft/sling load handling qualities. Will develop prototype UAV operator control station that can be worn by the soldier.	7515	15072	18946
Small Business Innovative Research/Small Business Technology Transfer Programs	0	514	0
Totals	35533	34553	37716

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
47B	VEH PROP & STRUCT TECH	3630	3650	3913	4192	4264	4233	4310

A. Mission Description and Budget Item Justification: The Vehicle Propulsion and Structure Technology project investigates engine, drivetrain and airframe technologies for Army / DoD rotorcraft specific to the Future Force. 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 vehicles' logistics footprint for unmanned and manned 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 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, incomplete loads/usage data, and inaccurate inspection and tracking methodologies. Technical solutions are pursued through propulsion and structures research – with a focus on applications towards UAV technologies while supporting manned vehicle requirements. The propulsion research is focused on fluid mechanics, high temperature materials, and mechanical behavior for significantly improved small airflow turbine engines, transmissions, and gears, bearings, and shaft components for advanced drivetrains at significantly reduced weight and cost. This propulsion research supports the goals of the DoD integrated high performance turbine engine technology (IHPTET) / Joint Turbine Advanced Gas Generator (JTAGG) 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 2003	FY 2004	FY 2005
Rotor & Structure Technology - In FY03, investigated reliability-based design methods, durability and damage tolerance analysis techniques and non-contacting nondestructive evaluation (NDE) methods for UAV rotorcraft structures. Investigated advanced comprehensive design concepts for "Full Authority" on-blade active control rotor system. Acquired smart actuator materials for advanced ATR in support of the Low Cost Active Rotor program. In FY04, conduct experiments and validate reliability-based design methods, durability and damage tolerance analysis methods, crashworthy concepts, and NDE methods on selected airframe and rotor hub UAV components. In FY05, will conduct wind tunnel experiments on advanced “smart rotor” concept. Will conduct analytical study of tiltrotor concept applicability to UAV applications. Will evaluate soft-inplane hub for application to large rotorcraft design advanced tiltrotor UAV concept.	1745	1849	1850
Propulsion & Drive Train Technology - In FY03, conducted experiments on a compact high performance two-stage engine compressor to reduce engine weight. Evaluated cooled monolithic ceramic and ceramic matrix composite turbine nozzles to achieve more fuel-efficient high temperature engine operation. In FY04, analyze the performance of a compact high performance two-stage engine compressor and cooled monolithic ceramic and ceramic matrix composite turbine nozzles. Research full 3-dimensional distributed propulsion simulation. In FY05, will conduct experiments and computer simulations of active stall control technologies to extend stable engine operation. Will investigate autonomous propulsion system technology for future UAV propulsion control and operation.	1885	1800	2063
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1	0
Totals	3630	3650	3913

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost	17002	16471	18034	20806	20663	16366	16589
442 TACTICAL EW TECHNOLOGY	9717	10342	11449	12918	13119	9395	9524
906 TAC EW TECHNIQUES	7285	6129	6585	7888	7544	6971	7065

A. Mission Description and Budget Item Justification: This Program Element (PE) researches and investigates electronic warfare (EW) technologies to improve the Army's battlespace survivability, enemy targeting capability and situational awareness (SA) 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), threat warning and countermeasures against munitions, missiles, improvised explosive devices, missiles and target acquisition sensors. It will provide deployed Future Force elements with information dominance and increased force protection. The intent of the PE is to deny, disrupt, or degrade the enemy's use of the electromagnetic spectrum for offensive or defensive operations. Specifically, its technologies focus on detecting threat emitters associated with weapon guidance systems, targeting systems and command, control, communications, computers, and intelligence (C4I) systems and networks. Work in this PE covers the spectrum in the radio frequency (RF), infrared (IR), electro-optical (EO), and ultra-violet (UV) ranges. In addition, this PE offers improvements to our EW sensors, and electronic countermeasures (ECM) systems to further protect high-value ground targets, aircraft, and the soldier from threat surveillance/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. Finally, this PE will research automated intelligence fusion and automated battlefield assessment management tools. This PE includes Warfighter Electronic Collection and Mapping, Electronic Support for the Future Force, Advanced Radar Deception and Countermeasures, Advanced EW Sensors, EO/IR Countermeasures, Sensor Countermeasures, Fusion Based Knowledge, Networked Sensors, Information Operations, and Joint Intelligence and Surveillance and Reconnaissance (JISR).

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 supports and is fully coordinated with efforts in PE 0602782A (Command, Control and Communications (C3) Technology), PE 0602709A (Night Vision and Electronics-Optics Technology), PE 0603789F (C3 Intelligence Technology Development), PE 0603270A (Electronic Warfare Advanced Technology), PE 0604270A (Electronic Warfare Development), and PE 0603745A (Tactical Electronics Support Systems - Advanced Development). Work is performed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	17303	17029	17923
Current Budget (FY 2005 PB)	17002	16471	18034
Total Adjustments	-301	-558	111
Congressional program reductions		-161	
Congressional rescissions			
Congressional increases			
Reprogrammings	-301	-397	
SBIR/STTR Transfer			
Adjustments to Budget Years			111

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
442 TACTICAL EW TECHNOLOGY	9717	10342	11449	12918	13119	9395	9524

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 vehicle survivability approach will provide detection avoidance through signature management and hit avoidance using warning receivers and 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, radar directed target acquisition systems, target-tracking sensors, Surface-to-Air Missiles (SAMs), Air-To-Air Missiles (AAMs), top attack weapons and fuzed munitions. The ability to neutralize improvised explosive devices (IEDs) will be researched with the goal of embedding the maximum capability in projected FCS/ Future Force systems to minimize 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. The Electronic Support for the Future Force effort will design and evaluate a light weight, low cost Electronic Support Measure (ESM) capability for Unmanned Ariel Vehicles (UAV) and Unattended Ground Sensors (UGS) enabling collection, identification, location and tracking of "hard-to-detect" communications and radar emitters not addressed by space, airborne or ground based intelligence systems. The Tactical Aircraft Self Defense program will investigate new EW technology that will deceive an enemy's radar based sensors and neutralize their ability to locate, target and guide weapons against early entry forces and the Future Force. Cost-effective sensors for use in missile warning systems (MWS) will be investigated to protect Army ground combat vehicles and aircraft from gunfire, rocket propelled grenades (RPGs), SAMs, top attack (TA) weapons and antitank guided missiles (ATGMs). The Electro-optic and Infrared (EO/IR) Countermeasures program investigates active and passive devices to protect aircraft and ground vehicles with conventional and suppressed signatures from EO and IR guided threats. The Sensor Countermeasures for the Future Force effort will investigate a multi-functional on the move (OTM) capability to detect, locate, deceive and jam enemy netted ground and airborne sensors, communications, IEDs, artillery fuzes, and battlefield surveillance radar. 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 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 in this PE is performed by the Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- 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, and electronics support for the Future Force. In FY03, transitioned co-channel mitigation techniques to test bed. Expanded the co-channel mitigation techniques to include combat net radios and other narrow band emitters. Established the requirements to embed multi-path mitigation techniques with signal id and geolocation algorithms in UGVs and UAVs. In FY04, integrate multi-path mitigation software and test. Transition modulation recognition software to test bed and evaluate in field test. Pursue advanced simulation capabilities to define the utility of UGV and UAV sensors. In FY05, will develop and provide advanced simulation capability to refine the operational utility of UGV and UAV signals intelligence sensors in the Mounted Maneuver Battlespace Lab at Fort Knox and continue sensor, antenna, and receiver design efforts.	1479	2500	3274
- Advanced Radar Deception and Countermeasures: In FY03, conducted lab and controlled field-testing on new techniques that countered frequency hopping air defense radars and top attack munitions. Established techniques for an enhanced ground vehicle and aircraft protection suite that simultaneously countered multiple advanced RF threats. Provided a counter booby trap Quick Reaction Capability against a specific RF threat in support of Operation Enduring Freedom and Operation Iraqi Freedom to increase the survivability of our warfighters in those Areas of Operation. In FY04, test countermeasure techniques against LPI and battlefield surveillance radars in the laboratory and in a controlled field environment. These techniques will attempt to jam top attack munitions, artillery and anti-aircraft artillery fuzes causing 90% prefunction of all rounds significantly beyond the lethal distance of the round.	2582	2583	0
- Electro-Optical/Infrared Countermeasures and Advanced Radar Deception and Countermeasures: This effort researches and investigates technologies that enable Electro-optic (EO)/Infrared (IR) Countermeasures and Advanced Electronic Warfare using Sensors. In FY03, improved IR jamming techniques to defeat advanced ATGMs, and evaluated the capability of an IR jamming system to defeat ATGMs, evaluated the ability of a multispectral mid-IR laser to defeat advanced IR SAMs and IR imaging missiles, integrated and tested a system of new low cost sensor and warning algorithms for protection of air and ground platforms against missiles. Conducted field measurements of IR and UV signatures of SAMs, ATGMs, background and manmade point false alarm sources. Researched new techniques to increase detection, identification and classification of “background clutter” signals.	4756	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Sensor Countermeasures for the Future Force: In FY03, characterized the emerging threat from Improvised Explosive Devices (IEDs)/booby traps and investigated key sensor component technologies (highly sensitive RF receivers and antennas that quickly scan multiple threats simultaneously including those threats operating at very low transmit power). Developed countermeasure techniques and proposed design architecture for a modular, multi-spectral (RF/UV/EO/IR) sensor required for multiple Future Force systems. In FY04, pursue exploitation techniques for those threat sensors, begin lab testing of detection and jamming algorithms. Conduct modeling and simulation, laboratory and controlled field-testing of detection, location, deception, and countermeasure techniques against threat sensors and booby traps. Assess potential for embedding a capability in existing and near term systems. In FY05, will collaborate with other US and foreign government agencies on threat and countermeasure techniques. Conduct deception and jamming technique research, investigate modeling and simulation hardware and software. Will expand investigation and conduct field-testing of countermeasures against RF and IR IED links.	900	2629	4548

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Suite of Sense Through the Wall Systems for the Future Force (STTW): 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 intuitive user interface. It will leverage STTW, concealed weapons, and concealed explosives detection programs conducted by the National Institute of Justice, Technical Support Working Group, Air Force Research Lab and Bureau of Customs and Border Protection. In FY04, assess the feasibility of various technologies (i.e., RADAR, millimeter wave, acoustic, x-ray) for STTW applications. Based on this assessment, award one or more contracts for maturation of advanced processing techniques and improved algorithms leading to the next generation STTW system with increased standoff, a user-friendly graphical user interface (GUI), accurate target geo-location, and detection of multiple targets through walls. In FY05, will continue maturation of the STTW system and begin investigation of technologies for concealed weapons/concealed explosives detection (CWD/CED). Will develop and refine techniques for detection of stationary personnel through light construction materials. Will integrate prototypes with emerging FCS and Objective Force Warrior (OFW) network communications architectures to demonstrate transmission of STTW data on a real time basis. Will evaluate data transmission, dissemination, and software tools. Will provide STTW performance model for incorporation into Battle Lab and OFW operational modeling & simulation.	0	1770	2644
- Fusion Based Knowledge for the Future Force: In FY04, develop a Higher Level Fusion Knowledge Infrastructure to facilitate plug-n-play assessment. Conduct a pilot experiment for higher-level fusion tool to develop metrics and scenarios for testing. Conduct a Battle Damage Assessment experiment to assess the problem. Identify technical issues associated with data fusion models for application to an advanced knowledge generation capability to answer time critical priority intelligence reports (PIRs) at a rate supporting tactical agility concepts of the Future Force. In FY05, initiate Physical Damage Assessment (PDA) tools evaluation. Transition the Intelligent Agent work being conducted by Army Research Lab into the Knowledge Infrastructure to increase the efficiency and effectiveness of intelligence gathering, processing, and exploitation to provide higher quality and timelier answers to critical intelligence requirements.	0	700	983
Small Business Innovative Research/Small Business Technology Transfer Programs	0	160	0
Totals	9717	10342	11449

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
906	TAC EW TECHNIQUES	7285	6129	6585	7888	7544	6971	7065

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 in whole and as part of a complex, adaptive organization, allowing a "See First, Understand First, Act First" standard of operations. This project matures radio frequency (RF) collection and mapping technologies into integrated multifunction devices, 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 C4I 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 provide tools to the Unit of Action (UA) that will enable interpretation of current and future enemy activities and allow development of Courses of Action in time to act pre-emptively and decisively. The Warfighter Electronic Collection and Mapping (WECM) program provided the warfighter at the unit level the ability to locate enemy tactical RF emitters and investigate a new generation of low cost distributed unmanned networked sensor systems organic to the RSTA team. The Joint Intelligence, Surveillance, and Reconnaissance (JISR) program developed technology to provide the warfighter a comprehensive near-real-time view of ISR information based on both traditional and selected non-traditional sensors to enhance situation awareness at all echelons. The Information Operations for the Future Force effort provides a Unit of Action (UA) on-the-move (OTM) capability for precision detection and location of commercially available wired and wireless telecommunications and computers in an urban environment. The Electronic Support for the Future Force effort will evaluate a light weight, low cost Electronic Support Measure (ESM) capability for UAVs and UGSs enabling them to collect, identify, locate and tract “hard-to-detect” communications and radar emitters not addressed by space, airborne or ground based intelligence systems. The Fusion Based Knowledge for the Future Force effort will investigate an advanced knowledge generation and explanation capability to answer warfighting commanders’ priority intelligence requirements (PIRs), enabling the force to see and understand at a rate supporting tactical agility concepts of the Future Force.

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Joint Intelligence, Surveillance and Reconnaissance (JISR): In FY03, conducted experiment with high fidelity modeling and simulation of all-source sensor correlation that used advanced data mining web applications to minimize volume of network data traffic. Conducted experiment with military operators to optimize user interfaces in support of JISR ACTD. Demonstrated Initial Operational Capability (IOC) and began transition to the future system. Additional funding for this program is contained in PE 0603270A.	1448	0	0
- Information Operations for the Future Force (IOFF): In FY03, determined/characterized typical wireless network protocols and traffic analysis algorithms. In FY04, determine wired digital traffic analyses algorithms. Investigate inadvertent emissions analysis techniques to increase detection range. Provide models of preliminary threat and C4ISR detection systems to battlelabs at Fort Huachuca, Fort Knox, and Fort Leavenworth. In FY05, identify and test techniques to cross cue/correlate RF emission geolocations and Internet Protocol (IP) virtual address locations in lab environment.	2881	1768	2584
- This effort researches and investigates EW sensors and electronics signal processing technologies. In FY03, investigated software algorithms for unmanned Electronic Support Measures (ESM) signals intelligence (SIGINT) sensor systems that included unattended ground and air vehicle applications for the Future Combat Systems and Divisional Tactical SIGINT Payload (DTSP). In FY04, design compact RF receiver architectures that will enable the deployment of remote, unmanned ESM/SIGINT sensors and enhance the effectiveness of the Future Force Warrior. In FY05, research 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. Investigate the ability to integrate the unmanned ESM/SIGINT sensor systems with Networked Sensors for the Future Force ATD communications equipment.	1985	4361	4001
- Fusion Based Knowledge for the Future Force: In FY03, identified technical issues associated with data fusion models for application to an advanced knowledge generation capability to answer time critical priority intelligence reports (PIRs) at a rate supporting tactical agility concepts of the Future Force.	971	0	0
Totals	7285	6129	6585

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	52793	91560	51993	59900	46443	36549	38221
214	MISSILE TECHNOLOGY	46217	39571	35154	43072	35347	36549	38221
223	AERO-PROPULSION TECHNOLOGY	4574	24301	0	0	0	0	0
340	SWORD	2002	2905	0	0	0	0	0
G02	NATIONAL AEROSPACE INITIATIVE APPLIED RESEARCH	0	8130	16839	16828	11096	0	0
G04	AIR DEFENSE TECHNOLOGIES (CA)	0	4454	0	0	0	0	0
G05	MISSILE TECHNOLOGY INITIATIVES (CA)	0	3292	0	0	0	0	0
G06	UNMANNED SYSTEMS TECHNOLOGIES (CA)	0	8907	0	0	0	0	0

A. Mission Description and Budget Item Justification: This applied research program element investigates advanced technologies for missiles, rockets, and launch systems for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The overall objectives of the PE are to 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. Major technology areas include missile guidance systems, air defense systems, multi-spectral seekers, high fidelity simulations, missile aerodynamics and structures, missile propulsion, hypersonic missile efforts and the maturation of a common high-gravitational force (high-g), low cost, Micro Electro-Mechanical Systems (MEMS) Inertial Measurement Unit (IMU). The high-g MEMS IMU program will provide affordability and precision to missile and munitions guidance. 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). The National Aerospace Initiative applied research program explores and matures the critical technologies required for expendable hypersonic missiles. Primary technology focus areas are those deemed critical by National Aerospace Initiative to advance the national goals in hypersonic weapon maturation and access to space. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	53308	43269	50407
Current Budget (FY 2005 PB)	52793	91560	51993
Total Adjustments	-515	48291	1586
Congressional program reductions		-4302	
Congressional rescissions			
Congressional increases		54800	
Reprogrammings	-515	-2207	
SBIR/STTR Transfer			
Adjustments to Budget Years			1586

Significant Change Explanation:
FY04 - Ten FY04 Congressional Adds totaling $54800 were added to this PE.

FY04 Congressional Adds with no R-2As:
($9394) Hypersonic Army Missile Technology, Project 223: The purpose of this one year Congressional add is to advance distributed processing for hypersonic computational fluid dynamics. No additional funding is required to complete this project.

($470) Large Energy National Shock Tunnel (LENS), Project 223: The purpose of this one year Congressional add is to improve the Large Energy National Shock facility to extend capabilities to address lower Mach numbers at higher altitudes for hypersonic flight. No additional funding is required to complete this project.

($11273) MARIAH II Hypersonic Wind Tunnel Development Program, Project 223: The purpose of this one year Congressional add is to develop component technologies required for pilot scale test facility to produce actual flight conditions for timeframes orders of magnitude greater than currently available. No additional funding is required to complete this project.

($2442) Multiple component flight test, Project 223: The purpose of this one year Congressional add is to fabricate prototype divert altitude control system to validate wind tunnel model predictions for the low-cost flight testing of hypersonic vehicles.

No additional funding is required to complete this project.

($2819) E-STRIKE Short Range Radar, Project 340: The purpose of this one year Congressional add is to perform comprehensive systems engineering analysis establishing future radar requirements and underlying critical technology needs required to engage aerial threats such as rockets, artillery and mortars. No additional funding is required to complete this project.

($4322) Maneuver air defense system, Project G04: The purpose of this one year Congressional add is to perform force-level trade studies and mission requirements analysis, establish a best technical approach and begin demonstrating critical technologies in support of the Extended Area Air Defense System (EAADS). No additional funding is required to complete this project.

($3195) Red Rain, Project G05: The purpose of this one year Congressional add is to perform technology assessments. No additional funding is required to complete this project.

($8643) Unmanned Systems Initiative (USI) at the Aviation and Missile Research Development and Engineering Center (AMRDEC), Project G06: The purpose of this one year Congressional add is to focus on immediate efforts to support the development of unmanned systems through interoperability and the delivery of lethal payloads to better position the military for situations in homeland defense and urban scenarios. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
214	MISSILE TECHNOLOGY	46217	39571	35154	43072	35347	36549	38221

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 FCS and Future 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. 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-g, low cost MEMS 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). The High-g MEMS IMU will also be transitioned to Excalibur, Extended Range Gun Munition (ERGM), and 120-mm Line-of-Sight / Beyond Line-of-Sight (LOS / BLOS) Advanced Technology Demonstration (ATD). This is a joint program with the Armament Research, Development and Engineering at Picatinny Arsenal. Another effort in this project is the Advanced Multi-Mission Precision Guided Munition (AMMPGM) program, which transitions its 6.2 work in FY04 to PE 0603313A (Missile and Rocket 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 at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- High-G MEMS IMU - In FY03, matured and live-fire tested IMUs to meet the following parameters: Gyro Bias <75 degrees/hour, Volume <8 cu. in., Acceleration <9mg, Gun-Hardened to 10,000g. In FY04, mature and live-fire test IMUs to meet the following parameters: Gyro Bias <20 degrees/hour, Volume <4 cu. in., Acceleration <4mg, Gun-Hardened to 20,000g. electronic miniaturization will be necessary to fit on the two inch diameter electronics board. In addition, the vibration isolation system will be redesigned for the modified mass and diameter. The 20,000 g launch challenge will require board stiffness redesign with emphasis on high yield and low cost. Test and evaluation will be performed on the Phase 2 IMU devices. In FY05, additional electronics miniaturization will be required to reduce the volume to 2 cubic inches. Assembly, test, and calibration will be increasing automated. Manufacturing and process improvements to get high yields on sensors will be incorporated. Digital electronics design will be improved.	10000	8900	14000
- High-g MEMS/IMU Technology Development Acceleration– This Congressional add in FY03 completed the preliminary design for integration of deeply integrated GPS prototypes into first generation hardware for testing and research and tested Global Positioning System (GPS) anti-jam hardware. In FY04, this add develops and substantiates an IMU "deeply integrated" with a Selective Availability Anti-Spoofing Module (SAASM) GPS military receiver incorporating a single microprocessor architecture and incorporating integrated hardware and software anti-jam capability. Additionally, this add will make manufacturing and process improvements to reduce cost, and reduce process, manufacturing, and testing variability to facilitate the production of the final MEMS IMU and deeply integrated GPS navigational unit design.	12250	8196	0
- MEMS IMU/M-Code GPS – This Congressional add accelerated the development of MEMS IMU/M-Code GPS. No additional funding is required to complete this project.	1681	0	0
- Low Cost Guidance Navigational Unit - This Congressional interest add enhances an existing guidance navigations unit design that will lower cost and power. In addition, it will prototype, test, and evaluate the anti-jam technology.	0	964	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Missile Guidance Systems and Seeker Technology - In FY03, integrated and tested MEMS-based angular rate sensors and roll rate sensor into a three-axis rate package for transition to FCS and industry. In FY04, perform laboratory tests of infrared counter-countermeasures (CCM) guidance algorithms in a seeker; devise hardening techniques and algorithms for infrared (IR) seekers to defeat laser counter-countermeasures; and enhance MEMS angular rate sensors with vibration feedback for signal stabilization in high-vibration environments. In FY05, will mature controlled arrays of MEMS sensors to provide full dynamic performance ranges for miniature sensing systems, focusing on inertial applications; design geometry transformations for rapid retraining of automatic target recognition (ATR) systems that will allow precision strike of a target from a different direction than it was originally detected. Will perform field tests of IR CCM guidance algorithms in a seeker; mature concepts of advanced uncooled IR seeker and sensor hardware. Will design, mature, and test advanced optics, signal processing, and guidance and control techniques utilized in uncooled imaging IR seeker and sensor packages. Will conduct captive carry tests of prototype uncooled seeker and sensor systems.	6238	8202	8594
- High Fidelity System Level Simulations and Aerodynamics - In FY03, developed and improved target signature and background scenario modeling and simulation techniques for real-time hardware-in-the-loop system simulations and perform wind tunnel tests and missile aerodynamic predictions. Completed the investigation of an improved method of Radio Frequency (RF) millimeter wave scatter extraction from measurements and validated "spinning tail" and "bent nose" aerodynamic predictions. In FY04, complete the design for a method of rapid infrared passive signature prediction using the MuSES code and investigate techniques for modeling target signatures as perceived by Laser Detection and Ranging (LADAR) sensors; characterize supersonic/hypersonic aerodynamic missile controls and power-on base drag; investigate FCS missile geometry and thrust level prediction methodologies. In FY05, will continue development of techniques for modeling target signatures as perceived by LADAR sensors. Will complete FCS missile geometries and thrust levels characterization.	1000	2083	1720

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Smart, Stealthy, Smokeless Missile Propulsion and Smart Structures - In FY03, designed, fabricated, and static tested an integrated deep throttling booster that extends the capabilities of controllable thrust technology to increase range and provide multi-mission capability for a family of FCS and Future Force weapon systems. Matured controllable thrust components applicable to the 2.75-inch and smaller diameter family of rockets and delivered a validated Computational Fluid Dynamics (CFD) tool for designing compact thrusters. Matured system level concepts, select one propulsion option and one pressurization option for brassboard evaluation, evaluate designs using CFD model, and begin design of component hardware (TRL 3). In FY04, complete design and fabricate hardware, conduct functional demonstration of critical components, and begin CFD model validation (TRL 4). In FY05, will test components in brassboard hardware.	3720	3420	3670
- Focused Technology Integration - In FY03, established the best technical approach for the component technologies for AMMPGM and transitioned AMMPGM to 0603313 Missile and Rocket Advanced Technology. In FY04, perform concept development and subsystem/component level development of supporting technologies of an air defense capability for the Unit of Action. In FY05, will mature system concepts and complete initial system and component design of an air defense capability for the Unit of Action.	7532	7062	7170
- Multiple Component Army Flight Test - This one year Congressional add designed alternative test processes to verify advanced missile components in a ground test facility under duplicated flight conditions to avoid performing the actual expensive and difficult flight tests. No additional funding is required to complete this project.	2451	0	0
- Advanced Composite Chassis - This one year Congressional add investigated the feasibility of using advanced, novel, lightweight composites for hypervelocity missile airframe and support structures. No additional funding is required to complete this project.	1345	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	744	0
Totals	46217	39571	35154

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
G02	NATIONAL AEROSPACE INITIATIVE APPLIED RESEARCH	0	8130	16839	16828	11096	0	0

A. Mission Description and Budget Item Justification: This project funds applied research to explore and mature the critical technologies required to mature expendable hypersonic missiles. Primary technology focus areas are those deemed critical by the National Aerospace Initiative (NAI) to the advancement of national goals in hypersonic weapon maturation and access to space. These focus areas include scramjet engines, active and passive cooling mechanisms, turbulent mixing enhancement at low Reynolds numbers, computational fluid dynamics, high yield storable fuel grains. Initial effort will focus on concept maturation of Scramjet enabled missiles to enhance Army operational missions. Efforts will be conducted through detailed system and subcomponent simulation, design, maturation and test in laboratory and operational settings. Funding for this effort is provided in coordination with other DOD and government elements participating in NAI. As a result, numerous leveraging and technology insertion opportunities are available. 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 2003	FY 2004	FY 2005
- Hypersonic System Trade Studies: In FY04, perform trade studies at both system and component level to determine the system and subsystem technical requirements required for future design efforts and to assess the operational enhancement expected from a hypersonic enabled system. Use computational fluid dynamic and high fidelity simulation analysis to identify airframe components under critical aero thermal stress at worst-case operational conditions. In FY05, will complete design trade studies culminating in preliminary subcomponent designs. Will initiate constructive simulations based on preliminary design trades to further explore operational advantages of the proposed systems.	0	1000	2700
- NAI Engine: In FY04, perform computational fluid dynamic analysis to develop initial engine flow path design. Formulate design concepts for inlet, combustor, fuel injector, and mixing enhancement methodologies. In FY05, will be complete design concepts for engine flow path subcomponents . Will conduct lab and ground testing of preliminary engine component designs.	0	6888	14139

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	242	0
Totals	0	8130	16839

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		19785	14706	16641	19589	19962	20386	20790
042	HIGH ENERGY LASER TECHNOLOGY	11926	13737	16641	19589	19962	20386	20790
NA3	MICROELECTRO MECHANICAL SYSTEMS	4048	0	0	0	0	0	0
NA5	ADVANCED WEAPONS COMPONENTS (CA)	3811	969	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program matures technologies for the Army Transformation as related to High Energy Laser (HEL) weapon systems. Specific program focus is maturing Solid State Laser (SSL) technology for platform-based lethality. Potential HEL weapon system missions in the areas of Information Dominance and Force Protection include countering airborne electro-optical sensors and defending against airborne threats, providing a new, low cost per shot, complement to conventional offensive and defensive weapons. At weapon system power levels, SSL technology has the potential to enhance Future Combat Systems (FCS) survivability by defeating Precision Guided Munitions such as Anti-Tank Guided Missiles (ATGMs). This program will address technical issues such as high average power output from compact and more efficient lasers; precision optical pointing and tracking; laser influence degradation due to atmospheric effects; lethality; and effectiveness against low-cost laser countermeasures. A key project within this program is the development of a multi-hundred kilowatt (kW) solid-state laser (SSL) laboratory demonstrator. This project will demonstrate a 15-25 kW diode-pumped solid-state laser (SSL) breadboard in FY04. By FY05, the Army will evaluate this concept against alternative SSL technology approaches being supported by the High Energy Laser (HEL) Joint Technology Office (JTO) High-Power Solid-State Laser program. The most promising technology will then be upgraded to a 100kW SSL laboratory device, scheduled for completion in FY07. The project will continue to mature the selected SSL technology into a multi-hundred kW laboratory device. The program element contains no duplication with any effort within the Military Departments. Work in this program element 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), PE 0603305A/TR3 (Army Missile Defense Systems Integration/Mobile Tactical High Energy Laser), 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 Army Test and Engineering Center, White Sands Missile Range, NM.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	19976	14189	17560
Current Budget (FY 2005 PB)	19785	14706	16641
Total Adjustments	-191	517	-919
Congressional program reductions		-129	
Congressional rescissions			
Congressional increases		1000	
Reprogrammings	-191	-354	
SBIR/STTR Transfer			
Adjustments to Budget Years			-919

FY04 Congressional Add with no R-2A:

($940) Rapid Target Acquisition & Tracking System, Project NA5: The purpose of this one year Congressional add is to mature a brassboard with the elements of a rapid, passive infrared (IR) acquisition and tracking system for use in detection of fast, low signature threats such as Anti-Tank Guided Missiles (ATGM). No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
042	HIGH ENERGY LASER TECHNOLOGY	11926	13737	16641	19589	19962	20386	20790

A. Mission Description and Budget Item Justification: This project matures technologies for Army Transformation relating to solid-state High Energy Laser (HEL) weapon systems. Specific program focus is maturing Solid State Laser (SSL) technology for platform-based lethality. Potential HEL weapon system missions include defense against airborne threats and countering electro-optical sensors. At weapon system power levels, Solid-State Laser (SSL) technology has the potential to enhance Future Combat Systems (FCS) survivability by defeating Precision Guided Munitions such as ATGM's. To achieve the program goal of rapidly developing weapon level power, the Army has concentrated on developing the Solid State Heat Capacity Laser (SSHCL) technology. The Army effort will develop and demonstrate a 15-25 kilowatt (kW) diode-pumped SSHCL breadboard in FY04. By FY05, the Army will evaluate the SSHCL technology against alternative SSL technology approaches being supported by the High Energy Laser (HEL) Joint Technology Office (JTO) High-Power SSL Program. The most promising SSL technology will then be upgraded to a 100kW laboratory device, scheduled for completion in FY07. This project would continue to mature the selected SSL technology into a multi-hundred kW laboratory SSL device. The 100kW 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 0602890 D8Z and PE 0603924D8Z (High Energy Laser Joint Technology Office), PE 0605605A (DOD High Energy Laser Systems Test Facility), PE 0603305A/TR3 (Army Missile Defense Systems Integration/Mobile Tactical High Energy Laser), 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 Army Test and Engineering Center, White Sands Missile Range, NM.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Solid State Laser (SSL) Development: In FY03, completed integration of the diode-pumped SSHCL breadboard and demonstrated 16.6 kW of laser power. Modified intra-cavity active resonator and initiated tests within diode-pumped test bed. In FY04, integrate thermal management system into the SSHCL concept and complete laboratory characterization of the laser device to include thermal cycling time, power management requirements, and beam quality. This breadboard device will demonstrate the major aspects of power scaling and beam combining/quality/efficiency that support the engineering analysis used in the technology selection process.	8704	8712	0
SSL Subcomponent Development: - Laser crystal development - In FY03, demonstrated ability to grow high-quality, large diameter (>10cm) laser crystals. In FY04, reliably produce laser crystals, maintaining state-of-the-art crystal dislocation density while increasing crystal diameter by 50 percent. - Thermal management - In FY03, maintained a uniform temperature (< 1degC) across a large bulk media crystal. Improve alternative mist-cooling thermal management system to enable a reduction in cool down time by a factor of five. In FY04, integrate scaled versions of thermal management system into SSHCL breadboards. Design and validate novel rotating disk approach (or Gain Media Exchange) for SSHCL thermal management. - - Laser Diode Development - Developed an industrial effort for area scaling (monolithic array) of laser diode/cooler package. This technology enables the processing of multiple diode bars per cooler and reduces manpower requirements for assembly.	1793	4616	0
High Power SSL Development - In FY05, will analyze results of competitive 25 kW SSL laboratory demonstrations; down select best design, and initiate development of 100kW SSL. Will begin procurement of several long-lead items, such as power supplies, crystal media, diode arrays and thermal management technologies. Will develop brassboard components for 100kW laser prototype and begin integration. Will conduct laboratory testing of breadboard design with the goal to achieve at least 50 kW average laser output power with a beam quality goal of 2 times the diffraction limit and will demonstrate propagation effectiveness through at least 500 m of atmosphere.	0	0	16641
- Laser Diode Production - This one year Congressional add built additonal diode arays to enhance diode-pumped SSHCL breadboard. No additional funding is required to complete this project.	1429	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	409	0
Totals	11926	13737	16641

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602308A - Advanced Concepts and Simulation

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		28453	30431	15041	16144	16662	16888	17260
C90	ADVANCED DISTRIBUTED SIMULATION	13953	10309	10204	10717	10840	10943	11196
D01	PHOTONICS RESEARCH	2381	4841	0	0	0	0	0
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	7120	5115	4837	5427	5822	5945	6064
D03	JOINT MODELING & SIMULATION SYSTEM (JMASS)	1000	0	0	0	0	0	0
D14	ADVANCED MODELING AND SIMULATION INITIATIVES (CA)	3999	7745	0	0	0	0	0
HB4	IMMERSIVE ENVIRONMENT APPLIED RSCH INITIATIVE (CA)	0	2421	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element conducts applied research in modeling and simulation technologies for application to training and evaluation of the Future Combat Systems (FCS), the Future Force (FF), and where feasible, 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 and training evaluation 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 generation of tactics, doctrine, training techniques, soldier support systems, and system upgrades. This program directs and stimulates advances in those 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. This program 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 project will ensure the transition of the research results of the ICT into the Army technology base and future Army training products. These programs are fully coordinated with other Army applied research programs, the Defense Advanced Research Projects Agency (DARPA), and the Defense Modeling and Simulation Office. Results from this applied research will feed PE 0603015A (Next Generation Training & Simulation 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 PE is performed by the Research Development and Engineering Command (RDE Command), Orlando, FL.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	30150	15941	15643
Current Budget (FY 2005 PB)	28453	30431	15041
Total Adjustments	-1697	14490	-602
Congressional program reductions		-277	
Congressional rescissions			
Congressional increases		15500	
Reprogrammings	-1697	-733	
SBIR/STTR Transfer			
Adjustments to Budget Years			-602

Significant Change Explanation:
FY04 - Five FY04 Congressional adds totaling $15500 were added to this PE.

FY04 Congressional Adds with no R-2A:
($3757) Combat Trauma Patient Simulator, Project D14: The purpose of this one year Congressional add is to enhance the Combat Trauma Patient Simulation system functionality and to establish a third site to support continued test and evaluation. No additional funding is required to complete this project.

($2630) Joint Unmanned Systems Test and Research Center, Project D14: The purpose of this one year Congressional add is to establish and operate the Unmanned Systems Controlled Experimental, Test and Research Facility at the Virginia Polytechnic Institute to support the cost effective and timely evaluation and development of military autonomous vehicle systems. No additional funding is required to complete this project.

($1127) On-Line Contract Data Management, Project D14: The purpose of this one year Congressional add is to mature the On-Line Contract Data Management project and to provide demonstration of prototype development efforts. No additional funding is required to complete this project.

($4697) Photonics Research, D01: The purpose of this one year Congressional add is to manufacture, assemble and characterize optical components and laser output for a unique fiber laser combiner. No additional funding is required to complete this project.

($2349) Institute for Creative Technologies, Project HB4: The purpose of this one year Congressional add is to fund technology supporting an enhanced simulation capability at Fort Sill. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
C90	ADVANCED DISTRIBUTED SIMULATION	13953	10309	10204	10717	10840	10943	11196

A. Mission Description and Budget Item Justification: This project develops enabling technologies for advancing distributed interactive simulation in a synthetic environment by maturing advanced distributed simulation technologies, 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 (RDE Command), Orlando, FL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Collaborative and Immersive Environment Technologies. In FY03, evaluated approaches to provide training assessment and student performance feedback in distance learning courseware and simulations as well as embedded training. Investigated simulation technologies to support a persistent, interactive simulation environment to support training with unconventional threats. Researched on 3-dimensional graphics, and photorealistic rendering of human features and behaviors to support virtual training environments. In FY04, mature advanced distributed learning environments to provide anytime, anywhere training. Prototype test-beds for distributed component simulations to support the training missions of the Future Force (FF) to include Future Combat Systems (FCS) and dismounted warrior systems. Investigate concepts for an embedded training decision aid utilizing 3-dimensional virtual environments. In FY05, will assess expanded learning environment to support the development and evaluation of a reach-back capability. Will expand high performance and large-scale robotic simulations. Will validate and evaluate 3-dimensional and human features modeling simulations in an interactive training environment.	3006	2803	4878
Modeling and Simulation Training Technologies. In FY03, established a medical training capability in the Multiple Integrated Laser Engagement System XXI (MILES XXI) system with research into laptop and personal digital assistant (PDA) platforms. Created medical behaviors in ONE Semi-Automated Forces Test-Bed (OTB). Researched augmented reality with advanced medical modeling and visualization technology. Extended the composable robotics simulation test-bed through the addition of higher level mission behaviors and prototype man/machine interfaces allowing a single user to control multiple unmanned systems. In FY04, research and develop proof of principle portions of ruggedized, portable patient simulators that provide increased realism and fidelity. Demonstrate ad hoc wireless networks, performance tracking systems, and centralized command and control in a simulator. Conduct team performance assessment for multiple unmanned robotic systems and enhance robotic behavior interaction with use of intelligent agents. In FY05, will demonstrate a prototype patient simulator with advances in material sciences, including realistic skin and physiologically accurate injuries, sensor technologies, miniaturization/packaging technology and Ad Hoc wireless networking for use in the Current and Future Force. Will develop advanced techniques that support the creation of digital libraries for scenario based simulation.	1989	1902	920

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Embedded Training for Dismounted Soldiers. In FY03, extended test-bed functionality and conducted experiments to evaluate concepts for a mobile training network for dismounted soldiers. Investigated concepts for technologies to precisely track a soldier's location and weapon orientation inside/outside of buildings in order to support Military Operations in Urban Terrain (MOUT) at the FCS and dismounted warrior systems cell level. Completed requirements analysis, experiments, and initial tracking technology platform. In FY04, extend test-bed functionality to include augmented reality (virtual targets, weapon effects, threats, and friendlies) for a mobile training network for dismounted soldiers. Mature embedded training through augmented reality. Prototype test-beds and algorithms to support assessment of tracking technologies. Mature advanced sensor for live simulation of non-line-of-sight weapons and improved urban tracking resolution. In FY05, will prototype mobile range and conduct experiments to evaluate an augmented reality training environment for the dismounted warrior systems cell level at Fort Benning, Georgia. Will conduct experiments with advanced tracking test-bed to validate/improve MOUT training.	2500	2729	1332
RDEC Federation. In FY03 established a Joint Virtual Battlespace (JVB)/RDEC Federation reference implementation architecture for interfacing with the FCS Advanced Collaborative Environment. Conducted analysis of interface requirements and identified human performance modeling requirements. Incorporated engineering-level M&S, virtual prototypes, and distributed requirements. Matured a concept of operations for reference implementation to support FF experimentation. Identified technologies from the Institute for Creative Technologies (ICT) for incorporation into reference implementation. In FY04 and beyond, this effort is funded in PE 0603015A, Project S31 (RDEC Federation).	3000	0	0
Rapid Generation of Synthetic Natural Environments. In FY03, investigated and developed environmental data model representation of urban terrain structures (building components: windows, floors, rubble, etc.) and improved realism of virtual urban training environments. In FY04, investigate toolsets to rapidly generate additional terrain structures in existing databases. Prototype simulation engine that will support persistent interactive simulation over the internet and allow users to create unconventional threats. In FY05, will assess performance of rapid generation technologies and recommend a standard toolset for FF training environments. Will evaluate simulation engine that will support persistent interactive simulation over the internet and allow users to create unconventional threats.	2500	2632	3074
Online Contract Document Management. This one year Congressional Add matured integrated prototype tools with external legacy acquisition systems and an enterprise management system. No additional funding is required to complete this project.	958	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	243	0
Totals	13953	10309	10204

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	7120	5115	4837	5427	5822	5945	6064

A. Mission Description and Budget Item Justification: This project enables the rapid transfer and maturation of simulation and training research results to the Army from the Institute for Creative Technologies (ICT). The ICT provides research in modeling, simulation, and training technologies, such as immersive training, leadership development, and concept exploration. This project creates a true synthesis of creativity and technology by leveraging the capabilities of industry and the R&D community. It revolutionizes military training and mission rehearsal by making it more effective in terms of cost, time, types of experiences that can be trained or rehearsed, and the quality of the result. This project accomplishes this by maturing research in virtual humans to enable them to embody natural language, speech recognition in noisy environments, gesture, gaze, and conversational speech. This will make training applications widely available and enhance the Army's ability to train any time and any place. This project also investigates and matures techniques and methods for integrating different sensory cues into virtual environments to enhance training and leader development. This project investigates and matures the application of emerging photo-realistic rendering algorithms and 3-dimensional signal processing techniques to advanced experience learning applications. These efforts will mature the efficiency of 3-dimensional sound techniques in virtual environments. The environments will 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. These techniques and environments will impact education and training systems for the Future Force (FF) and enhance 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 Defense Technology Area Plan (DTAP). Work in this project is performed by the Research Development and Engineering Command (RDE Command), Orlando, FL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Immersive Technology Environments. In FY03, matured the architecture structure for integrating speech, gesture, gaze and speech synthesis into a virtual human, and identified research shortfalls for human to virtual human interactions. Matured the concept of use of virtual humans in advanced leader development environments. In FY04, create solutions for shortfalls in human to virtual human interactions where feasible. Mature research approach for additional study to solve the more complex phenomena. In FY05, will integrate virtual humans into leader training exercises and advanced technology demonstrations in collaboration with TRADOC. Will mature virtual humans research based on feedback from exercise and demonstration evaluations to support self-guided and self-directed training.	1366	2241	2274
Immersive Technology Techniques. In FY03, incorporated photo-realistic rendering algorithms matured by ICT into the next generation of personal computer graphics cards to make recent advances in computer graphics commercially available. Investigated and matured techniques for using low-cost training platforms like game-based consoles and emerging high-speed hardware. Completed maturation of personal computer based proof-of-principle and worked on evaluation of proof-of-principle with TRADOC and Army Research Institute (ARI). Conducted preliminary Sensory Environment Evaluations (SEE). In FY04, provide concept demonstration of photo-realistic rendering of human faces and integrate into SEE and Mentoring Prototype (MP). Integrate audio and sensing cues implemented in algorithms and techniques into the SEE and MP. In FY05, will mature and demonstrate next generation global illumination algorithms and facilitate their adoption into military training applications. Will develop advanced techniques that support the creation of digital libraries for scenario based simulation.	2418	2722	2563
Institute for Creative Technologies (Simulations for Capabilities for the Warfighter). In FY03, this one-year Congressional Add matured research in immersive environments to provide an enhanced simulation capability at Fort Sill. No additional funding is required to complete this project.	3336	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	152	0
Totals	7120	5115	4837

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602601A - Combat Vehicle and Automotive Technology

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		81562	125147	69638	71287	71005	63399	57364
C05	ARMOR APPLIED RESEARCH	18144	26598	14811	10303	10492	10680	10887
C84	AC84	1122	0	0	0	0	0	0
H77	ADV AUTOMOTIVE TECH	22498	55475	21158	16312	16263	16418	16729
H91	TANK & AUTOMOTIVE TECH	21984	28987	33669	44672	44250	36301	29748
HH8	VOICE INTERACTIVE DEVICE	1619	0	0	0	0	0	0
HH9	UNIVERSITY PROGRAM IN MOBILE ROBOTICS	1430	0	0	0	0	0	0
T21	21ST CENTURY TRUCK (T21)	11338	0	0	0	0	0	0
T26	GROUND VEHICLE TECHNOLOGIES (CA)	0	14087	0	0	0	0	0
T27	ADVANCED COATINGS RESEARCH	1047	0	0	0	0	0	0
T28	FASTENING AND JOINING RESEARCH	1238	0	0	0	0	0	0
T29	NBC AGENT WATER CONTAMINATION MONITORING	1142	0	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 vehicles. 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 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 of protection against Chemical Energy (CE) and medium Kinetic Energy (KE) threats with less than one fourth the weight burden of conventional heavy armor. Goals are to provide lightweight structural armor at 20 lb/sq.ft. or less to defeat heavy machine gun threats and 60 lb/sq.ft. or less frontal armor to protect against more severe threats. Project H91 is investigating testing and characterizing unique active protection countermeasure warheads for intercepting tank fired CE & KE threats. Project H91 also investigates hybrid electric propulsion and electronic vehicle component technologies, which are key enablers for achieving Future Combat Systems (FCS) and Future Force capabilities. In the near term, FCS vehicles will be designed with hybrid electric architectures, providing power for propulsion, communications and control systems, life support systems, and electromagnetic (EM) armor. In the far term, vehicle energy and power levels will be increased to accommodate advanced electric weapons (e.g.

lasers, high power microwaves and electric guns) and advanced electric-based protection systems. Project H91 provides components for improved vehicle performance and mobility, including active suspensions, motors, regenerative brakes, vehicle electronics (VETRONICS), generators, controllers, hybrid electric architectures, inverters and lightweight track. It also investigates and matures high temperature/power electronics, high energy density energy storage devices, and components of pulse forming networks (PFN) elements (batteries, switches, inductors and capacitors) required for electric vehicle mobility and survivability. 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 integration and assessment of these technologies in lightweight conceptual platforms using advanced virtual prototyping capabilities. 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. This PE adheres to Tri-Service Reliance Agreements on advanced materials, fuels and lubricants, and ground vehicles, with oversight and coordination provided by the Joint Directors of Laboratories. The PE is coordinated with the Marine Corps through the Naval Surface Warfare Center and with other ground vehicle developers within the Departments of Energy, Commerce, Transportation, and DARPA. The program element contains no duplication of any similar effort within the Military Departments. Products of this program transition primarily to PE 0603005A 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 TARDEC, Warren, MI.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	79952	80910	71108
Current Budget (FY 2005 PB)	81562	125147	69638
Total Adjustments	1610	44237	-1470
Congressional program reductions		-8598	
Congressional rescissions			
Congressional increases		55850	
Reprogrammings	1610	-3015	
SBIR/STTR Transfer			
Adjustments to Budget Years			-1470

Significant Changes.
FY 2004 - Twenty-five FY04 Congressional adds totaling $55850 were added to this PE.

FY04 Congressional Adds with no R-2As:
($1034) Advanced Coatings Research, Project T26: The purpose of this one-year Congressional Add is to focus on coating systems to increase process flow and allow application with minimum equipment and environmental impacts. No additional funds are required to complete this project.

($940) Advanced Coatings Research to Extend the Service Life of Vehicles/Equipment, Project T26: The purpose of this one-year Congressional add is to develop coatings which will resist Nuclear, Biological and Chemical (NBC) contamination and offer the possibility of self-correction of surface damage. No additional funds are required to complete this project.

($3381) Ballistic Missile Technology, Project T26: The purpose of this one year Congressional add is to fund research in ballistic missile technology. No additional funds are required to complete this project.

($3851) Combat Vehicle Mobility System, Project T26: The purpose of this one-year Congressional add is to develop component technology to improve the mobility and survivability of Army ground vehicle systems. No additional funds are required to complete this project.

($1643) Fuel Preporator, Project T26: The purpose of this one-year Congressional add is to conduct testing to identify and evaluate manufacturers of filter systems that claim to improve fuel efficiency, remove entrapped air from the fuel, and improve emissions. No additional funds are required to complete this project.

($940) Hybrid HMMWV Technology Insertion Program, Project T26: The purpose of this one-year Congressional add is to develop, integrate and field test a Li-Ion battery pack at the module level in the lab and at the vehicle level in the hybrid HMMWV. No additional funds are required to complete this project.

($940) Moldite, Project T26: The purpose of this one-year Congressional add is to evaluate Moldite, a lightweight moldable composite material, for ground vehicle system and component applications and recommend potential prototype applications/evaluations. No additional funds are required to complete this project.

($940) Soldier Mobility Program, Project T26: The purpose of this one-year Congressional add is to improve soldier mobility in combat & tactical situations, and DoD civilian / Military Police mobility for logistical support and perimeter security patrol. No additional funds are required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
C05	ARMOR APPLIED RESEARCH	18144	26598	14811	10303	10492	10680	10887

A. Mission Description and Budget Item Justification: This project investigates, designs and tests integrated armor component technologies and armor packaging to achieve lightweight, ballistically-superior integrated structures and armor that will provide the last line of defense for Future Combat Systems (FCS) and Future Force vehicles. The effort provides the analytical basis for understanding and predicting the effectiveness of various armor systems and examines the vehicle armor systems required to protect against collateral damage from debris generated by the Active Protection (AP) system threat defeat. The major focus is on providing armor component technologies with reduced weight, reduced space claim and lower cost for protection against medium kinetic energy (KE) projectiles, chemical energy (CE) warheads, Explosively Formed Penetrators (EFP) and blast fragments from mines. Goals are to provide base armor to defeat heavy machine guns and residual fragments from AP threat defeat at 20 lbs/ sq.ft. or less; armor packages to defeat limited rocket propelled grenade (RPG) and medium caliber KE at 40 lbs/sq.ft. or less; and novel frontal armors to defeat heavier threats at 80 lb/sq.ft. or less for FCS Increment 1 and FCS spiral insertions. The goal for frontal armor will be to reduce the weight efficiency to 60 lb/sq.ft. or less for FCS Increment 2. The armor technologies designed and fabricated in this project complement innovative non-armor survivability component techniques that are funded in project AH91. In addition, this project investigates low-burden solutions for the protection of tactical vehicles in war and operations-other-than-war, focusing on appliqué armor for small arms and land mine protection. International cooperative research in mine blast characterization and vehicle response is also conducted. Efforts are fully coordinated and complementary to work performed under PE 0602618A (Ballistic Technology) and PE 0602105A (Materials). 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 TARDEC, Warren, MI in collaboration with Army Research Laboratory, Adelphi, MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Advanced Armor - In FY03, provided advanced armor solutions and model data for defeat of AP residual debris; evaluated armor solutions that address medium caliber KE and CE threats that meet the intermediate frontal weight efficiency goal of 80lbs/sq ft or less; provided 1st generation electro magnetic (EM) armor solutions for defeat of CE weapons. In FY04, evaluate 2nd generation EM armor solutions that address large CE threats and meet the intermediate weight efficiency goal of 80lbs/sq ft.	15370	1912	0
Countermine - In FY03, evaluated lightweight ballistic solutions for mine blast protection and developed representative applied modeling and simulation (M&S) tools. In FY04, test and evaluate mine protection armor configurations, obtain improved mine blast test data, and validate M&S. In FY05, will complete testing and evaluation of FCS mine resistant lower hull appliqué concept(s) integrated into FCS prototype designs; use finite element models to evaluate FCS prototype vehicle designs against multiple mine scenarios to assess capabilities beyond single blast events.	2774	1726	891
Structural Armors - In FY04, build representative vehicle section ballistic targets; range test these fully integrated 3rd generation armor/structure designs against FCS objective threats, and evaluate results of armor/structural capability at FCS vehicle design weights; evaluate integration of critical armor components; test armor/structural reliability; evaluate EM armor components for structural armor applications; improve physics and engineering based models and design tools. In FY05, will conduct ballistic range tests to optimize and validate the best achievable integrated armor packages for lightweight combat vehicle platforms, including defeat of advanced RPG and future medium cannon KE projectiles; complete design and fabrication of advanced full scale ballistic structure/platform.	0	14967	13920
Full Spectrum Active Protection Close-in Layered Shield (FCLAS) - FCS Support: The purpose of this one year Congressional add is to fund demonstration of a FCLAS system that provides close-in, full hemispherical protection for ground combat and tactical vehicles against Rocket Propelled Grenades. No additional funds are required to complete this project.	0	7237	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	756	0
Totals	18144	26598	14811

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H77	ADV AUTOMOTIVE TECH	22498	55475	21158	16312	16263	16418	16729

A. Mission Description and Budget Item Justification: This project funds the National Automotive Center (NAC), which leverages the large commercial investments in automotive technology research and development. NAC conducts shared technology programs that focus on benefiting military ground vehicle systems. Component technologies being matured in this project support the Army's current and future combat and tactical vehicle fleets. Improvements in the current force 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 three primary areas: Advanced Automotive Technology (AAT), Future Tactical Truck System (FTTS) Advanced Concept Technology Demonstrator (ACTD) and Mobility Vehicle Design (MVD). A major effort in AAT is Hybrid Electric Drive (HED) for tactical vehicles and light combat vehicles to improve fuel economy and mobility. Past work has included: Hybrid Electric Commercially Based Tactical Trucks (COMBATT), HED Heavy Expanded Mobility Tactical Truck (HEMTT) and in-hub motor HED 8X8 vehicle. This area also includes other fuel efficiency technologies, vehicle modernization, crew safety, maintenance, 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. FTTS ACTD is a new initiative to incorporate a number of advanced automotive technologies, that the Army and commercial sector have been maturing in recent years, into tactical support vehicles for the FCS and Future Force. The ACTD will provide a number of FTTS demonstrator vehicles for evaluation in a military unit field environment. ACTD test results will validate FTTS modeling estimates, refine FTTS User requirements, reduce the FTTS program risk and reduce risk of technology transfer to current platforms. Additional funds for the ACTD are contained in PE 0603005A, project 440. MVD is investigating the use of emerging commercially developed electrical systems at 42VDC, 120 VAC for use in Army vehicle applications. Some activities of the NAC are supported by other government agencies via a Memorandum of Agreement (MOA). 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 TARDEC, Warren, MI.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Advanced Automotive Technology: In FY 03, continued Commercially Based Tactical Trucks (COMBATT) and Hybrid Electric COMBATT testing; updated Hybrid Electric design configuration and associated testing for the HEMTT; continued advanced research of the 8X8 to enhance power converter; completed instrumentation of HEMTT ESP hydraulics with diagnostic sensors; tested concept vehicle (Hybrid Electric M113) at Aberdeen Test Center (ATC); worked with PM community to standardize A-kit and B-kit installations for embedded diagnostics on Brigade Combat Team vehicle fleet. In FY04, continue testing of advanced propulsion systems, including hybrid electric for light tactical vehicles, at Yuma Test Center (YTC) and potentially at ATC; continue to evaluate hybrid hydraulic systems on medium and heavy tactical vehicles; and conduct extensive tests and evaluations of subsystems and components which comprise hybrid electric propulsion systems in ground vehicles. In FY05, will continue testing and evaluating the synergistic effects of hybrid electric subsystems and components, primarily for light and medium tactical vehicles at YTC and ATC, when integrated with mission specific hardware/electronics and provide these technologies/systems as potential candidates for inclusion in FCS. This testing will include: the Hybrid Hydraulic Propulsion system demonstrator will be at ATC; the HEMTT A3 Chassis Dyno Testing and the Independent Active Suspension Test Rig Component Development testing at the Oshkosh facility; reliability & performance testing of the COMBATT vehicles and the Severe Off-Road Vehicle (SORV) at YPG; and Contractor Shakedown Testing: GM & Daimler-Chrysler, 5 each of the COMBATT Vehicles at their respective facilities.	15202	9070	11049

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Future Tactical Truck System (FTTS) ACTD: In FY04 award multiple contracts that will focus on key component technology selections and subsystem designs through Modeling and Simulation (M&S) of the Maneuver Sustainment Variant (MSV) and the Utility Variant (UV) vehicles for the FTTS ACTD. Four to six contractors will utilize M&S tools to analyze and optimize the MSV and UV vehicle concept design. The modeling will focus on the Hybrid powertrain, energy/power management, material handling, mobility, and ease of vehicle maintenance. The capabilities provided will be fed into operational models to determine the impact new technologies have on the Soldier's ability to complete the mission. Design, performance and operational trade space will be defined and evaluated throughout the M&S cycle. During late FY04 Contractor testing of key subsystems and components will be utilized to validate modeling results. Preliminary design reviews will be held. In FY05, will complete the final Government analysis; complete the design of the multiple maneuver sustainment and utility vehicle demonstrators/prototypes; evaluate the vehicles to validate the M&S predictions of the performance and military utility of the different MSVs and UVs; and perform virtual prototyping and mobility modeling through the use of 3D models and analysis. The number of contractors will be reduced with an emphasis on completing contractor subsystem and component testing prior to the Critical Design Review CDR. The M&S facilitates the Critical Design Review before the fabrication of the MSV and the UV. Vehicle hardware will be purchased. This effort supports the maturation of technologies in PE 603005 Project 440 by determining the optimal system integration and subsystem layout of the vehicles through M&S before physical fabrication begins.	0	11791	9109
Mobility Vehicle Design - In FY03, completed requirements analysis and design for use of emerging commercially developed systems at 42VDC, 120 VAC. In FY04, establish baseline 42V power generation, energy storage devices, and smart power architecture components. In FY05, will mature power distribution, power modules, and smart switching technologies.	700	500	1000
Advanced Energy & Manufacturing Technology: The purpose of this one-year Congressional add is to research automotive power technologies for possible application in military land warfare systems. No additional funds are required to complete this project.	0	2025	0
Advanced Electric Drive: The purpose of this one-year Congressional add is to determine the potential impact of Advanced Electrical Drive Technologies on vehicle performance, fuel economy and life-cycle costs. No additional funds are required to complete this project.	0	1157	0
Advanced Manufacture of Lightweight Materials (AMLM): The purpose of this one-year Congressional add is to focus on the development of advanced lightweight materials for applications in military and commercial vehicles. No additional funds are required to complete this project.	0	482	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
CALSTART Defense Advanced Trans: The purpose of this one-year Congressional add is to facilitate joint programs and communication between the DOD, the private sector, and state and regional governments to develop advanced heavy-duty vehicle technologies focused on hybrid drive trains and fuel cells. No additional funds are required to complete this project.	0	4918	0
Digital Humans & Virtual Reality: The purpose of this one-year Congressional add is to develop tools and capabilities for the analysis, optimization, and simulation of the human interface for current and evolving vehicle systems. No additional funds are required to complete this project.	0	964	0
Future Tactical Truck System (FTTS) Companion Trailer System(s): The purpose of this one-year Congressional add is to fund research and development of a technologically advanced trailer to follow behind the FTTS. No additional funds are required to complete this project.	0	1639	0
Hydrogen PEM Fuel Cell Heavy Duty: The purpose of this one-year Congressional add is to build a power plant to undergo durability testing and conduct product improvement redesign effort based on the test results. No additional funds are required to complete this project.	0	2411	0
Hydrogen PEM Ambient Pressure Fuel Cell Demonstration: The purpose of this one-year Congressional add is to assemble the first prototype proton exchange membrane (PEM) power plant for verification and validation tests. No additional funds are required to complete this project.	0	3278	0
Fuel Efficiency Technology: The purpose of this one-year Congressional add is to investigate a pre-reforming concept for processing logistic fuels used in ground vehicle fuel cell auxiliary power units. No additional funds are required to complete this project.	0	964	0
Next Generation Smart Truck: The purpose of this one-year Congressional Add is to test, integrate, and showcase cutting-edge automotive technologies with military and homeland security/counterterrorism applications. No additional funds are required to complete this project.	0	4146	0
Army Truck Diagnostic System: The purpose of this one-year Congressional add is to identify existing commercial vehicle electronics technologies that can be leveraged into Army tactical trucks and/or combat platforms to enhance core capabilities. No additional funds are required to complete this project.	0	1639	0
Auragen Vehicle Integrated Primary Electrical Resource (VIPER): The purpose of this one-year Congressional add is to research and develop under-hood power generating systems capable of producing 3-12 kilowatts of AC power compatible with combat and tactical vehicles with a drive system. No additional funds are required to complete this project.	0	3375	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
M-Gator Improvements: The purpose of this one-year Congressional add is to identify and prove out improved electric- and hybrid-electric drivetrains for the John Deere M-Gator series of ultra light mobility platforms. No additional funds are required to complete this project.	0	964	0
Rapid Prototyping Technologies: The purpose of this one-year Congressional add is to design and develop a robust metal spray system and to mature process planning and reverse engineering software. No additional funds are required to complete this project.	0	1350	0
Unmanned Vehicle Control Technologies: The purpose of this one-year Congressional add is to develop improved control of unmanned vehicles and investigate the best human and vehicle interfaces. No additional funds are required to complete this project.	0	1639	0
Military Wheeled Vehicle Electronic Architecture Integration: The purpose of this one-year Congressional add is to identify existing commercial software and hardware technologies that can interface with Army tactical truck electronic architectures to facilitate the movement and manipulation of on-board data. No additional funds are required to complete this project.	0	1639	0
COMBATT - This one-year Congressional add evaluated and matured technologies on commercial light truck platforms that enhanced vehicle's performance while demonstrating the benefits of hybrid propulsion. No additional funds are required to complete this project	3346	0	0
Smart Truck - This one-year Congressional add tested and evaluated emerging automotive/military technologies on commercially based platforms that could be used for homeland defense. No additional funds are required to complete this project.	3250	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1524	0
Totals	22498	55475	21158

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H91	TANK & AUTOMOTIVE TECH	21984	28987	33669	44672	44250	36301	29748

A. Mission Description and Budget Item Justification: This project investigates, matures and tests innovative vehicle concepts, mobility, critical power, propulsion, survivability, and other component technologies for future combat vehicles. The project also addresses: military fuels and lubricants and water recovery/purification. Hybrid Electric and Electric vehicle technologies are key enablers for achieving Future Combat Systems (FCS) and Future Force capabilities. Future combat vehicles will be designed with hybrid electric architectures, providing power for propulsion, communications and control systems, and life support systems. In the mid-term, electrothermal chemical (ETC) guns and electromagnetic (EM) armor will be available. In the longer term, vehicle energy and power levels will be increased to accommodate advanced electric weapons (e.g., lasers, high power microwaves, and electric guns) and advanced electric-based protection systems. The Hybrid Electric/Electric Vehicle effort designs, fabricates and tests critical components for energy storage and power distribution. Mature components developed under this effort can be incorporated into the Hardware-In-The-Loop Systems Integration Laboratory (funded in PE 0603005A, project 441) for testing and evaluation. The Pulse Power effort focuses on providing high energy/high power density components (including film capacitors, solid-state switches and pulse charging circuitry for EM armor, ETC gun and EM gun) and design of pulse forming networks (PFNs), which are enablers for the advanced weapon and protection systems. These two efforts support the Office of the Secretary of Defense (OSD) Power and Energy Initiative, which is one of the top 3 DoD S&T priorities. The Vehicle Concepts Modeling and Simulation (M&S) effort investigates novel vehicles (both manned and unmanned), constructs realistic virtual prototypes, conducts trade studies, and makes performance predictions and analyses. Work in this project is performed in collaboration with the U.S. Army Engineer Research and Development Center located at Vicksburg, Mississippi. The goal of the Propulsion/Prime Power effort is to design engines and generators and their components with significantly improved performance characteristics and efficiencies. 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 fuel cell technology. The Mobility effort focuses on improving drive component performance and reliability (e.g., running gear, tracks and suspensions), fuels and lubricants, bridging, minefield breeching, and gap crossing technologies to enable high OPTEMPO and to reduce logistics burdens associated with manned and unmanned combat and tactical vehicles. The Vehicle Survivability effort provides component technologies that contribute to an integrated vehicle survivability approach. This effort includes design and testing of active protection and hit-avoidance components, signature reduction materials, pedestrian tracking/detection components for unmanned systems, laser protection materials, and advanced lightweight structure and base armor. This work complements, but does not duplicate, work performed under the armor exploratory development project (C05). The Water Recovery/Purification and Generation effort focuses on reducing the logistics footprint by leveraging emerging technologies and basic research being conducted by DARPA. The program will demonstrate enhanced water purification technology which can be embedded in combat platforms and support the individual soldier that have the capability of purifying any water source regardless of contaminants. The goal is to reduce water distribution requirements (projected to be 30% of the total daily sustainment requirement of the Future Force) through three approaches: 1) innovative purification of traditional water sources; 2) water recovery from exhaust; and 3) water recovery from atmospheric humidity. Activities are closely coordinated with TRADOC's Mounted and Dismounted Battlespace Battle Labs, Unit of Action Maneuver Battlelab, the Directorate of Combat Developments for Transportation, Quartermaster, Program Executive Office for

Ground Combat and Support Systems, ARL; DARPA and the Red River Army Depot. 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 TARDEC, Warren, MI.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Hybrid Electric/Electric Vehicle: In FY03, tested and evaluated high-power semi-conductor motor controllers for FCS. In FY04, build and evaluate advanced high power (10kW), high temperature silicon and silicon carbide (SiC) hybrid converters; obtain state-of-the-art energy storage and power generation components (advanced batteries, capacitors, switches, converters, etc.), characterize performance and condition these components to provide the data and the validated components to be incorporated into the Power and Energy (P&E) Hardware in the Loop System Integration Lab (SIL). In FY05, will test and evaluate SiC for use in high voltage rectifiers, converters, and motor drives for a more compact FCS Increment 2 hybrid power management system for FCS; demonstrate higher power and energy density in Li-ion batteries; increase the maturity of these critical technologies to enable system level integration and demonstrations, continue to characterize performance and condition additional state-of-the-art components for validation and incorporation into the P&E SIL and assess Li-Ion battery with improved performance (fire retarding material, power/thermal management, and higher power density). This is a collaborative TARDEC and ARL effort.	500	8150	12909
Pulse Power - In FY04, investigate, design and characterize novel silicon solid state device concepts for technology that will allow for integration of revolutionary survivability and lethality capabilities on deployable ground combat vehicles; design and validate high-action, fast rise-time output switches capable of State-of-the-Art (SOA) Power Density Levels; investigate, develop and evaluate high-performance dielectric materials and novel packaging/manufacturing techniques to increase the energy density of SOA fast-discharge, high-voltage capacitors; fabricate and evaluate SOA high-power density power converters. In FY05, will investigate and mature SiC solid state device concepts for improved output switches and for reduced size pulse charger inverter/rectifier circuits; mature high-performance dielectric materials to further increase the energy density of fast-discharge, high-voltage capacitors; mature novel, modular silicon solid-state output switch concepts; investigate and evaluate advanced thermal management approaches for high temperature operation. This is a collaborative TARDEC/ARL effort.	0	7025	5741

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Vehicle Concepts Modeling and Simulation (M&S): In FY03, matured physics based platform and terrain models for advanced manned and robotic ground vehicle subsystems; completed baseline and validation experiments for moving vehicle operations; and provided FCS concepts, trade studies and performance predictions/input to performance predictions. In FY04, mature physics based mobility and durability models for advanced manned and robotic ground vehicle platforms and their associated complex urban, all-season terrain environment. Model the tire, snow and 3-D soil interactions between the terrain and the vehicles running in real-time. Work in this project is performed in collaboration with the U.S. Army Engineer Research and Development Center located at Vicksburg, Mississippi. In FY05, will mature the understanding of adverse effects of moving vehicle operations and promising passive and active mitigation strategies; generate FCS spiral and incremental upgrade vehicle concepts and performance predictions, including powertrain vibration characteristics; develop method of generating real-time 3-D terrain databases from 2-D terrain elevation profiles, and integrate snow and soil models and add semi-frozen and thawing capabilities.	3765	2013	3050
Propulsion/Prime Power: In FY03, completed design analysis of FCS 4.5 Net HP/cu-ft power density test stand engines in support of FCS Increment I. In FY04, conduct full performance characteristics and 50 hour laboratory NATO durability testing for FCS engine. In FY05, will enhance FCS engine performance and durability to achieve the 6 Net HP/cu-ft system power density and improve FCS engine configuration to achieve 400 hours of laboratory NATO durability testing and for integration into a complete FCS MGV propulsion package; investigate feasibility of opposed piston engine concept to produce 8 hp/cu-ft power density propulsion system; investigate and characterize current fuel cell technology state-of-the-art capabilities and limitations for combat vehicle prime power source consideration; and conduct analysis of design variations in opposed piston engine configurations.	3000	1950	4950

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Vehicle Survivability (Active Protection/Minefield Breeching/Laser Protection/Hit Avoidance): In FY03, conducted dynamic countermeasures range tests of potential chemical energy and kinetic energy threat defeat countermeasure configurations against multiple dynamic horizontal and overhead threats; conducted joint demonstration of marking systems with the Navy. In FY04, determine optimum ground pressure to trigger recently emplaced as well as age affected mines; finalize surrogate instrumented mine configuration and subsurface ground pressure measurement devices; validate blast models with current test data to ensure accurate results/resolution; and develop preliminary designs for a laser-protected targeting sight using highly modified digital camera technology as the primary sensor. In FY05, will use modeling and simulation to conduct trade-off analysis between lightweight material solutions and blast dissipation techniques for scaleable and modular configurations capable of withstanding the blast effect of mines; finalize optical system designs that meet the targeting requirements and the integration plans for the frequency agile protection; complete technology evaluations to determine applicability of existing Hit Avoidance technology to the regional protection concept; and finalize sub-system requirements and construct Hit Avoidance Regional Protection System model.	1559	1586	2455

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Mobility for Manned and Unmanned Vehicles - In FY03, completed fuel economy dynamometer testing validating fuel economy benefits, conducted fleet testing of novel fuels and lubricants; implemented software to download the Petroleum Oil and Lubricants (POL) Analyzer sensor data into oil analysis database; and constructed virtual prototypes of future light tactical bridging configurations. In FY04, award multiple contracts to investigate lightweight automated modular gap defeat concepts compatible with FCS requirements, in collaboration with the U.S. Army Engineer Research and Development Center located at Vicksburg, Mississippi; evaluate the use of advanced mobility technologies (i.e., hybrid electric drive, active suspension, etc.) for Armed Robotic Vehicle (ARV). In FY05, will develop and analyze lightweight automated modular gap defeat concepts; evaluate automated emplacement techniques and gap sensor technology; develop gap defeat models; initiate the fabrication of test components; support the joint expeditionary mindset through augmentation of the ONR project for the development of non-standard bridging to include lightweight deck panels as a gap defeat concept; investigate technologies for providing an anti-tamper radius that surrounds an unmanned system, including enemy tracking and detection as well as non-lethal deterrent measures; and enhance the mobility characteristics of the ARV to ensure that the unmanned assets have equivalent mobility to the manned vehicles of the future force.	1845	2616	1832
Water recovery/purification - In FY03, conducted water recovery tests from exhaust prototype, with collection and purification system integrated and mounted on a HMMWV. In FY04, conduct a test track demonstration of water recovery from exhaust system on the NLOS-C Lancer demonstration vehicle and investigate optimal designs for water recovery from atmospheric humidity. In FY05 will conduct a structured technology demonstration of water recovery from exhaust system on the NLOS-C Lancer demonstration vehicle to validate system maturity, water production, and water quality; and develop technology and demonstrate laboratory breadboard system to establish proof of concept for water recovery from atmospheric humidity.	3000	4878	2212
Crew Integration & Automation Testbed (CAT): In FY03, in support of the CAT ATD, evaluated the use of 3D audio systems for the control and situational awareness of robotic and dismounted unmanned system assets; tested and evaluated speech recognition technology for speaker independence, natural language understanding and expanded control to unmanned systems while working high noise environment.	3192	0	0
Advanced Mobile integrated Power System (AMPS): In FY04, investigate and mature 42V power generation, energy storage devices, and smart power architecture components; and perform alternate concepts evaluation using modeling and simulation. In FY05, adapt and mature power flexbus low power distribution and modular low power modules and investigate and mature smart switching power management.	0	486	520

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Combat Vehicle Mobility System - Combat Vehicle Mobility System - This one-year Congressional Add matured component technology to improve mobility and survivability of the Army's ground vehicle systems. No additional funding is required to complete this project.	3415	0	0
Military Wheeled Vehicle Electronic Architecture Integration (EAI) - This one-year Congressional Add designed and created an interface to serial databus architecture, such as J1939 and J1708, for current vehicles such as HMMWV, which will enable the vehicle platform to be equipped with critical capability like embedded diagnostics/prognostics. No additional funding is required to complete this project.	1708	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	283	0
Totals	21984	28987	33669

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		61372	57197	51301	53700	56100	52348	53354
H03	ROBOTICS TECHNOLOGY	17091	18181	17740	17927	18215	18572	18937
H75	ELECTRIC GUN TECHNOLOGY	4805	5240	5133	4933	5138	5242	5372
H80	BALLISTICS TECHNOLOGY	39476	28355	28428	30840	32747	28534	29045
HB1	SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)	0	5421	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 and to allow US dominance in future conflicts across a full spectrum of threats in a global context. Project H75 focuses on technologies for electric armaments which offer the potential to field leap-ahead capability in 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 included advanced solid propellants, launch and flight dynamics, weapons concepts for light forces, warheads and projectiles, armor and munition/target interactions. Project H03 focuses on applied research for advanced autonomous mobility technology for future land combat systems of the Future Force. 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 0602105 (Materials Technology), PE 0602120 (Sensors and Electronic Survivability), PE 0602601 (Combat Vehicle and Automotive Technology), PE 0602624 (Weapons and Munitions Technology), PE 0602705 (Electronics and Electronic Devices), PE 0602716 (Human Factors Engineering), PE 602782 (Command, Control, Communications Technology), PE 0603004 (Weapons and Munitions Advanced Technology), and PE 0603005 (Combat Vehicle Advanced Technology). The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	62458	53478	52392
Current Budget (FY 2005 PB)	61372	57197	51301
Total Adjustments	-1086	3719	-1091
Congressional program reductions		-503	
Congressional rescissions			
Congressional increases		5600	
Reprogrammings	-1086	-1378	
SBIR/STTR Transfer			
Adjustments to Budget Years			-1091

Significant Change Explanation:
FY04 - Four FY04 Congressional Adds totaling $5600 were added to this PE.

FY04 Congressional Adds with no R-2As:
($939) Advanced LFT Composites for Lightweight Weapons Systems, Project HB1: The purpose of this one year Congressional add is to fund research in long fiber thermoplastic composites. No additional funds are required to complete this project.

($1973) Alloy Tungsten Armor Piercing Ammunition, Project HB1: The purpose of this one year Congressional add is to fund research in alloy tungsten armor piercing ammunition. No additional funds are required to complete this project.

($939) Structural Reliability of Electronic Components for Munitions, Project HB1: The purpose of this one year Congressional add is to perform research in electronic component structures. No additional funds are required to complete this project.

($1409) Structural Reliability of Electronic Components for Munitions and Lightweight Structures, Project HB1: The purpose of this one year Congressional add is to perform research in electronic component structures. No additional funds are required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H03	ROBOTICS TECHNOLOGY	17091	18181	17740	17927	18215	18572	18937

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, Objective Force Warrior (OFW) 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 will be focused towards 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: 63005/515, 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, NIST, NASA and DOE 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 OSD Joint Robotics Program and each of the Services. 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 2003	FY 2004	FY 2005
- Execute industry/academic consortium (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. In FY03, advanced technologies in terrain classification and mid-range perception and proved initial tactical behaviors and an improved understanding of human-machine interaction. In FY04, mature initial algorithmic structure to enable adaptive behaviors. In FY05, insert mature technologies onto testbed platforms to promote rapid transition of semi-autonomous capability to Future Force systems.	5602	7575	7674
- Enhance modeling and simulation infrastructure to enable maturation of semi-autonomous UGVs; devise and implement tools to enable rapid maturation of tactical behaviors. In FY03, matured common set of modeling tools for creation of tactical behaviors and for improving soldier-machine interfaces. In FY04, employ modeling tools to improve the soldier-machine interface. FY05, integrate mechanisms for behavioral adaptability into testbed vehicles and evaluate approach through field exercises during which a minimum of two vehicles collaboratively conduct maneuver required for a zone reconnaissance mission while adapting their behavior to reflect environmental changes.	915	928	843
- Mature and integrate perception and control technology required for an intelligent robotic follower vehicle capable of achieving 35 MPH on-road and 20 MPH off-road mobility (chassis limited) with a time delay between passage of the manned leader vehicle and unmanned follower of up to 12 hours. In FY03, proved technology maturity in Technology Readiness Level (TRL) 6 field exercise and transitioned technology to TARDEC for implementation in Robotic Follower Advanced Technology Demonstration (ATD) and FCS lead systems integrator (LSI) Unmanned Combat Demonstration.	2744	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 near-autonomously through the battlefield. In FY03, matured techniques of terrain classification for autonomous mobility and validated through extensive field experiments in three relevant FCS environments (rolling arid, rolling vegetated, near-urban). In FY04, implement fusion of multiple sensor modes for improved terrain reasoning. In FY05 mature technology required to show baseline adaptive tactical behaviors by unmanned ground vehicles.	2643	5018	5083
- 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. In FY03, advanced maturity of autonomous mobility technology required to implement FCS Increment 1 Armed Reconnaissance Vehicle and proved TRL 6 technology maturity for FCS Increment 1 level of capability. In FY04, incorporate improved perception and control technology to enable baseline cooperative behaviors. In FY05, prove baseline adaptive tactical behaviors.	5187	4148	4140

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	512	0
Totals	17091	18181	17740

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H75	ELECTRIC GUN TECHNOLOGY	4805	5240	5133	4933	5138	5242	5372

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), require 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 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, Aberdeen Proving Ground, MD and is closely coordinated with an advanced development program ongoing at the Armaments Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Pulse Power - In FY03, finalized and documented design of candidate EM gun pulsed power system. In FY04, devise advanced composite structures for pulsed power machine rotor and explore advanced thermal management technology. In FY05, prove through laboratory testing the strength of new, thick composite rotor bandings and validate thermal management components.	3865	1955	1948
Launcher - In FY03, identified and solved some of the engineering challenges associated with an EM launcher to enable acceptable service life of an EM weapons system. In FY04, establish processing methodology for fabricating EM launcher; explore lightweight materials for EM launchers; and experimentally validate prototype 8 mega joule (MJ) projectile armatures. In FY05, will validate material and fabrication technologies for EM launcher; experimentally validate reduced-scale EM launchers for integrity; and experimentally validate full-scale projectile slugs.	940	1202	1238

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Launch Package (Projectile) - In FY04, establish hypervelocity performance of monolithic depleted uranium kinetic energy penetrator materials; ballistically evaluate two alternative novel kinetic energy penetrator technologies; and evaluate novel kinetic energy penetrator electronics in EM environment. In FY05, will down-select to most promising hypervelocity penetrator and evaluate performance against realistic targets in full-scale EM gun.	0	1956	1947
Small Business Innovative Research/Small Business Technology Transfer Programs	0	127	0
Totals	4805	5240	5133

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H80	BALLISTICS TECHNOLOGY	39476	28355	28428	30840	32747	28534	29045

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 insure 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 (KEAP) 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, 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 program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Optimize advanced lightweight structural, ceramic, and electromagnetic armor technologies that meet FCS threshold capability for transition to FCS vehicle designers, and mature ballistic shock and mineblast mitigation technologies to enable revolutionary survivability for FCS and Future Force Platforms. In FY03, experimentally validated frontal, structural, and applique armor technologies and transitioned to TARDEC and FCS Lead System Integrator for application to FCS Increment 1; optimized logic and control system to minimize space and weight for FCS system. In FY04, evaluate improved objective armor technologies to include electromagnetic and enhanced ceramic armor that improve upon the performance of the transitioned threshold armor and evolve ballistic shock and mineblast mitigation technologies. In FY05, optimize armor packaging and transition improved hybrid armor technologies to FCS vehicle designers, prove capability of ballistic shock and mineblast mitigation technologies, and prove advanced pulse power componentry necessary to enhance FCS survivability. Program executed by ARL in coordination with TARDEC.	18190	9094	8098
- 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 FY03, experimentally validated multi-disciplinary design tools on gun-launched maneuvering munition employing novel control mechanisms and fully characterized high-g GN&C components under realistic launch conditions. In FY04, prove validated multidisciplinary models for precision gun-fired munitions, couple with system effectiveness models, and prove gun launch as well as deployment of gun launched dynamic retargeting assets. In FY05, transition fully coupled suite of models and validated first generation dynamic retargeting technology to munitions development community.	4139	4568	4765

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 FY03, performed critical evaluation of IHEM concepts including quantification of late-time impulse energy delivery (enhanced blast) from thermobaric explosive and characterization of combustion and erosion properties of propellant formulations containing Hi-nitrogen molecules which show promise of reducing gun wear and erosion by 40%. In FY04, characterize candidate novel insensitive high-energy materials and assess concepts for exploiting managed energy release for FCS/Future Force gun/missile systems and warheads. In FY05, extend and validate modeling tools used for design of managed energy systems; experimentally assess promising insensitive high-energy materials in notional energy managed configuration; and provide matrix of novel IHEM propellant and explosives for specific Future Force applications.	3000	2850	3150
- Mature counter-munition and sensor technologies effective for active protection defeat of kinetic energy (KE) munitions, which is critical to enable revolutionary survivability of FCS and Future Force platforms. In FY03, combined blast deflect KE counter-munition and sensor suite in breadboard KE active protection experiment which proved limited-range tracking radar and blast counter-munition capable of diverting KE rod to completely miss vehicle crew compartment; showed feasibility of using this counter-munition to defeat selected chemical energy (CE) threats. In FY04, prove effectiveness of blast-deflect KEAP system consistent with Tank Automotive and Armaments Command Full Spectrum Active Protection (FSAP) system requirements. In FY05, optimize blast-deflect countermeasure design against both KE and CE threats, and transition to TARDEC full spectrum active protection (FSAP) development program.	4450	1900	2050

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- 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 FY03, experimentally validated improved KE missile lethal mechanism and transitioned design technology to AMRDEC for compact kinetic energy missile (CKEM) and to ARDEC; Performed 1/3 scale experimental validation proving feasibility of dual mode penetrator/warhead concept capable of providing single round to defeat armor, bunkers, personnel, and UAVs. In FY04, identify preferred options to reduce energy/mass required to defeat emerging threats and to provide multi-purpose capabilities for revolutionary Future Force lethality. In FY05, mature and integrate emerging materials and novel lethal mechanism technologies & conduct full-scale experimental validation of integrated solution for transition to Future Force munitions developers.	3290	3440	3671
- Devise state-of-the-art survivability/lethality/vulnerability methodologies to dynamically model the interaction of conventional ballistic threats versus FCS and Future Force System of Systems. In FY03, the first generation advanced armor penetration algorithms were implemented into survivability/lethality analysis codes for sophisticated multi-layering protection schemes employed for multi-hit protection of U.S. Army ground systems and the Future Force. Advanced Finite Element Analysis simulation code was exercised to predict the dynamic responses of novel glass-fiber composite panels under blast wave pressure loadings. Coding is being performed to provide the survivability/lethality analysis framework to dynamically model the interaction of an incoming conventional ballistic threat versus a ground combat vehicle equipped with an active protection system. In FY04, devise models for various damage mechanisms such as fuel fire and ammunition reaction as well as penetration and blast damage to new/novel materials. In FY05, experimentally validate models.	6407	6231	6694
Small Business Innovative Research/Small Business Technology Transfer Programs	0	272	0
Totals	39476	28355	28428

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		15480	21722	3476	3633	3661	3716	3798
552	SMOKE/NOVEL EFFECT MUN	3238	3424	3476	3633	3661	3716	3798
BA1	PROTECTION TECHNOLOGIES (CA)	0	18298	0	0	0	0	0
BA3	ADVANCED SENSORS AND OBSCURANTS	1905	0	0	0	0	0	0
BA4	METALLIC PARTICLES IN DEFENSE APPLICATIONS (MPDA)	1430	0	0	0	0	0	0
BA5	SYSTEMS FOR SAMPLING AND DETECTING BIOAEROSOLS	4333	0	0	0	0	0	0
BA6	VAPOROUS HYDROGEN PEROXIDE TECHNOLOGY	4574	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This applied research Program Element (PE) investigates and develops smoke and obscurant technologies to increase personnel and platform survivability for use in the Future Force, and where feasible, exploits opportunities to enhance Current Force capabilities. The PE funds applied research in materials science and dissemination technologies to counter enemy weapon target acquisition systems and to provide the ability to degrade enemy surveillance capability. The material and dissemination systems will be designed to be safe and environmentally acceptable. Work in this PE is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. This PE contains no duplication with any effort within the Military Departments. This work is performed by the U.S. Army Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	15643	3540	3553
Current Budget (FY 2005 PB)	15480	21722	3476
Total Adjustments	-163	18182	-77
Congressional program reductions		-194	
Congressional rescissions			
Congressional increases		18900	
Reprogrammings	-163	-524	
SBIR/STTR Transfer			
Adjustments to Budget Years			-77

Significant Change Explanation:
FY04 - Six FY04 Congressional Adds totaling $18900 were added to this PE.

FY04 Congressional Adds with no R-2As:
($3758), Systems for Sampling and Detecting Bioaerosols, Project BA1: The purpose of this one year Congressional add is to develop new types of bioaerosol detection systems using advancements in air sampling, biological and chemical speciation, and optics. No additional funding is required to complete this project.

($2818), Metallic Particles in Defense Applications, Project BA1: The purpose of this one year Congressional add is to research metallic materials for obscurant applications. No additional funding is needed to complete this project.

($1973), Asymmetric Threat Countermeasure Solutions Suite, Project BA1: The purpose of this one year Congressional add is to examine unconventional countermeasures for asymmetric threats. No additional funding is required to complete this project.

($4697), Vaporous Hydrogen Peroxide Technology, Project BA1: The purpose of this one year Congressional add is to research and evaluate vaporous hydrogen peroxide technology for decontamination applications. No additional funding is required to complete this project.

($1220), US Army Biotechnology Center, Project BA1: The purpose of this one year Congressional add is to develop educational courses for military, government, and industry personnel in biotechnology disciplines related to US Army applications. No additional funding is required to complete this project.

($3288), Deep Digger, Project BA1: Funding for this Congressional add will be executed by the Armaments Research Development and Engineering Center, Picatinny Arsenal, NJ. The purpose of this one year Congressional add is to research advanced technology with potential to destroy underground targets. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
552	SMOKE/NOVEL EFFECT MUN	3238	3424	3476	3633	3661	3716	3798

A. Mission Description and Budget Item Justification: Project 552 researches and investigates smoke and obscurant technologies to increase personnel/platform survivability and to provide the ability to degrade enemy surveillance sensor capability. Improved multi-spectral smokes/obscurants are explored to enhance survivability by providing effective, affordable, and efficient screening of deployed forces from threat force surveillance sensors and effective defeat of target acquisition devices, missile guidance, and directed energy weapons. These systems will be designed to be safe and environmentally acceptable. Modeling and Simulation (M&S) tools will be investigated to predict performance and analyze strategic use of obscurants on the battlefield. A major effort, Advanced Infrared (IR) Obscurants, is focused on increasing current IR obscurant performance by 4X (reducing logistics by >50%), for use in IR smoke pots, grenades and projected munitions. Other efforts within this project investigate obscurant enabling technology for Smoke Pot and other obscurant capabilities. These efforts advance dissemination, delivery, M&S and vehicle protection technology to expand survivability options through increased standoff and threat protection. 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 by the U.S. Army Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Advanced IR Obscurants In FY03, produced test quantities of several candidate materials. Evaluated promising candidates in a laboratory environment. Established an emissive IR theory/modeling effort and a survivability study. Established laboratory method for evaluating obscurant performance as an aerosol. In FY04, test and assess new IR obscurant screening materials using laboratory evaluation methods; perform simulations to investigate potential applications of this advanced obscurant material and estimate the increase of survivability for the soldier. In FY05, will identify dissemination techniques for new IR materials; will develop concepts for prototype systems for use in grenades, artillery rounds, and other smoke generating systems; will conduct trade-off analyses of prototype concepts.	2248	2437	2350

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Obscurant Enabling Technology for Smoke Pot and other obscurant capabilities In FY03, assessed performance of promising smoke pot and grenade dissemination technologies. Upgraded Modeling and Simulation tools for vehicle protection. Conducted studies of quick response vehicle protection concepts. In FY04, conduct Modeling and Simulation case studies to predict and analyze performance of Smoke Pot and other obscurant applications. Evaluate concepts for small through medium area (e.g., urban terrain) screening obscuration capabilities. In FY05, will perform field experiments on obscuration/dissemination technologies to optimize vehicle protection in selected environments.	990	920	1126
Small Business Innovative Research/Small Business Technology Transfer Programs	0	67	0
Totals	3238	3424	3476

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H21	JT SVC SA PROG (JSSAP)	5373	5649	5739	5932	6205	6311	6433

A. Mission Description and Budget Item Justification: This Program Element designs and develops key individual and crew-served weapon technologies that will enable the Army Transformation to the Future Force by enhancing the fighting capabilities and survivability of dismounted battlefield personnel of the Services and, where feasible, exploits opportunities to enhance Current Force capabilities. Funded efforts include component technologies for: the Objective Crew-Served Weapon (OCSW); the Objective Individual Combat Weapon (OICW) System Enhancements; the Lightweight Machine Guns and Ammunition (LMGA); and Lightweight 5.56mm Ammunition. OCSW provides the next generation crew-served weapon with improved combat effectiveness, including bursting munitions technology to provide 500%+ increase in probability of target incapacitation at extended range (to 2000m) with the capability to hit protected personnel targets in defilade (obscured or non-visible), and reduced weight over weapons it replaces. The OCSW is designed to replace selected M2 machine guns and MK19 grenade machine guns. The OICW System Enhancement efforts develop lethality-enhancing and cost/weight-reducing technologies for OICW. The LMGA, complementing both the highly lethal OICW & OCSW will offer significantly reduced weight over the currently fielded M249 Squad Automatic Weapon 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 current levels of performance. The lightweight 5.56mm polymer ammunition evaluation seeks to determine the feasibility of utilizing polymer composite cases for 5.56mm ammunition for use in current and future weapons. The technology enhancement efforts of this PE will assure that the Objective Family of Small Arms (OFSA), the next generation of small arms weapons systems, continues to overmatch the evolving threat and addresses the needs of the Future Force. All Joint Service Small Arms Program (JSSAP) efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP), Mission Needs Statements and 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). The program element contains no duplication with any effort within the Military Departments. This program is primarily managed by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey. 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 Soldier, Project Manager Soldier Weapons, Product Manager (PM) Crew Served Weapons, PM Individual Weapons, USMC Director Ground Weapons and US Special Operations Command (SOCOM).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
OCSW: In FY03, refined fuze design; evaluated explosive train functionality; conducted environmental testing of weapon; fabricated/upgraded weapons; completed contractual reporting requirements.	1351	0	0
OICW System Enhancement: In FY03, completed Micro Scale Firetrain formulation and transfer charge design for gun launched micro electro-mechanical system based safe and arming evaluation.	1000	0	0
LMGA: In FY03, researched weapon component technologies and worked with Objective Force Warrior Lead Technology Integrators to determine needs. Quantified operational and human enhancements for individual soldiers through modeling, simulation and analyses of applicable concepts. Assessed alternate case ammunition concepts as enabling technologies for a lightweight family of weapons and for lightweight 5.56 ammunition. In FY04, evaluate and mature lightweight material technologies for small arms application. Design and assess mechanisms to reduce weight and provide component commonality across a family of weapons. Assess potential of placing traditional weapon function on the soldier and of placing other soldier system controls on the weapon. In FY05, will downselect to final weapon development design, finalize design, conduct component evaluation and build non-firing prototype.	3022	5003	5739
Future Lightweight 5.56mm Ammunition: In FY04, evaluate 5.56mm polymer cased ammunition concepts to potentially achieve 20% ammunition weight reduction.	0	501	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	145	0
Totals	5373	5649	5739

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	5468	5835	5979
Current Budget (FY 2005 PB)	5373	5649	5739
Total Adjustments	-95	-186	-240
Congressional program reductions		-50	
Congressional rescissions			
Congressional increases			
Reprogrammings	-95	-136	
SBIR/STTR Transfer			
Adjustments to Budget Years			-240

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	71917	75266	44666	43385	41160	41508	41348
H18	ARTY & CBT SPT TECH	15973	14322	14603	14114	15208	15317	15605
H19	CLOSE COMBAT WEAPONRY	9560	6622	6821	11385	12160	12262	6486
H1A	WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	2381	28125	0	0	0	0	0
H28	MUNITIONS TECHNOLOGY	23376	26197	23242	17886	13792	13929	19257
WA2	GREEN ARMAMENTS TECHNOLOGY	5335	0	0	0	0	0	0
WA3	CORROSION MEASUREMENT AND CONTROL	3240	0	0	0	0	0	0
WA4	ARMAMENT SYSTEMS NETWORK IA CENTER	3334	0	0	0	0	0	0
WA5	HOMELAND DEFENSE TECHNOLOGIES	4668	0	0	0	0	0	0
WA6	NANOTECHNOLOGY CONSORTIUM	952	0	0	0	0	0	0
WA7	PUBLIC-PRIVATE PARTNERSHIP, NON-MUNITIONS	1668	0	0	0	0	0	0
WA8	SEAMLESS DATA DISPLAY	1430	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) designs and matures improved weapon and munitions technologies to enable combat overmatch for the Future Force with a focus on meeting requirements of the Future Combat Systems (FCS). Efforts in this PE result in increased system lethality and survivability with the potential for better affordability, lower weight and reduced size. Projects H18, H19, and H28 support the FCS 120mm Line-Of-Sight (LOS) Beyond-Line-Of-Sight (BLOS) System Advanced Technology Demonstration (ATD). The ATD's objective is to mature and evaluate 120mm LOS and BLOS armament system components and ammunition suite in support of the FCS Increment 1 Mounted Combat System (MCS). This effort will incorporate System Requirements Analysis and establishment of Best Technical Approach (BTA) to support Lead Systems Integrator (LSI) prime contractor detailed MCS design. The ATD will mature advanced materials, advanced recoil techniques, and electrical ignition to overcome the challenges of creating a smaller, lighter armament system with lethality equaling or exceeding that of current systems. Projects H18, H19, and H28 also support the corresponding MCS Ammunition System Technologies to develop lighter weight armament components to enhance both the performance and stowed ammo capabilities of the FCS Increment 1 120mm LOS/BLOS armament system.

Other major efforts in Project H18 include the Objective Non Line Of Sight (NLOS) Mortar Technology program, which provides a 120 mm breech loaded

mortar weapon to meet FCS range and firing rate performance requirements; advanced laser radar/infrared (LADAR/IR) sensor technology to enhance performance of smart munitions; technology advances in acoustic sensors; and the Future Intelligent Munition (FIM) which will provide the FCS Intelligent Munition System (IMS) with an improved munition, which covers a greater area of terrain with fewer munitions and supports remote delivery at tactical and operational ranges using a variety of delivery platforms (i.e., artillery, rocket, missile, vehicular, and mortar). Project H19 will define, mature and evaluate a breadboard/brassboard Agile Target Effects System (ATES) to suppress/defeat close in threats to the FCS. Project H28 focuses on simultaneously increasing lethality and reducing system weight and includes the development of advanced warheads (both shaped charge and explosively formed penetrators); the maturation of modeling and analytic codes for thermal analysis; and high impetus, low flame temperature propellants to reduce wear on gun tubes, which degrades accuracy and increases the system cost. 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 program element contains no duplication with any effort within the Military Departments. This work is performed by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), at Picatinny Arsenal, New Jersey.

Work in this PE is related to, and fully coordinated with, efforts in PE 0602618A (Ballistics Technology) and PE 0602623A (Joint Service Small Arms Program (JSSAP), and its technologies typically transition to PE 0603004A (Weapons and Munitions Advanced Technology) and PE 0603802A (Weapons and Munitions Advanced Development).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	72504	39485	45598
Current Budget (FY 2005 PB)	71917	75266	44666
Total Adjustments	-587	35781	-932
Congressional program reductions		-705	
Congressional rescissions			
Congressional increases		38300	
Reprogrammings	-587	-1814	
SBIR/STTR Transfer			
Adjustments to Budget Years			-932

Significant Change Explanation:
FY04 - Fifteen FY04 Congressional adds totaling $38300 were added to this PE.

FY04 Congressional Adds with no R-2As:
($890) Advanced Materials and Processes for Non-Munition Armament Structures Program, Project H1A: The purpose of this one year Congressional add is to research the use of metal matrix composites, titanium alloys, advanced aluminum alloys, and functionally gradient materials. No additional funding is required to complete this project.

($1965) Applied Research Integration, Project H1A: The purpose of this one year Congressional add is to investigate new conventional and advanced energy weapons systems. No additional funds are required to complete this project.

($3652) Armaments Information Assurance, Project H1A: The purpose of this one year Congressional add is to develop a homeland defense network for reporting and disseminating from unattended sensors for "situational awareness." No additional funds are required to complete this project.

($3933) Army Welding Technology Development Initiative, Project H1A: The purpose of this one year Congressional add is to design, develop and implement a management system to ensure the introduction of critical materials joining technologies to Army defense contractors, suppliers, and depots for armament system needs. No additional funds are required to complete this project.

($4589) Green Armaments Technology, Project H1A: The purpose of this one year Congressional add is to fund research in green armaments technology at Picatinny Arsenal. No additional funds are required to complete this project.

($2622) Homeland Defense Technologies, Project H1A: The purpose of this one year Congressional add is to establish a multi-acre site that will serve as a dual use Armament Development and Homeland Security/Defense Research and Training area. No additional funds are required to complete this project.

($3278) RangeSafe Technology Demonstration Initiative, Project H1A: The purpose of this one year Congressional add is to develop and evaluate technologies for remediation of Army firing ranges. No additional funds are required to complete this project.

($1311) Seamless Data to Display, Project H1A: The purpose of this one year Congressional add is to conduct research in data display technologies for weapons systems. No additional funds are required to complete this project.

($3651) Smart Coating Material Program, Project H1A: The purpose of this one year Congressional add is to conduct research in the next generation of coatings for Army materiel through the use of nanotechnology. No additional funds are required to complete this project.

($1311) Titanium Extraction Mining and Process Engineering Research (TEMPER), Project H1A: The purpose of this one year Congressional add is to

identify and develop new extraction and mining technologies that will significantly reduce the cost of titanium for Army systems. No additional funds are required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H18	ARTY & CBT SPT TECH	15973	14322	14603	14114	15208	15317	15605

A. Mission Description and Budget Item Justification: This project focuses on applied research of technologies for 120mm LOS BLOS cannon, mortar weapon, smart munitions, fire control and combat support systems in support of FCS increment 1 and the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Specific efforts include FCS 120mm LOS BLOS System Advanced Technology Demonstration (ATD); Objective Non Line Of Sight (NLOS) Mortar Technology; Advanced Sensors for Smart Munitions; and Advanced Acoustic/Seismic Systems. Efforts beginning in FY04 include: MCS Ammunition System Technologies (MAST); Common Smart Submunition; Lightweight Dismounted Mortar Weapon; and Future Intelligent Munition. MAST will mature technologies to enhance the capabilities of FCS Increment 1 120mm LOS/BLOS munition suite for the MCS through spiral technology insertion. LOS/BLOS/NLOS Gun Enhancements development includes utilization of lightweight materials and advanced recoil mitigation technologies to enhance or create more lethal, lightweight armaments. Advanced acoustic sensors will be investigated for providing non-line of sight target cueing for a variety of weapons platforms. Technologies for reducing artillery target location error, for providing real time targeting data to fire direction centers and enhancing functionality of sensor inter-networking are being matured to support information dominance strategies for FCS. Improved smart munitions will be pursued for FCS NLOS and area denial capabilities that 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, reducing logistic burden. 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 Arsenal, New Jersey and the Army Research Laboratory at Aberdeen Proving Ground, Maryland.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Objective NLOS Mortar Technology: In FY03, completed kinematics analysis on selected configuration; established the hardware design of the breech loaded, recoiling mortar. At the end of FY 03, designs and models generated were transitioned to support the maturation and demonstration effort under PE0603004A.	3771	0	0
Advanced Sensors for Smart Munitions: In FY03, fabricated smart sensor component hardware and performed captive flight test; concluded sensor suite packaging analysis for smart munitions. This effort will transition to the Common Smart Submunition Program for use in the work described in PE0603004A	1790	0	0
Networked Sensors for the Future Force ATD: In FY03, evaluated acoustic sensor system to accurately locate artillery and mortar fires to cue AN/TPQ-36/37 (Fire Finder Radars); implemented the ground target classifier and target counting algorithm for integration into a real-time, high fidelity system. In FY04, develop low cost, distributed and networked unattended ground sensors.	1989	1316	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Future Intelligent Munition: In FY04, conduct system/subsystem simulations and determine best technical approach; conduct analysis to determine the on-board detector requirements of the munition in the context of the sensor technology proposed for the Intelligent Munition System and FCS. In FY05, will begin design of ground detector, air seeker and propulsion mechanism hardware along with associated electronics and algorithms.	0	855	3268
FCS 120mm LOS BLOS System: In FY03, completed detailed design of ETC propulsion and turreted armament system; conducted gun testing of cartridge case and seals with ETC ignition and kinetic energy (KE) composite sabot; continued laboratory demos of shaped charge (SC) and explosively formed penetrator (EFP) warheads. Conducted maneuverability analysis and preliminary guidance and control design for laboratory testing. In FY04, complete system integration laboratory demo of fire control functionality; complete functional demos (TRL6) of launcher and autoloader prototypes; conduct turret manufacturing/integration; conduct Guide-To-Hit test of MRM with single mode seeker. Conduct High-g tests of multi-mode sensor components for MRM.	4045	5882	0
LOS/BLOS/NLOS Armament System Technologies: In FY05, will initiate and complete light weight armament component optimization and design; will complete modeling, analysis, and design of fully automated ammunition handling resupply module for main gun and secondary armament dual feed with reduced logistics tail; will develop fire control techniques for improved accuracy through in-flight communication at extended ranges and improved gun pointing	0	0	8364
MCS Ammunition System Technologies (MAST): In FY04, complete initial designs and fabricate improved proximity sensor for LOS Multi-Purpose (MP) projectile.	0	1850	0
Common Smart Submunition: In FY04, begin system design, risk assessment, and trade studies to baseline metrics for hard and soft carrier applications, and operational performance of sensor and lethal mechanism design requirements. In FY05, will design and build critical subsystems for breadboard sensor and electronics evaluation prior to full function submunition integration.	0	854	2971
Lightweight Dismounted Mortar Weapon: In FY04, conduct analysis of material options to assess viable candidates for thermal, dynamic and economical feasibility; fabrication of mock-ups will be conducted for mechanical assessment. Beginning in FY2005, this effort continues in PE0603004A.	0	984	0
Nanotechnology for Smart Munitions: This one year Congressional add matured nanoparticle materials and transducer devices for integration into smart munitions. No additional funding is required to complete this project.	1347	0	0
Smart Coatings: This one year Congressional add completed maturation of coatings for Army materiel that are self-healing and have advanced attributes such as providing camouflage. No additional funding is required to complete this project.	1684	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Applied Research Integration: This one year Congressional add investigated new armament and fire control technologies to increase lethality for lighter Army systems in the future. Technologies explored include warheads, fire control, fuzing, smart munitions/algorithms, directed energy, etc. No additional funding is required to complete this project.	1347	0	0
Acoustic Counter Battery System: The purpose of this one year Congressional add is to continue development of a passive acoustic sensing system to detect and locate hostile artillery fires and to provide targeting data to fire direction centers. No additional funding is required to complete this project.	0	2350	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	231	0
Totals	15973	14322	14603

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H19	CLOSE COMBAT WEAPONRY	9560	6622	6821	11385	12160	12262	6486

A. Mission Description and Budget Item Justification: This project focuses on applied research and technology for maneuver and fire support cannon armament systems in support of FCS and the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The project conducts research in technologies that will result in significantly greater lethality with more accurate delivery, significantly reducing logistics footprint while reducing life cycle costs for ground and air combat platforms. This project provides opportunities for longer range, more accurate and more lethal cannon systems for armored vehicles, to include enabling technologies to support FCS. Principal efforts support the ammunition suite for the FCS for rapid extended range defeat of high value targets out to 8km+, expanding the maneuver commander's battle area 7-fold. This project funds modeling and simulation of advanced armament systems leading to application for FCS. Cannon design technologies include: recoil mitigation techniques for use of large caliber cannons on lightweight (less than 20 ton) vehicles and a novel chamber configuration, leading to overall compact armament system configurations. Advanced barrel coating technology, utilizing cylindrical magnetron sputtering (CMS) of refractory alloys, is being pursued to provide extended barrel life for tanks, artillery and FCS cannon systems, with potential to provide an environmentally friendly process as a future replacement for electro-deposition of chrome plating. This project will mature advanced multi-mode fuzing technologies including some lower cost, self-destruct technologies for submunitions that could reduce unexploded ordnance on the battlefield and provide low cost electronic safe and arm devices for single and future multi-mode warheads. The project also matures extended range munitions and alternative mechanisms to defeat advanced armor systems. Both hardware and analytical tools will be matured and used to assess system performance, identify problem areas and formulate solutions. This project matures and evaluates a breadboard/brassboard Agile Target Effects System (ATES) that delivers a synergistic combination of directed energies to suppress/defeat close in threats to the FCS. The project also matures advanced on-board munition power systems with increased energy and power densities, increased mission time, improved temperature performance and reduced volume and weight for the Objective Force. 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 Arsenal, New Jersey and the Army Research Laboratory at Aberdeen Proving Ground, Maryland.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
FCS 120mm LOS BLOS System: In FY03, completed test firing of 105 swing chamber gun system, formulated design of lightweight 120mm cannon, autoloader, fire control, advanced propulsion and turreted armament system; conducted initial system component demonstration; conducted high-G tests of beyond line of sight (BLOS) projectile sensor components; optimized multimode warheads in prototype projectile designs. In FY04, evaluate Advanced KE with novel penetrator by firing against future heavy armor target.	6048	2633	0
MCS Ammunition System Technologies (MAST): In FY04 complete initial designs and initiate fabrication of LOS-MP projectile.	0	548	0
LOS/BLOS/NLOS Armament System technologies: In FY05, will conduct dynamic modeling and analysis of FCS Increment 1 armament system to determine methods of increasing gun elevation capability through the reduction in recoil swept volume enabled through advanced propellant venting. Develop candidate concepts for propellant venting, fabricate and demonstrate most promising concepts to assess integration impacts and validate recoil reductions predicted in models.	0	0	3995
Agile Target Effects (ATE): In FY03, identified Agile Target Effects laser and microwave sources and determined reduction of energy source power required to defeat selected targets due to synergistic effects; developed enhanced dazzler energetic material using nano-particles. In FY04, integrate selected directed energy sources into brassboard ATE weapon system and determine effectiveness and benefit of synergy against representative target(s). In FY05, will complete detailed concept design of ATE system; will conduct feasibility demonstrations of major ATE components with reduced size/weight/power and will continue ATE effects investigations on selected targets to refine/enhance system design requirements.	3512	3386	1460
Common/Modular Power Source for Munitions: In FY05, will design configuration and testing of advanced energy systems with higher power densities, including concepts for alternate/hybrid systems, and will perform modeling of advanced thermal battery technology.	0	0	1366
Small Business Innovative Research/Small Business Technology Transfer Programs	0	55	0
Totals	9560	6622	6821

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H28	MUNITIONS TECHNOLOGY	23376	26197	23242	17886	13792	13929	19257

A. Mission Description and Budget Item Justification: This program advances the state of the art for enabling technologies supporting the FCS and the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The project focuses on achieving increased lethality using smaller and lighter weapon systems with smaller and lighter armaments. The project funds maturation of warheads, both shaped charge (SC) and explosively formed penetrators (EFP); high energy explosives; large-caliber gun propellants with barrel wear reducing additives; insensitive munitions (IM); energetics; advanced materials/processes for warheads; and techniques/processes to address material corrosion. Novel warhead architectures, new initiation techniques and advanced material technologies are being applied to produce smaller, lighter, more effective, multi-role warheads having advanced warhead liners to defeat existing and projected targets more efficiently. Aerostable EFP designs will be investigated to enable target defeat from greater standoff range to counter threat Active Protection Systems. High-energy, high-density explosives are being matured to increase lethality and optimize design performance. New improved energetic materials provide numerous transition opportunities for weapon system upgrades and FCS. High-impetus propellant formulations, optimized for Electrothermal Chemical Initiation (ETI), offer increased muzzle kinetic energy, precision ignition and unmatched repeatability. The integrated propellant and explosive insensitive munitions program will increase the battlefield survivability of land combat systems and enhance overall safety at manufacturing plants, storage depots, and during air and sea transport. Efforts under this project support the FCS 120mm LOS BLOS System ATD and MAST, which mature and evaluate a lightweight, multi-role armament and ammunitions system. Analysis and maturation of Multiple-EFP warheads also supports the Army's Full Spectrum Active Protection System (APS) research and development, performed by the Tank Automotive Research Development and Engineering Center (TARDEC) under Program Element (PE) 0603005A. 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 Arsenal, New Jersey and the Army Research Laboratory at Aberdeen Proving Ground, Maryland.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
FCS 120mm LOS BLOS System ATD: In FY03, used small-scale (pilot) process to prove feasibility of an environmentally friendly process for a selected explosive formulation. Delivered 200 pounds of the candidate high-energy and high blast, insensitive explosive formulations for testing in FCS warheads; tailored selected multi-purpose SC and EFP warhead designs for fabrication in the optimum FCS munition configuration. In FY04, fabricate, characterize and assemble FCS propellant charges for full-up firing demo of ETI propulsion capability; conduct warhead demo of MRM warhead.	8681	8741	0
MCS Ammunition System Technologies (MAST): In FY04, complete initial propulsion and warhead designs, fabricate and conduct initial warhead laboratory tests of Line Of Sight-Multi Purpose (LOS-MP) munition. In FY05, will complete warhead demonstrations of LOS MP for airburst capability; will optimize Electronic Safe & Arm (ESA) subsystem of multi-effects warhead; will complete design of advanced propulsion providing precision ignition and hot performance across entire temperature range.	0	1747	9002
Full Spectrum Active Protection (FSAP)/Integrated Survivability: In FY03, successfully evaluated lethality of active protection system (APS) warhead designs to defeat kinetic energy (KE) penetrators, anti-tank guided missiles (ATGMs) and rocket propelled grenades (RPGs); successfully evaluated initial tactical warhead design for FSAP counter-munition. In FY04, integrate APS warhead into counter-munition; optimize warhead design with system fuzing. In FY05, will conduct dynamic testing of optimized APS warhead integrated into counter-munition. This task is complementary to and fully coordinated with work accomplished in PE0602601A and supports demonstration of APS, conducted under PE0603005A.	1500	1776	2060
Novel Energetic Materials for the Future Force: In FY03, evaluated nanometals and nanoalloys for advanced gun propellant and explosive formulations; matured new processing technologies for nanomaterials. In FY04, characterize candidate energetic materials and assess energetic system concepts exploiting managed energy release for advanced gun propellant and explosive formulations. In FY05, will define matrix of energetic materials technologies for advance gun propulsion and advanced explosives for warhead applications.	3000	2920	3800
Hardened Combined Effects Penetrator Warhead Technology: In FY04, conduct hardened shaped charge warhead modeling/design evaluation and initial baseline hardware experimentation including armor penetration, MOUT targets and baseline fragmentation. In FY05, will determine bash-through loads for key targets; will mature hardening techniques and hardened designs of the penetrator; will evaluate candidate multi-purpose energetic materials including energetics structural integrity.	0	973	4706
Multiple Effects Warhead Technology: In FY04, mature and evaluate a revolutionary Gen II EFP warhead concept for FCS smart munitions. An EFP, 1-3 caliber long, will be designed and evaluated. In FY05, will optimize Gen II design with aerostable tail configuration and demonstrate enhanced penetration capability at standoff greater than 50 meters.	0	1564	3197

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Common/Modular Power Source for Munitions: In FY05, will begin design configuration and testing of advanced energy systems with higher power densities, including concepts for alternate/hybrid systems, and will perform modeling of advanced thermal battery technology.	0	0	477
Generation 2 Warhead Development (X-caliber) Explosively Formed Penetrator (EFP): In FY03, this Congressional add supported the design iterations of a Gen-2 warhead (x-caliber) EFP to achieve a greater than 1.5 caliber penetrator. In FY04, the Congressional add will support the design iterations to achieve an Aerostable Gen-2 (x-caliber) EFP hitting targets at greater than 50 meters. No additional funds are required to complete this project.	1340	1984	0
Tandem Explosively Formed Penetrator Warhead Systems: In FY04, the purpose of this one year Congressional add is to develop warhead technology to enable a next generation LOS/NLOS missile and projectile system that can guide to hit for high probability of kill. No additional funds are required to complete this project.	0	945	0
Liquidmetal Alloy-Tungsten (LA-T) Armor Piercing Ammunition: The purpose of this Congressional add is to investigate the properties and performance of liquid metal tungsten alloy penetrators. In FY03, optimized the bulk-density and mechanical properties of amorphous tungsten-alloy penetrator material for greater launch survivability and penetration performance while upgrading the manufacturing process to produce larger scale parts for possible 30mm GAU-8 applications. In FY04, the purpose of this add is to optimize the manufacturing process for long-term producibility and production-readiness while altering the penetrator material for Long-Rod Armor Piercing Applications. No additional funds are required to complete this project.	4068	1489	0
Single Crystal Tungsten Alloy Penetrators: This Congressional add investigates the potential of single crystal tungsten as a viable candidate material to replace depleted uranium for use as kinetic energy penetrators. In FY03, developed a chemical vapor deposition process to manufacture oriented single crystal tungsten billets for ballistic evaluations. In FY04, the purpose of this add is to perform surface engineering processes on sub-scale penetrator rods to eliminate parasitic in-flight fracturing and enhance the ballistic performance of the oriented single crystal tungsten penetrator rods fabricated by the chemical vapor deposition process. No additional funds are required to complete this project.	2872	1417	0
Modular Artillery Charge System (MACS) High Zone Development: The purpose of this one year Congressional add is to develop hybrid propellant for the M232. No additional funds are required to complete this project.	0	1984	0
M795, Extended Range, High Explosive Baseburner Projectile: In FY03, this one year Congressional add supported the maturation of a M795 extended range high explosive projectile. No additional funds are required to complete this project.	1915	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	657	0
Totals	23376	26197	23242

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	61510	76809	41236	45919	43609	42780	43329
EM4	ELECTRIC COMPONENT TECHNOLOGIES (CA)	0	6971	0	0	0	0	0
EM6	HEATING AND COOLING TECHNOLOGIES (CA)	0	4357	0	0	0	0	0
EM7	POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)	0	28987	0	0	0	0	0
H11	BATTERY/IND POWER TECH	32944	7087	12362	16702	13050	12172	12237
H94	ELEC & ELECTRONIC DEV	28566	29407	28874	29217	30559	30608	31092

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 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 to provide electronic components, power components, frequency control and timing devices, display technologies, and low-cost, lightweight, high-energy density power sources for communications, target acquisition, and miniaturized displays, for applications such as the Future Combat Systems (FCS) and soldier systems. This program 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, magnetic materials, ferroelectrics, microwave and millimeter-wave components, batteries, electromechanical systems (engine generator sets) and fuel cells. Supported systems 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. Work in this PE is related to and fully coordinated with efforts in PE 0602120 (Sensors & Electronic Survivability), PE 0602782 (Command, Control, Communications Technology), PE 0602709 (Night Vision Technology), PE 0602783 (Computer and Software Technology), PE 0603008 (Command, Control, Communications Advanced Technology), and PE 0603772 (Advanced Tactical Computer Science and Sensor Technology). The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work is 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 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	59682	33694	42005
Current Budget (FY 2005 PB)	61510	76809	41236
Total Adjustments	1828	43115	-769
Congressional program reductions		-673	
Congressional rescissions			
Congressional increases		45640	
Reprogrammings	1828	-1852	
SBIR/STTR Transfer			
Adjustments to Budget Years			-769

Significant Change Explanation:
FY04 - Twenty FY04 Congressional Adds totaling $45640 were added to this PE.

FY04 Congressional adds with no R-2A:
($1879) E-Beam Reticle and Lithography Inspection, Project EM4: The purpose of this Congressional add is to investigate E-Beam reticles and lithography. No additional funding is required to complete this project.
($3946) Electronics and Electronic Devices, Project EM4: The purpose of this Congressional add is to research electronic devices. No additional funding is required to complete this project.
($939) Flexible Polymer Multilaminate Packaging, Project EM4: The purpose of this Congressional add is to research flexible polymer multilaminate packaging. No additional funding is required to complete this project.
($939) Heat Actuated Coolers for Portable Military Applications, Project EM6: The objective of this Congressional add is to research and develop injection pumps and micro-channel heat exchangers. No additional funding is required to complete this project.
($3288) Transcritical CO2 Environmental Control Unit, Project EM6: The objective of this Congressional add is to mature environmental control system components and demonstrate improved cooling technology. No additional funding is required to complete this project.
($1598) 1.5V Cylindrical Cell - Metal Oxide Cathode, Project EM7: The objective of this Congressional add is to mature lithium copper oxide and lithium-air batteries for CIA applications. No additional funding is required to complete this project.
($1127) 1.5V Alkaline Cylindrical Cell - Metal Oxide Cathode, Project EM7: The objective of this Congressional add is to mature an alkaline

battery for CIA applications. No additional funding is required to complete this project.
($1315) Vehicle Battery Health Monitoring System, Project EM7: The objective of this Congressional add is to mature status monitoring systems for lead-acid batteries. No additional funding is required to complete this project.
($1409) Advanced Liquid Silicon Rechargeable Battery, Project EM7: The objective of this Congressional add is to mature a safe, non-flammable, high-energy density, polymer rechargeable battery for Land Warrior systems. No additional funding is required to complete this project.
($3193) Advanced Power, Project EM7: The objective of this Congressional add is research power management systems for Army Tactical Operation Centers, shelters, and generators. No additional funding is required to complete this project.
($2818) Center for Advanced Fuel Cell Technology (UND), Project EM7: The objective of this Congressional add is to mature new materials for fuel cells as well as new process developments. No additional funding is required to complete this project.
($2349) Cylindrical Zinc Air Battery for Objective Force Soldier, Project EM7: The objective of this Congressional add is to mature a higher performance zinc-air cylindrical cell for the Land Warrior hybrid battery. No additional funding is required to complete this project.
($3193) Dry Polymer Electrolyte Development for Safe Soldier Power, Project EM7. The objective of this Congressional add is to develop technology for extruding dry polymer battery electrodes. No additional funding is required to complete this project.
($4698) Enhanced Wireless Digital Communications for the Army's Urban First Responder, Project EM7: The objective of this Congressional add is develop a wireless RF-location and digital communication system for Homeland Security urban first responders and for the Army. No additional funding is required to complete this project.
($1315) Enhanced Wireless Digital Communications, Project EM7: The objective of this Congressional add is to develop wireless RF-location and digital communication system for Army urban first responders. No additional funding is required to complete this project.
($1353) Micro and Miniature Fuel Cells, Project EM7: The objective of this Congressional add is to produce demonstration systems for fuel cell systems that provide power for soldier applications. No additional funding is required to complete this project.
($1315) Portable Reforming on the Battlefield, Project EM7: The objective of this Congressional add is to develop a portable reforming system for a proton exchange membrane fuel cell (PEMFC) power source. No additional funding is required to complete this project.
($1409) Rechargeable Cylindrical Cell System – Lithium Ion / Nickel Metal Hydride, Project EM7: The objective of this Congressional add is to develop the fast recharge NiMH cell and fat "D" lithium ion cell for Army standard batteries. No additional funding is required to complete this project.
($1034) Soldier Fuel Cell System, Project EM7: The objective of this Congressional add is to develop mixed hydrides to improve hydrogen storage energy density. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H11	BATTERY/IND POWER TECH	32944	7087	12362	16702	13050	12172	12237

A. Mission Description and Budget Item Justification: This project conducts applied research to identify, advance and enhance emerging power generation and power management technologies for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. There is a critical need for ultra-lightweight man portable power, chargers, and power management for the dismounted soldier in support of Land Warrior and Objective Force Warrior (OFW). Mobile electric power sources that are smaller and more fuel-efficient are key enablers for tactical sustainability and survivability. This project researches advancements in energy conversion, electrochemistry, and signature suppression technologies, including those for primary batteries, rechargeable battery hybrids, fuel cells, power management, and components for electromechanical power generation. It will provide (1) high energy and high power density hybrid power source components that combine the best features of individual power technologies, (2) rapid recharging systems, and (3) power management through low power design tools and software operating system dynamic power management. It will provide the OFW 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 Portable and Mobile Power Sources for the Future Force program will mature various emerging power source technologies to provide portable high energy, low weight power sources for Land Warrior, the Objective Force Warrior, and mobile electric power sources for Future Force platform applications.

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 Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Portable and Mobile Power for the Future Force: Research hybrid power sources and power management technologies in order to decrease soldier load, increase power capabilities, decrease battery costs, and address tactical mobile electric power needs. Investigate component power technologies that will provide higher energy, reduced weight, quiet, more fuel and cost efficient power sources, generators, silent mobile power sources, charger, and power management systems. In FY03, designed fuel cell component system for fuel reformer and direct fuel conversion; demonstrated system level smart charger technology for mobile platforms with 2.5 hour recharge for LI7 battery; demonstrated a 4 pound, 200 Watt-hour/kilogram (Wh/kg) metal-air/lithium battery hybrid power source with a 300 Wh/kg re-fuel; simulated power profiles and system specific static power management procedures. In FY04, investigate 10 kilowatt proof-of-concept system components leading to quiet, smaller, and fuel-efficient generator; investigate a safe 2 pound 170 Wh/kg lithium-ion polymer rechargeable LP10 battery; investigate and mature power management approaches for soldier systems. In FY05, will investigate system level smart charger technology with 2 hour recharge integrated for LP10 battery. Will investigate a lighter weight 3.5 pound, 250 Wh/kg battery hybrid power source with a 350 Wh/kg re-fuel. Will investigate fuel cell reformer components for 1-2 kilowatt system for scout vehicle silent watch. Will investigate and mature logistic fueled Stirling engine generator components for silent soldier power. Will mature power management techniques to reduce operating system power draw for soldier systems by 50%.	4326	6911	12362
- Logistics Fuel Reformer Development Program: This one year congressional add integrated microchannel reformer technology components into an integrated system for both a man-portable methanol fuel reformer and a multi-kilowatt sulfur-laden fuel reformer. No additional funding is required to complete this project.	1666	0	0
- Center for Advanced Fuel Cell Technology: This one year congressional add researched micro fuel cell technologies to include (1) new electrolytes and catalysts, (2) improved membranes, and (3) heat and water management. No additional funding is required to complete this project.	1907	0	0
- Soldier Fuel Cell System: This one year congressional add evaluated a prototype fuel cell hydrogen storage system under various combat scenarios. No additional funding is required to complete this project.	1002	0	0
- Cylindrical Zinc Air Battery for Land Warrior Applications: This one year congressional add investigated and integrated the Cylindrical Zinc Air Battery for Land Warrior. No additional funding is required to complete this project.	955	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Improved High Rate Alkaline Cell (or CFx): This one year congressional add incorporated cells into batteries and tested under various simulated equipment load scenarios. No additional funding is required to complete this project.	955	0	0
- Rechargeable Cylindrical Cell System - Lithium Ion/Nickel Metal Hydride: This one year congressional add tested and evaluated Rechargeable Cylindrical Cell System under extreme temperatures. No additional funding is required to complete this project.	955	0	0
- Dry Polymer Extrusion for Battery Cathode and Electrode Research: This one year congressional add researched high conductivity electrodes and electrolytes that will be incorporated in cells for testing and evaluation. No additional funding is required to complete this project.	3530	0	0
- Extrusion on Multilaminate Battery Packaging: This one year congressional add incorporated multilaminate film packaging into lithium-ion cells for test and evaluation. No additional funding is required to complete this project.	4292	0	0
- Solid State Polymer Battery for Land Warrior System: This one year congressional add investigated lithium-ion cells with newly developed high-conductivity polymer electrolyte. No additional funding is required to complete this project.	955	0	0
- Liquid Silicone Lithium Rechargeable Battery: This one year congressional add investigated additives to decrease the flammability of electrolytes. No additional funding is required to complete this project.	1431	0	0
- Zinc Air Power Sources for ABN, SOFs & USMC: This one year congressional add developed the BA-8180 zinc air batteries for use as an extended life power sources for military communications equipment. Batteries were provided to the USMC, Army airborne, and SOF and are now being used in South West Asia. No additional funding is required to complete this project.	973	0	0
- Miniature and Micro Fuel Cells: This one year congressional add investigated materials and stacks for miniature and micro fuel cell applications. No additional funding is required to complete this project.	3339	0	0
- Portable Hybrid Electric Power Systems: This one year congressional add investigated methanol concentration measurement and control issues, system balance-of-plant optimization and control, direct methanol fuel cell/Lithium-ion hybridization issues, and model development including both detailed and system-level models. No additional funding is required to complete this project.	1334	0	0
- Intell Power Control for Sheltered Sys: This one year congressional add investigated small, modular, and intelligent power distribution systems. The effort demonstrated a remote monitoring and control integrated power management system for a vehicle shelter, and studied the potential power management of unmanned ground systems, unmanned ground vehicles, and on-the-move vehicular systems. No additional funding is required to complete this project.	3624	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Block II Stryker Environmental Control Units: This one year congressional add developed prototype transcritical carbon dioxide based cooling system which was installed and tested in an up-armored HMWWV vehicle. No additional funding is required to complete this project.	1700	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	176	0
Totals	32944	7087	12362

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H94	ELEC & ELECTRONIC DEV	28566	29407	28874	29217	30559	30608	31092

A. Mission Description and Budget Item Justification: This project conducts applied research in electronics and electronic devices to support advanced power and energy generation and storage, Command, Control, Communications, Computers (C4) and Intelligence, Surveillance and Reconnaissance (ISR) technologies for the Future Combat Systems (FCS) and the Future Force. This research supports thrusts aimed at enhanced battlefield situational awareness, increased vehicle mobility, reduced acquisition cost, and reduced operations and support costs.

Areas of investigation include: Low noise clock 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 applications and FCS. The fabrication of novel structures on new electronic materials, such as langasite for oscillators or molecular beam epitaxy (MBE) of superlattices, 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 processes. This project also funds the flexible display initiative. This project will serve to enhance the survivability, lethality, and mobility of future Army platforms by enhancing their survivability electronics suite, increasing ranges, while decreases time lines, for target acquisition sensors, and evolving more efficient, controllable power sources, and displays. This program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Mature components and software for C4 technology. Mature affordable design concepts for an integrated radio frequency sensor which performs radio, radar, and control functions to allow communications, combat identification (ID), target acquisition and track, active protection, and munition command guidance through a single antenna for use on small ground and air vehicles. Perform research in advanced tactical software tools for mobile, ad hoc network access control, intrusion detection, and authentication techniques for the Future Force. In FY03, integrated solid state modules into Electronic Scan (Escan) antenna. Identified vulnerabilities in mobile ad hoc networks and devised cooperative intrusion detection approach that minimizes bandwidth required to protect Future Force Networks. In FY04, complete design and testing of planar, polarimetric radiating elements for wide bandwidth mmW arrays; and identify automated deployment techniques and verify their robustness through experiments. In FY05, complete True Time Delay beam steering in 2 dimensions for widebandwidth, high-resolution RF sensors and provide techniques and software codes for autonomous use in the field to prevent intrusions and to repel attacks.	1762	1550	1600
- Investigate micro and nano technology for small low cost highly reliable RF MEMS switches, resonators and filters for multifunction. In FY03, fabricated Aluminum Nitride (AlN) resonators for high frequency filter applications. In FY04, establish reliability testing of 1st generation AlN MEMS resonators and design 2nd generation resonators for high frequency filter applications. In FY05, examine the performance of E-Beam lithography in patterning nanoscale RF structures for FCS and future Soldier communications.	750	1150	1125
- Investigate and mature silicon carbide (SiC) power device and high-temperature packaging technologies to enable high power density, high-temperature converters for motor drive applications for FCS. In FY03 fabricated SiC power devices, custom high-temperature AlN substrates/modules and investigated/showed power sharing capability among paralleled SiC devices for high-temperature power conversion and world's first high-temperature bi-directional SiC switch for motor drive applications. In FY04, fabricate and validate a10 kilowatt (kW) silicon carbide (SiC)-based high-temperature modified matrix converter (MMC) for alternating current (AC) motor control and 50 kW high-temperature SiC diode power modules for direct current - direct current (DC-DC) conversion applications. In FY05, implement a high-temperature controller circuit for 10 kW matrix converter.	1800	1600	375

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Design highly stable, low-acceleration sensitivity, low-noise oscillators, by integrating the high quality factor of photonic resonators and conventional microwave components for improved Future Combat System radar systems engaging in slow moving target detection. In FY03 assessed noise characteristics for fiber optic opto-electronic oscillator (OEO) and model performance. In FY04, evaluate performance of microsphere based OEO with performance suitable for moving target indicator (MTI) sensors. In FY05, test phase locked cavity based stabilized local oscillator (STALO) with RF front ends.	2900	2400	1900
- Investigate new component materials, structures and EM issues to enhance the performance of Millimeter Wave (mmW) components and active devices, such as vacuum electronic (VE) devices and millimeterwave integrated circuits (MMICs), and to enhance integration. In FY03, completed phase II fabrication of Ka- and Q band millimeter VE tubes. In FY04, devise VE tubes for millimeter power modules (MMPMs) for EW and radar applications. In FY05, integrate VE tube with semiconductor amplifier and power supply in MMPMs and characterize. Evaluate new components to support design of next generation mmW active apertures.	1700	1880	2319
- Research and design improved, millimeter-wave solid-state devices based on new device materials and structures to achieve higher output power, power-added-efficiency, linearity, and dynamic range for increased operation and detection range in systems such as FCS, unmanned aerial vehicle (UAV) and soldier system. In FY03, evaluated prototypes in two-dimensional (2D) Escan and created enhanced design with new higher dynamic range MMICs from FCS-Comms program. In FY04, assess performance of microwave/millimeter wave wide bandgap (WBG) devices and circuits. In FY05, complete transmit/receive (T/R) module incorporating wide bandgap (WBG) based MMICs to support tactical unmanned aerial vehicles (TUAV) synthetic aperture radar/moving target indicator (SAR/MTI) radar.	1400	800	1500
- Investigate technology for advanced batteries, fuel reformers and fuel cells to be used in hybrid power sources for the future force warrior, future combat systems (e.g., electromagnetic armor and smart munitions. In FY03, showed early feasibility of a Li/air battery chemistry for very high specific energy battery charger. In FY04, formulate and evaluate new catalysts for efficient hydrocarbon reformation for fuel cells. In FY05, provide technology for an advanced high-energy rechargeable battery with low flammability/ good charge retention at high temperatures and for a lithium air (Li/air) battery and for fuel cell systems utilizing carbonaceous fuels. (This work is in support of project AH11.)	1400	1500	1500

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Investigate eye-safe scannerless three-dimensional (3-D) imaging laser radar for both long-range FCS and short-range unmanned ground and air vehicle applications. In FY03, showed a scannerless laser radar breadboard system in the lab. In FY04, integrate eye-safe components, laser and detector operating at 1.5 um, into LADAR breadboard system. In FY05, show an improved eye-safe version, field test, and collect data to show functionality for target acquisition and robotic navigation.	2300	475	475
- Investigate multi-color infrared (IR) imaging cameras, small pixel focal plane arrays (FPAs) capable of both passive infrared (IR) and active laser detection and acousto-optical tunable filter (AOTF) based hyperspectral imagers for target detection and identification for FCS, countermine, active protection, and other Army applications. In FY03, characterized improved long wave IR detector array devised for airborne buried mine detection tests, analyzed and reported on mid wave and long wave IR radiometric measurements of muzzle flash and kinetic energy (KE) penetrator rods in flight for active system development. In FY04, show improved long-wave IR AOTF for hyperspectral imaging. In FY05, show provision of mid-wave IR azimuth and elevation tracking information to radar kinetic energy projectile tracker for FCS vehicle survivability active protection system.	3378	2000	2100
- Research semiconductor superlattice and quantum dot materials for high operating temperature, high-performance IR detectors and mid-wave infrared (MWIR) quantum cascade lasers to reduce the cost of FCS and other Army sensors. In FY03 showed continuous-wave operation at temperatures reachable by inexpensive thermoelectric coolers. In FY04, show operation of quantum dot detectors at temperatures significantly higher than required for present state-of-the-art high-performance IR detectors, showing potential for lower-cost sensors. In FY05, show low defect density antimony-based superlattice material for future high operating temperature IR detectors.	2353	2400	2450
- Investigate optical limiter designs with promising nonlinear materials in realistic, emulated Army imaging devices for enhanced survivability. In FY03, characterized highly nonlinear reverse saturable absorbing (RSA) dyes in low f-number testbeds. In FY04 fabricate and characterize the nonlinear properties of phase change materials (such as fast switches), sacrificial materials. In FY05 characterize mercury mirrors, engineered RSA materials, two-photon absorbing materials and highly nonlinear optical materials (such as large organic molecules).	350	1000	1000

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Investigate a broad base of extremely quick, accurate, and novel photonic architectures to enable detection of hazardous substances to enhance soldier survivability. In FY04, characterize miniaturization of sensor based on Photoacoustic spectroscopy and the leveraged use of quantum cascade lasers technologies for detection of hazardous chemicals. In FY05, demonstrate concept of remote particle sizing using inversion of scattering from broad-band laser source for remote sensor applications.	0	1450	1530
- Investigate, design and fabricate a micro electro mechanical system (MEMS) based micro-power generator for producing electricity for the dismounted soldier and micro-cooling technology that can be applied to both soldier applications as well as FCS power module thermal management. In FY04, investigate, design, and mature processes to provide: 3D micro-turbine blades and passive micro-cooling systems [300 watts/centimeters squared (W/cm2)]. In FY05, fabricate and show high-temperature high-speed 3D micro-turbine blades; identify other viable approaches to micro-power generation and cooling; and show micro-cooling systems capable of 500 W/cm2.	0	1000	3000
- Investigate and evaluate prognostics and diagnostics (P&D) algorithms; design, fabricate and evaluate micro-electro-mechanical systems (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 FY04, design and show combined MEMS and nanotechnology sensor concept models. In FY05, conduct validating experiments on MEMS/nanotechnology sensors.	0	2400	3000
- The flexible display initiative will establish a university led center to devise flexible display science and technology for FCS and future Soldier applications. In FY04 devise flexible display backplane, electronics and materials. In FY05, mature flexible display technology to devise prototypes. Applied research will be conducted by the center in collaboration with the ARL, industry, and other university partners.	0	3680	5000
- Flat Panel Displays/Flexible Display Initiative: In FY03 and FY04, the objective of this Congressional add is to improve the quality of equipment and materials available from U.S. suppliers for flat panel display technologies; to identify and insert improvements into manufacturing, pre-production and pilot facilities; and to establish standards and manufacturing benchmarks for the flat panel display industry.	6779	3769	0
- Display and Development and Evaluation Laboratory: The objective of this one-year Congressional add was to conduct research in the fabrication and characterization of luminescent materials, components, and prototype display devices for flexible displays; and to create a database of information on display technologies and vendors. No additional funding is required to complete this project.	1694	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Small Business Innovative Research/Small Business Technology Transfer Programs	0	353	0
Totals	28566	29407	28874

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H95	NIGHT VISION & EO TECH	18707	21506	22617	24488	27166	28110	29417

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 covered in this PE have the 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) in support of the Future Force, and, where feasible, exploits opportunities to enhance Current Force capabilities. The Disposable Sensors project, performed in concert with Army Research Laboratory (ARL), will apply industry expertise in high volume, low cost electronic components and imaging systems to explore concepts for very low cost unattended ground sensors. The Low Power Display Components program advances helmet mounted display technology to reduce power consumption by >50 percent over existing helmet mounted miniature displays, enabling the warfighter to execute longer missions with less head-borne weight and logistics (battery) burden. The goal of this program is to produce miniature flat panel displays that consume less power, save weight and space, support both monochrome and full-color applications, have high-image fidelity, and integrate easily with current and next-generation sensors. The Distributed Aided Target Recognition (ATR) effort will research to dramatically reduce the time necessary to acquire targets, and collect intelligence data. 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 program. 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 Low Cost High Resolution Focal Plane Array (FPA) effort researches new infrared (IR) focal plane array technologies for both cooled, high performance IR FPAs and uncooled, low cost IR FPAs. The Lightweight Laser Designators program 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 Soldier Vision System Components effort 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 the Future Force Warrior program. The Tactical Hyperspectral Sensors for the Future Force effort will leverage the Defense Advanced Research Projects Agency's (DARPA) adaptable focal plane array program on high performance tunable multiband hyperspectral sensing for integration into compact ground and air vehicles. The Signal Processing for Sensors on a Chip effort will research advanced signal processing and target recognition algorithms for sensors on a chip. 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 electronics for both cooled and uncooled infrared. Work in this PE contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermine Technology), and PE 0603710A (Night Vision Advanced Tehchnology). 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 PE is performed by the Coummunications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorated (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Disposable Sensors. During FY04, conduct design trade studies, determine initial sensor mix and study exfiltration methodologies and concept of operations tradeoffs. In FY05, will fabricate initial imaging and non-imaging breadboards, develop initial embedded signal processing and fusion methodologies, and conduct a proof of principle demonstration of early warning and rear security capabilities in urban terrain.	0	1650	1650
Soldier Vision System Components. In FY03, determined via trade studies, optimal head-mounted configurations for multispectral indirect view pixel fusion components and investigated a miniature 1280 x 1024 video-based low light level mobility sensor. Assessed pixel fusion processors with image registration, non-uniformity correction, and video optimization algorithms. In FY04, develop imaging brass board helmet mounted 1280 x 1024 image intensifier and electron bombarded video-based mobility sensor and uncooled forward looking infrared (FLIR). Develop a small pixel 1280 x1024 or larger color micro display and low power uncooled FLIR electronics. Evaluate initial pixel fusion of multisensor imagery vision board sets with low light sensor and down select the best design. In FY05, will develop 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. Will develop and evaluate large format (1600 x 1200/High Definition TV) low light video sensors for phase II Objective Force Warrior transition.	1149	5240	5310
Warrior Extended Battlespace Sensors. In FY03, tested and delivered affordable infrared micro-cameras for netted micro-sensor field applications; uncooled infrared sensor materials for stable low cost infrared cameras; and acoustic and infrared image sensor fusion algorithms for positive target identification and multiple target deconfliction. Transitioned to Networked Sensors for the Future Force ATD, “smart” sensor nodes for target location & tracking utilizing acoustic, seismic & magnetic sensors; IR & visible image pointing; reporting target information and images to command and control echelon. Tested and evaluated acoustic/IR imaging fused detection & tracking algorithms and delivered very low cost IR micro-cameras based on commercial IR camera manufacturing to the Networked Sensors for the Future Force ATD.	3666	0	0

Accomplishments/Planned Program B(continued)	FY 2003	FY 2004	FY 2005
Low Power Display Components. In FY03, evaluated full color 1280x1024 display components for see-through and high-resolution applications. Completed testing and evaluation of ambient optical-channel attenuators and color optics to enhance display performance. Transitioned 1280x1024 Active Matrix Liquid Crystal Display (AMLCD) to Comanche (flight testing began spring 2003). Transitioned 800x600 Active Matrix Organic Light Emitting Diode (AMOLED) to Land Warrior system (testing began summer 2003).	4286	0	0
Distributed Aided Target Recognition (ATR) Evaluation Center of Excellence. In FY03, completed assessment and evaluation of Multi Function Staring Sensor Suite (MFS3) ATR algorithms and hardware for FCS. In FY04, evaluate and assess automatic and aided target recognition algorithms using experimental sensor imagery obtained from field collection in multiple wavebands for evaluating 3rd generation cooled sensor algorithms designed for future FCS insertion. In FY05, will extrapolate findings and expand evaluation and assessment of ATR algorithms to accomodate a wider variety of scene, clutter and environmental conditions.	598	770	970
3rd Generation Forward Looking Infrared (FLIR) Technology. In FY03, tested and evaluated small pitch 20 micron, large 640X480 multicolor array. Tested and evaluated 3-D laser radar (LADAR) with high range resolution and multiple looks can increase probability of identification through clutter.	4948	0	0
Advanced Sensor Modeling and Simulation. In FY03, implemented “Paint the Night” image design tool onto computer hardware for static scenes. Integrated distributed networked sensor simulation capability with joint virtual battlespace (JVB) and supported TRAC FCS AoA C4ISR Experiment at Fort Knox. In FY04, design and develop a new Field-of-View (FOV) search model for integration into the Combined Arms and Support Task Force Evaluation Model. In FY05, will evaluate the new FOV search model, improve multispectral modeling, and deliver one sensor Semi-Automated Forces (SAF) Test-bed to Fort Knox.	4060	4160	4670
Lightweight Laser Designators. In FY04, verify critical designator system specifications with users. Carry out technology tradeoffs and initiate solid-state laser design. In FY05, selected basic solid-state laser design will be built and tested in the laboratory to verify energy output, beam quality and operation over temperature.	0	2050	2650
Low Cost High Resolution Focal Plane Array. In FY04, research long wave FPA of Mercury-Cadmium Telluride (MCT) on Silicone and evaluate shutter time constant uncooled arrays. In FY05, will evaluate multi-band pixel interconnect approach, patterned thin-film filters on CdZnTe, and 1280x720 uncooled ROIC design and fabrication.	0	7390	7367
Small Business Innovative Research/Small Business Technology Transfer Programs	0	246	0

Accomplishments/Planned Program B(continued)	FY 2003	FY 2004	FY 2005
Totals	18707	21506	22617

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	19696	22233	22420
Current Budget (FY 2005 PB)	18707	21506	22617
Total Adjustments	-989	-727	197
Congressional program reductions		-209	
Congressional rescissions			
Congressional increases			
Reprogrammings	-989	-518	
SBIR/STTR Transfer			
Adjustments to Budget Years			197

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		18408	26016	20547	20064	26768	27844	28016
H24	COUNTERMINE TECH	16033	18038	17918	17341	23997	25029	25145
H35	CAMOUFLAGE & COUNTER-RECON TECH	2375	2557	2629	2723	2771	2815	2871
HB2	COUNTERMINE COMPONENT TECHNOLOGY (CA)	0	5421	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 Army's transformation to the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This program focuses on concepts and technologies that improve mine detection and neutralization using standoff man-portable, ground and air platforms. The goal of this program is to increase mine and improvised explosive device detection probability, reduce false alarm rate, and research precision neutralization capabilities in support of sustaining a high operational tempo in Future Force operations. Working in conjunction with the US Army Engineering, Research and Development Center (ERDC), examine countermine phenomenology of booby-traps, improvised explosive devices, and surface and buried mines. In addition, mature wide area airborne countermine sensor concepts for higher altitude, wider area coverage, higher probability of detection, and lower false alarm rate for airborne minefield detection operations. This PE addresses emerging mine 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. This PE also examines signature management techniques for tactical operation centers and counter sensor techniques to reduce the reconnaissance capabilities of our adversaries. This effort is fully coordinated with the Marine Corps. It adheres to Tri-Service/Project Reliance Agreements on conventional air/surface weapons and ground vehicles. This PE contains no duplication of effort within the Army, other Services, or the Department of Defense. It also is fully coordinated with PE 0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermine and Barrier Development), PE 0603710A (Night Vision Advanced Technology)and ERDC. 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 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.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	16857	21291	21422
Current Budget (FY 2005 PB)	18408	26016	20547
Total Adjustments	1551	4725	-875
Congressional program reductions		-247	
Congressional rescissions			
Congressional increases		5600	
Reprogrammings	1551	-628	
SBIR/STTR Transfer			
Adjustments to Budget Years			-875

Significant Change Explanation:
FY04 - Four FY04 Congressional adds totaling $5600 were added to this PE.

FY04 Congressional Adds with no R-2A:
($1596) Advanced Airborne Hyperspectral Imaging System (AAHIS) Overland Countermine, Project HB2: The purpose of this one year Congressional add is to research passive and active airborne hyperspectral minefield detection sensors in the visible through long-wave infrared wavebands. No additional funding is required to complete this project.

($1034) Acoustic Technology for Landmine Detection, Project HB2: The purpose of this one year Congressional add is to investigate linear and non-linear acoustic technology for use in landmine detection. No additional funding is required to complete this project.

($1315) Polymer Based Landmine Detection, Project HB2: The purpose of this one year Congressional add is to research the development of amplified fluorescence quenching polymer (AFP) based explosive sensing technology and its application as a mine detecting device. No additional funding is required to complete this project.

($1315) Small Synthetic Aperture Radar (SAR) Buried Mine Detection, Project HB2: The purpose of this one year Congressional add is to investigate a synthetic aperture radar system with a unique switching component and interface and to test and modify the system for forward and side standoff

mine detection. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H24	COUNTERMINE TECH	16033	18038	17918	17341	23997	25029	25145

A. Mission Description and Budget Item Justification: This project supports the Future Force by examining new countermine technologies using man-portable, ground-vehicular, and airborne platforms for detection discrimination and neutralization of individual mines and minefields, and, where feasible exploits opportunities to enhance Current Force capabilities. The types of mines include both conventional and electronically activated categories. Uses data collections to assess the ability of various sensor combinations and signal processing/fusion algorithms to consistently detect mines while sustaining continued reductions in false alarms and increased operational tempo. To increase the potential for sustained rapid movement of tactical forces, emphasizes forward-looking mine detection and stand-off neutralization technologies. It will also characterize a variety of airborne sensor technologies to support wide area minefield detection. This project will investigate the phenomenology of booby-traps, improvised explosive devices, surface and buried mines, and research models for exploiting novel sensing devices. Additionally, it will examine sensors for the detection of off-route mines. The 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 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 Communications-Electronics Research, Development and Engineering Center, 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 2003	FY 2004	FY 2005
Center of Excellence for Unexploded Ordnance: In FY03, this DoD center provided continuous and global surveillance of possible detection and neutralization efforts. In FY04, identify possible Countermine Technologies for examination by the Services for technology maturation/ insertion into mission programs through coordination with and leveraging of technological capabilities of the government, industry, academic and international communities. In FY05, will continue surveillance, studies, and examination of promising technologies to improve countermine detection and neutralization efforts.	482	460	480
Wide Area Airborne Countermine Technologies: In FY03, conducted field tests and data collection at Yuma Proving Grounds and performed analysis of the data collected. In FY04, continue the testing and characterization of a variety of airborne sensor technologies and collect image data for signal processing/clutter rejection to support wide area minefield detection. Pacing technologies include multi-spectral Long Wave IR/Short Wave IR (LWIR/SWIR), ultra wideband ground penetrating synthetic aperture radar, high resolution synthetic aperture radar (for scatterable mines), and creation of autonomous target recognition algorithms for clutter rejection. In FY05, will obtain and analyze measurements in a wider variety of environmental conditions (soil conditions, temperature, humidity, ambient lighting, etc.) and collect extensive clutter data for algorithm development, testing and refinement.	800	4780	4750
Forward Looking Precision Mine Neutralization. In FY04, evaluate and select neutralization technology options. In FY05, will design and build precision neutralization breadboard components and subsystems, perform initial field experiments, and conduct analysis on collected data. Will begin building and testing point neutralization breadboard systems based on evaluation and assessment of prior field experiments.	0	680	2850

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
FCS Mine Detection. In FY03, built mobile forward looking Ground Penetrating Radar (GPR) data collection and acoustic sensor data collection systems. Performed data collection for GPR systems from distances of 2-15 kph(s) at relevant field sites of tactically realistic mine deployments on roads. Created an electronically accessible data repository for Automatic Target Recognition (ATR) developers. Conducted initial analysis of metal-cased AT mines at all tactically revelant deployment depths on roads. In FY04, show performance and speed improvements in forward looking GPR and acoustic sensors. Combine forward looking sensors onto a single vehicle platform and conduct data collections and phenomenological studies with the combined systems. Continue maturation of forward looking ATR algorithms with emphasis on the detection of buried plastic mines. Conduct analysis and assess improvements of individual forward looking detection sensors. Conduct end-to-end demonstration with statistical results to compare against program exit criteria.	7144	4686	0
Off Route Mine Detection and Neutralization: In FY03, this program examined and evaluated technologies to provide the warfighter new detection capabilities against the threats of off-route/side attack mines, booby traps, anti-helicopter mines, and improvised explosive devices through the exploitation of their distinctive short wave infrared and acoustic resonance signatures. In FY04, examine a variety of forward looking detection technologies including ground penetrating radar and infrared, against improvised explosive devices (IEDs). In FY05, will continue to examine and conduct evaluations of off route detection capabilities designed to provide FCS increased OPTEMPO and enhanced vehicle and soldier survivability.	2200	3740	3918
Countermine Phenomenology: In FY04, conduct analyses, tests and evaluations to characterize and predict the effects of the environmental, surface, and shallow subsurface conditions on sensor response and signal interpretation. In FY05, will conduct an investigation of clutter encountered with various sensor modalities that will be used to predict and reduce false alarms.	0	2730	3650
Precision Forward looking Confirmation and Localization. In FY04, develop a data collection system, collect acoustic confirmation sensor data and information, and evaluate the data. Examine aided target recognition concepts, investigate algorithms, and conduct breadboard design and environmental component tests. In FY05, will perform data collection and evaluation, continue algorithm development and maturation, and fabricate breadboard for field evaluation/testing and environmental studies.	0	480	2270

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Countermine (CM) Task Force (TF). Established in FY03 to conduct a review of existing CM S&T programs and to determine which mine detection and neutralization technologies offered the greatest potential to satisfy detection and neutralization needs for the Future Force. In FY03, resourced an Independent Review Team (IRT) to evaluate the current posture of CM S&T and future investments in science and technology which showed greatest promise to satisfy mine detection and neutralization requirements for FCS.	916	0	0
Polymer-based Landmine Detection: This one-year Congressional add examined chemical based explosive detection techniques and conducted modeling and data collections that facilitated a better understanding of the phenomenology associated with these two applications. No additional funding was required to complete this project.	1338	0	0
Acoustic Mine Detection: This one-year Congressional add examined and evaluated phenomenology of linear/non-linear acoustics combined with ground penetrating radar for mine detection in downward and forward looking modes of anti-tank (AT) mines in roads. No additional funding was required to complete this project.	3153	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	482	0
Totals	16033	18038	17918

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H35	CAMOUFLAGE & COUNTER-RECON TECH	2375	2557	2629	2723	2771	2815	2871

A. Mission Description and Budget Item Justification: This project designs and develops advanced signature management and deception technologies for masking friendly force capabilities and intentions, thereby increasing Future Force unit survivability, and, where feasible, exploits opportunities to enhance Current Force capabilities. Specific research areas include: (1) advanced materials and processes for countering visual, infrared (IR), and spectral sensors; (2) optical and electronic techniques for reducing the signatures of uncooled IR sensors used in Future Combat Systems/Future Force; (3) modeling and simulation of the vulnerability of sensors to laser blinding; and (4) new technologies to exploit or deny the enemy's use of reconnaissance sensors against the Future Force. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The PE contains no duplication with any effort within the military departments. Work in this PE is performed by the Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Low Cost Counter Reconnaissance Technology. In FY03, conducted field data collection to quantify near infrared/short wave infrared (SWIR) performance of existing camouflage nets and materials. Completed analysis of SWIR performance and constructed a new system performance model. In FY04, fabricate new reduced signature uncooled infrared (IR) focal plane arrays (FPA), determine the laser vulnerabilities of advanced uncooled IR sensors, and develop a background database and pattern generation software to determine new low cost measures to defeat hyperspectral sensors. In FY05, will integrate new FPAs and optics into a prototype uncooled IR sensor and fabricate advanced paints and patterns incorporating spectral signature reduction.	2375	2492	2629
Small Business Innovative Research/Small Business Technology Transfer Programs	0	65	0
Totals	2375	2557	2629

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	20247	23913	16899	18181	18707	18568	18856
H70	HUMAN FACT ENG SYS DEV	16913	18588	16899	18181	18707	18568	18856
J20	OMNI DIRECTIONAL TREADMILL UPGRADE	3334	5325	0	0	0	0	0

A. Mission Description and Budget Item Justification: The primary objectives of this program are to maximize the effectiveness of Soldiers in concert with their materiel so that they may survive and prevail on the battlefield in the context of the Army Transformation to the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. 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. Work in this PE is related to and fully coordinated with efforts in PE 0602601 (Combat Vehicle and Automotive Advanced Technology), PE 0602786 (Warfighter Technology), PE 0603001 (Warfighter Advanced Technology), and PE 0603005 (Combat Vehicle and Automotive Technology). The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Army Research Laboratory (ARL).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	20516	16749	16357
Current Budget (FY 2005 PB)	20247	23913	16899
Total Adjustments	-269	7164	542
Congressional program reductions		-210	
Congressional rescissions			
Congressional increases		7950	
Reprogrammings	-269	-576	
SBIR/STTR Transfer			
Adjustments to Budget Years			542

Significant Change Explanation:
FY04 - Two FY04 Congressional adds totaling $7950 were added to this PE.

FY04 Congressional Add with no R-2As:
($5167) Omni-Directional Treadmill Upgrade, Project J20: The purpose of this one year Congressional add is to research technology to upgrade the omni directional treadmill which allows Soldiers to move (crawl, walk, run) while training in a virtual environment. No additional funds are required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H70	HUMAN FACT ENG SYS DEV	16913	18588	16899	18181	18707	18568	18856

A. Mission Description and Budget Item Justification: The goal of this program is to maximize the effectiveness of soldiers in concert with their equipment, in order to survive and prevail on the battlefield in the context of the Army Transformation to the Future Force. 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. 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 2003	FY 2004	FY 2005
- 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 FY03, generated Command, Control, & Communications: Technically Reliable Assessment of Concept Execution (C3TRACE) models of FCS Mounted Combat System company level personnel and information flow incorporating information from Lead System Integrator (LSI) demos and soldier-in-the-loop Fort Knox Battle Lab experiments. In FY04, mature a suite of C2 tools for Future Force commanders, leaders, and soldiers to employ during close combat in complex and urban terrain. In FY05, provide baseline C2 tools to Training and Doctrine Command (TRADOC) schools. These tools will allow for collaborative and distributed decision making with the objective of improving performance under time, combat, fatigue, and workload stressor conditions.	2900	1700	1638
- Enhance human performance modeling tools to optimize soldier machine interactions for Objective Force Warrior (OFW) and FCS. In FY03, created a digital library of selected individual soldier equipment to support human figure performance of FCS and OFW. This digital library will transition early FY04 to Natick Soldier Center (NSC), Tank and Automotive Research Development and Engineering Center (TARDEC), OFW Integrated Product Teams, and to FCS contractors. To evaluate soldier perceptual performance when operating in an urban environment compared dark adaptation times between green and white phosphor night vision goggles and investigated binocular depth perception cues for use in night vision goggle design. In FY04, link vehicle dynamics, biodynamics, and anthropometric modeling capabilities to extend soldier centered design tools and techniques. Apply the previously developed hearing hazard model to firing weapons in hazardous environments such as Military Operations in Urban Terrain (MOUT) enclosures and tunnels to specific hearing protection requirements. In FY05, provide user-accessible soldier-centered tools, models and expertise to combat and materiel developers so that the full range of soldier cognitive and task performance can be considered in a cost-effective manner in all phases of acquisition.	3160	2440	2651

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Increase soldier performance while conducting operations on-the-move. Validate and recommend methods to mitigate soldier performance degradation due to motion sickness induced by noise, vibration, vehicle movement and confinement during operations-on-the-move. Identify, mature, and quantify human performance measures and methods to address future warrior performance issues. Model baseline task, workload, and human figure performances to assess soldier and system performance benefits of integrating advanced concepts into crewstations. In FY03, measured human performance in a simulated remote vehicle control task in an enclosed vehicle, in both moving and stationary conditions and examined aftereffects (i.e. motion sickness, eye fatigue, coordination) on performance. Investigated the availability and utility of generic Head-Related Transfer functions and surveyed commercially available three dimensional (3-D) systems and head trackers for potential use in Crew Integration and Automation Testbed environment. In FY04, evaluate new head-mounted displays (HMD), cognitive decision aids and driving aids concepts. Identify helmet and HMD clearance problems in vehicle's turret. Investigate the interaction of physical and cognitive loading and its impact on soldier shooting performance. In FY05, perform studies on discrete mitigation strategies to improve solider performance in dynamic environments.	3284	3109	3941
- Investigate and determine interface design solutions for Unit of Action (UoA) Maneuver Team information systems that enhance situational understanding and decision cycle performance. In FY03, identified critical information required by UoA dismounted soldiers in three scenarios and for Mounted Combat System (MCS) and Reconnaissance Surveillance Target Acquisition (RSTA) vehicles in two scenarios. Initiated development of decision cycle performance models. In FY04, complete platform models of additional vehicle variants, conduct iterative live fight-ability experiments of interface solutions at minimum fight-ability levels, and identify initial information interface solution concepts. In FY05, refine metric development of decision cycle time and effectiveness, conduct experiments for model validation for integration into force-on-force models, provide interface design solutions to OFW, and conduct decision cycle time model validation studies.	3200	3050	2400

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Provide on-site human factors engineering (HFE) and MANPRINT to the Army community to optimize soldier performance and soldier-machine interactions. In FY03, in support of Army Materiel Command (AMC) Logistical Support Element in Southwest Asia, investigated theater distribution of water and materiel, researched and supported improved maintenance initiatives fro Army Depots, Army Reserve and National Guard, and collected empirical maintenance and personnel information to support the development of the Improved Performance Research Integration Tool (IMPRINT) maintenance model. Provided unique materiel design solutions to provide a laser-based "direct lay" night operations fire control system for 60mm Mortar Sections. In FY04 and FY05, continue to provide Human Factors Engineering (HFE) and MANPRINT support to AMC, Army Research Development and Engineering Centers (RDECs), Army Test and Evaluation Command (ATEC), Joint Forces Command, and other service laboratories. Support Commanders with Science and Technology expertise, identify problems or opportunities to apply new technologies, and assist with field evaluations and demonstrations.	2320	2301	2360
- Improve human-robotic interaction in a full mission context. In FY04, determine common operational definitions of soldier-robot interaction in concert with tri-service, university and industry programs to advance a common understanding of issues and metrics. Conduct task and workflow analysis. Identify initial requirements for Operator Control Unit (OCU) for mounted and dismounted applications and transition results to TARDEC. In FY05, model cognitive workload and performance in multi-task conditions, and examine span of control, levels of autonomy, shared situation awareness, trust, and collaborative modalities. Determine requirements for mixed asset control and workload management for mounted and dismounted missions and transition results to TARDEC.	0	3766	3909
- MANPRINT Modeling: This congressional add focused on developing human performance modeling tools and associated databases for the Objective Force Warrior and FCS. No additional funding is required to complete this project.	2049	0	0
- Human System Interaction Modeling: The purpose of this one year congressional add is to augment human performance modeling tools to represent system level human performance tradeoffs at the system of systems level for Command, Control, and Communications (C3), level of automation, interface modality, and workload. No additional funding is required to complete this project.	0	2112	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	110	0
Totals	16913	18588	16899

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	26461	30824	17026	17880	20198	19819	19149
048	IND OPER POLL CTRL TEC	2542	3712	4127	3378	3444	3466	3535
835	MIL MED ENVIRON CRIT	2885	3170	3507	3621	3685	3738	3809
895	POLLUTION PREVENTION	0	0	1126	3448	6017	5567	5548
896	BASE FAC ENVIRON QUAL	8203	8858	8147	7312	6926	6915	6122
EM5	ENVIRONMENTAL QUALITY APPLIED RSCH - AMC (CA)	0	6390	0	0	0	0	0
F25	MIL ENV RESTOR TECH	7495	1916	119	121	126	133	135
F28	RANGE SAFETY TECH DEMO	2002	0	0	0	0	0	0
F35	ENVIRONMENTAL QUALITY APPLIED RESEARCH (CA)	0	6778	0	0	0	0	0
F39	ENVIRONMENTAL RESPONSE & SECURITY PROTECTION PROG	3334	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to provide technologies that will improve the Army's ability to comply with requirements mandated by Federal, state and local environmental/health laws and to reduce the cost of this compliance while supporting the long-term sustainment of Army training and testing activities. 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 program element 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). Work in this program element is performed by the U.S. Army Engineer Research and Development Center that is 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.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	26747	18252	17157
Current Budget (FY 2005 PB)	26461	30824	17026
Total Adjustments	-286	12572	-131
Congressional program reductions		-287	
Congressional rescissions			
Congressional increases		13600	
Reprogrammings	-286	-741	
SBIR/STTR Transfer			
Adjustments to Budget Years			-131

Significant Change Explanation.
FY04 - Four FY04 Congressional adds totaling $13600 were added to this PE.

Projects with no R-2As:
- ($4698) Army UXO Research and Development, Project F35: The objective of this one year Congressional add is to conduct Unexploded Ordnance (UXO) related research and development. No additional funding is required to complete this project.
- ($939) Bio/Chemical Materials Environmental Modeling, Project F35: The objective of this one year Congressional add is to modify and enhance the Army Risk Assessment Modeling System to address environmental terrorism threats. No additional funding is required to complete this project.
- ($939) Surface Finishing Sustainability, Project F35: The objective of this one year Congressional add is to conduct surface finishing sustainability research. No additional funding is required to complete this project.
- ($6200) Hawthorne Army Depot, Project EM5: The objective of this one year Congressional add is to upgrade the depot. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
048	IND OPER POLL CTRL TEC	2542	3712	4127	3378	3444	3466	3535

A. Mission Description and Budget Item Justification: This applied research project provides technologies to enable the Army to reduce or eliminate the effects of legal and regulatory environmental restrictions on installation facilities, training and testing lands, and ranges, as well as avoid fines and facility shutdowns. New and innovative technologies are essential for the effective control and reduction of military unique hazardous and non-hazardous wastes on military installations. Efforts include a focus on the impacts of new materiel that will enter the Army inventory within the next decade and beyond due to the Future Force. This project focuses on industrial pollution sources from production facilities, facility contamination, and other waste streams, to include deconstruction processes. The intent is to provide compliance through sustainable environmental protection technologies. Additional work is focused on noise pollution from training operations and 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). Work in this project is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Industrial Activities Readiness - In FY03, formulated protocol for energetic compound biological treatment of munitions production wastewater under anaerobic conditions leading to more cost effective compliance with effluent environmental quality standards. In FY04, determine best practices for Army recycled-concrete, other construction/demolition debris, and other Army solid waste, including that contaminated by lead-based paint and energetic compounds, in order to reduce disposal costs, protect human health and the environment and maintain sustainable installations. In FY05, will mature physiochemical and biosorbent treatment technologies for wastewater from munitions production allowing cost effective treatment while maintaining mission readiness. Will identify and mature alternative technologies and processes to improve solid waste management and reduce operational, logistical, and environmental requirements for deployed troops.	1881	2370	2641
Sustainable Live-Fire Range Design and Maintenance – In FY03, completed first order range risk assessment framework that identifies mission impact risk factors. In FY04, develop a risk assessment quantification methodology to evaluate level of environmental risk related to training range planning and designs. Mature a risk assessment protocol that identifies environmental compliance risks to ranges and incorporates approaches for mitigation of these risks. In FY05, will mature application of the range risk assessment protocol through a framework of integrated range and munitions modeling. Training and Test Range Noise Control – In FY03, improved weapons acoustic source information for model input. In FY04, improve sound propagation algorithms for air-to-ground and ground-to-ground noise model enhancement. In FY05, will integrate noise models for artillery, small arms and aircraft to better characterize the full effects of military training noise on people in the vicinity of installations.	661	1277	1486
Small Business Innovative Research/Small Business Technology Transfer Programs	0	65	0
Totals	2542	3712	4127

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
835	MIL MED ENVIRON CRIT	2885	3170	3507	3621	3685	3738	3809

A. Mission Description and Budget Item Justification: This applied research project provides 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 concentration levels that will protect the environment and human health from adverse effects. The main product of this research is the Army Risk Assessment and Modeling System (ARAMS). This PC-based platform links models of fate and transport to the exposure and effects models and databases of explosives and their degradation by-products. This reduces the uncertainty associated with both the probability of exposure and the ultimate effect if exposed. Interim products are U.S. Environmental Protection Agency approved health advisories and criteria documents to be used in risk assessment procedures. The Army uses these criteria during negotiations with regulatory officials to set scientifically and economically rational safe 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). Work in this project is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi, and the Center for Health Promotion and Preventive Medicine located at Aberdeen, Maryland.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Land Remediation/Hazard/Risk Assessment Tools for Military Unique Compounds; Long Term Monitoring for Army Ranges; Characterization, Evaluation and Remediation of Distributed Source Contamination on Army Ranges – In FY03, released version 1.1 of ARAMS with process descriptors for explosives fate and transport, aquatic explosives uptake, and in vitro bioavailability data for humans. This capability transitioned to advanced development. In FY04, generate a compendium of analytical methods applicable to military contaminants and establish the scientific basis for real-time in situ long term monitoring systems. Investigate the characterization and transport of distributed explosives contaminants relative to active/inactive military testing and training ranges. In FY05, will provide 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. Will continue studies to determine the fate and transport properties and characteristics of military relevant contaminants associated with training and testing ranges.	2885	3098	3507
Small Business Innovative Research/Small Business Technology Transfer Programs	0	72	0
Totals	2885	3170	3507

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
895 POLLUTION PREVENTION	0	0	1126	3448	6017	5567	5548

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 the DoD High-Performance Computing network; 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). Work in this project is performed by the Army Research Laboratory in collaboration with the Armaments Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ and the Aviation and Missile Research, Development and Engineering Center (AMRDEC), Huntsville, AL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Pollution Prevention - In FY05, mature environmentally benign additives for gun propellants and microbial additives to rapidly degrade unexploded ordnance (UXO). Mature non-polluting, low toxicity rocket missile propellants.	0	0	1126
Totals	0	0	1126

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
896	BASE FAC ENVIRON QUAL	8203	8858	8147	7312	6926	6915	6122

A. Mission Description and Budget Item Justification: The objective of this 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. The Army will be provided 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 will 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 will also provide advanced methods and technologies to restore lands damaged during training activities and allow sustained use of installation facilities and training land resources. 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 Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Threatened and Endangered (T&E) Species Management to Reduce Operational Constraints – In FY03, completed Army-wide inventory of priority T&E species issues and identified monitoring techniques for high priority T&E species. Established methodological and statistical protocols for determination of endangered species population viability to prevent training restrictions. In FY04, expand impact assessment protocols developed for the Red-cockaded Woodpecker to examine habitat impacts from land management practices. In FY05, will analyze the effects of military training and land management on high priority T&E species to support the reduction/elimination of training restrictions.	2998	3141	3585

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Predictive Risk Assessment and Management for Army Ranges and Training Lands – In FY03, evaluated range design, construction, and maintenance requirements against current and future environmental compliance requirements. In FY04, analyze selected range design features and recommend improvements to reduce environmental compliance requirements. Assess range munitions load and environmental factors that may impact long-term sustainability of range operations. In FY05, will prepare an engineering analysis of costs associated with life-cycle operations and maintenance of environmentally compliant range designs to reduce and facilitate maintenance, cleanup of munitions and scrap, and erosion control. Will mature design and operation and maintenance criteria for sustainable ranges that incorporate environmental compliance considerations.	2087	2530	1548
Land Planning and Management – In FY03, completed noise source characterization protocols and initial human response characterization to assess noise impact of operations. Matured Army Training and Testing Area Carrying Capacity (ATTACC) protocols to incorporate scientific improvements in wind erosion and soil compaction factors. In FY04, formulate particulate matter emission estimation models for tactical vehicle engines and chemical/physical particulate matter control technologies for unpaved surfaces. Link mission-use constraints to a community growth model. In FY05, will complete noise dose-response model augmentation and noise mitigation practice development for typical training operations. Will mature 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. Will mature Military Landuse Evolution and impact Assessment Model (MLEAM) to facilitate strategic plans to support long term military landuse sustainment. Will provide tools that will improve erosion control practices and prioritization of sites for land rehabilitation in support of sustainable training lands.	2896	2880	3014
Installation Operations/Hazardous Air Pollutants (HAP) – In FY03, developed integrated strategies to control emissions from combustion sources. In FY04, mature demilitarization furnace air emission control system that will include metal adsorption and high temperature filtration. Transition HAP applied research products to advanced technology demonstration.	222	175	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	132	0
Totals	8203	8858	8147

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**F25**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
F25	MIL ENV RESTOR TECH	7495	1916	119	121	126	133	135

A. Mission Description and Budget Item Justification: The objective of this project is to provide cost effective technologies required to clean up Department of Defense (DoD) hazardous waste sites, including active installations under the Installation Restoration Program, those indicated for closure under the DoD Base Realignment and Closure Program and the Formerly Used Defense Sites Program. Technologies focus on cost-effective and efficient remediation of active training lands that support enhanced readiness for the Future Force. The thrust of this effort is to expedite site cleanup, reduce the cost of cleanup of contaminated soil, groundwater, and structures, and ensure that human health and the environment are protected. Research is conducted in several major areas: innovative and cost-effective site identification, characterization, and monitoring technologies, groundwater systems; and treatment technologies to remediate soil and groundwater contaminated with military-unique contaminants such as explosives/energetics, chemical agents, heavy metals, and other organics. Emphasis is placed on the development of in-situ remediation technologies and real or near real-time sensing technologies for Unexploded Ordnance (UXO). Development of existing technologies provides near-term solutions while adding to the knowledge base applicable to successful development of more complex in-situ 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 the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Unexploded Ordnance (UXO) Identification and Discrimination - In FY03, matured optimum site characterization protocols to provide site adaptive UXO detection. Completed advanced UXO sensor fusion analysis algorithms to apply to new and developing UXO sensors resulting in enhanced false target rejection and increased detection/discrimination capabilities. Transitioned UXO applied research products to advanced technology development.	1649	0	0
Hazard/Risk Assessment Tools for Military Unique Compounds - In FY03, integrated predictive exposure and effects models with toxicity databases to determine exposure and toxicity indexes of explosives, propellants, smokes and illuminants as part of the Army Risk Assessment Modeling System (ARAMS). Transitioned hazard/risk assessment applied research products to advanced technology development.	525	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
In Situ Remediation Technologies for Contaminated Groundwater and Soils - In FY03, matured processes for recycling metal contaminated extracts for cost-effective restoration of inorganics contaminated military sites. Performed pilot-scale evaluation of in place bio-decontamination of TNT and of in place reactive barriers and/or reactive barriers coupled with bio-decontamination of explosives in groundwater for cost-effective restoration of explosives contaminated military sites. In FY04, complete pilot-scale evaluation of in situ biodegradation for TNT and of advanced electro-kinetic treatment technologies for lead contaminants for significantly improved in-place decontamination. In FY05, transition applied research in-place remediation technology products to advanced technology development.	2623	1353	119
Characterization, Evaluation and Remediation of Distributed Source Contamination on Army Ranges - In FY03, conducted an integrated assessment and evaluation of predictive models for widely distributed contamination on live fire training ranges. In FY04, adapt hazardous waste site restoration processes and techniques for application to distributed contamination sources on live fire ranges. Transition applied research products to advanced technology development.	1649	552	0
Military Impacts on Threatened and Endangered (T&E) Species and Land Planning and Utilization for Army Ranges - In FY03, completed Army-wide inventory of priority T&E species issues.	1049	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	11	0
Totals	7495	1916	119

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	20805	18115	18604	19705	20001	21012	21622
779	C2 & PLAT ELEC TECH	9061	7744	8445	9413	9904	10231	10616
H92	COMMUNICATIONS TECH	11744	10371	10159	10292	10097	10781	11006

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. Research includes the investigation of 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, network-centric battlefield environment. This PE will provide technologies that allow Future Force field commanders to communicate on-the-move (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.

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 related to and fully coordinated with efforts in PE 0603008A (Command, Control and Communications Advanced Technology), PE 0602783A (Computer and Software Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), PE 0603734A (Military Engineering Advanced Technology), and PE 62705 (Electronics & Electronics Devices). Work in this PE is performed by the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	21150	18728	18696
Current Budget (FY 2005 PB)	20805	18115	18604
Total Adjustments	-345	-613	-92
Congressional program reductions		-176	
Congressional rescissions			
Congressional increases			
Reprogrammings	-345	-437	
SBIR/STTR Transfer			
Adjustments to Budget Years			-92

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
779	C2 & PLAT ELEC TECH	9061	7744	8445	9413	9904	10231	10616

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. 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 enables commanders at all echelons to have better and more timely information and allows them to command from anywhere on the battlefield, freed from their command posts and while on-the-move. 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 Agile Commander Advanced Technology Demonstration (ATD) matures digital hardware and software technologies that provide agile, rapidly deployable, split-based C2 operations. The Networked Sensors for the Future Force ATD will model a lower echelon C2 information infrastructure to optimize information flow between dispersed C2 nodes and a series of unmanned 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 Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Battle Space Awareness & Positioning: Mature 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 environments. In FY03, transitioned handheld GPS anti-jam antenna into low rate initial production. Conducted laboratory evaluation of individual positioning, navigation and tracking sensor hardware for use in urban and complex environments, evaluated integration algorithms for positioning, navigation and tracking sensor hardware via computer simulation. In FY04, evaluate positioning, navigation, and tracking prototype-integrated systems (Radio Frequency ranging (hardware and algorithms), an enhanced pedometer system, and network assisted GPS) in laboratory environments, and field test the components to evaluate potential use in military operations in urbanized terrain. In FY05, will integrate best performing components into a complete positioning, navigation and tracking system for complex and urban terrain, perform laboratory evaluation, and prepare for field testing of total system.	1285	1429	3455
- Command and Control (C2) On-The-Move Enabling Technologies: Investigate and mature technologies and decision aids that enable course of action (COA) generation and analysis, and enable C2 on-the-move. In FY03, evaluated a robust tool set optimized for the commander and staff informational needs, capable of operating in a distributed environment, using a variety of structured and unstructured data sources; investigated bi-directional links between these tools, intelligent agents, and other analytical or course of action tools to provide an integrated tool suite for the command and staff. Completed on-going technology efforts for transition of products and concepts into the Distributed Analysis Visualization Infrastructure for C4I (DaVinci) tool set. Performed collaborative COA generation and analysis and wargaming. Defined soldier network communications architecture to support Joint Tactical Radio System. In FY04, mature intelligent software agents for execution monitoring of 100 events and mature mobile adaptive computing capabilities for dispersed and on-the-move C2 operations. Identify tactical scenarios to evaluate decision aids and autonomous asset management tools, and provide an information management scheme based upon information exchange requirements for use in C2 functions in complex and urban terrain. In FY05, will mature tactical decision aids transitioned from the Army Research Laboratory, identify requirements for a distributed collaboration environment, and develop a networked software environment for decision tools to support C2 functions in complex and urban terrain.	6540	2920	1766
- Airborne Engineering Support: Conduct flight test evaluation for C4IEW systems.	482	519	664

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Networked Sensors for the Future Force: Prototype a Command and Control (C2) information infrastructure to prioritize information flow, based on user requirements and a standardized technique of tasking networked sensors and unmanned platforms. In FY03, designed C2 data framework definition/protocol, common tasking infrastructure and tasking language. In FY04, model the behavior of the C2 information system using Unified Modeling Language (UML) to demonstrate the flow of information between operators, the collaboration between networked subsystems, and the information exchange with unmanned platforms. Evaluate Common Object Request Broker Architecture (CORBA) as a means of information exchange using a publish/subscribe model. In FY05, will integrate the infrastructure and test in simulation against representation of unmanned networked sensors.	754	2450	1012
- Battle Information and Knowledge Exchange: Develop, test, and evaluate technologies to support interfacing and information exchange management between current Army, Joint, Coalition, and National information systems and FCS unit of action (UA)/unit of employment (UE). In FY04, analyze UE operational architectures developed by TRADOC and derive conceptual UE systems and technical architectures. In FY05, will develop interface and information exchange technologies compatible with the Global Information Grid Enterprise Service architecture and intelligent software agent technology to provide customized decision making information to the commander and the command staff.	0	395	1548
Small Business Innovative Research/Small Business Technology Transfer Programs	0	31	0
Totals	9061	7744	8445

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H92	COMMUNICATIONS TECH	11744	10371	10159	10292	10097	10781	11006

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 main effort of this project concentrates on Dynamic Readdressing and Management (DRAMA), Advanced Antennas, C4ISR OTM Demo, Soldier Radio Waveform, Networked Sensors for the Future Force (NSFF), Free space Optical /Near-Optical Communications Systems (FOCUS) and Spectrum Utilization Program for Enhanced Radio Network (SUPERNET). These programs focus on key areas of research include: Mobile wireless technologies for hostile mobile environments (FOCUS), and to meet the size, weight and power needs of the individual dismounted soldier (Soldier/Squad Level Comms); quality of service techniques that enable efficient, automatic bandwidth management for mobile, wireless networks (DRAMA); open systems designs for wideband networking waveforms; and mobile internet protocols operating across different networks; networking technologies that support unattended sensors with the ability to task unmanned sensors and transport data and images from them to data fusion points and tactical commanders (NSFF Comms); research realistic models for emerging communications systems in dynamic field environments and network protection technologies; research Spectrum efficient communication through application of emerging spectrum efficient technologies. It leverages a variety of efforts including the DARPA Sensor Information Technology (SensIT), NeXt Generation (XG) program as well as technologies matured by Army Research Laboratory. In addition, this project investigates tactical antenna technologies to reduce the number required, and increase the range and throughput; Ferroelectric materials for reduced cost wideband on-the-move phased array antennas; and technology to increase survivability by reducing the antenna visual signature.

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Dynamic Readdressing and Management (DRAMA): This effort investigates advanced networking protocols and management enabling, robust, on-the-move communications. In FY03, integrated dynamic addressing and IP multicast protocols into Multifunctional On-the-move Secure Adaptive Integrated Communications (MOSAIC) Ad-Hoc mobility protocol suite. Tested and evaluated advanced, automated, fault-isolation and root cause analysis network management software in the C4ISR On-the-Move Demonstration. In FY04, develop and demonstrate intelligent agent and mobile agent software network management tools for automated network control and management of traffic flow (voice, data, video) over the network. Develop and demonstrate the operational capabilities of dynamic addressing and network reconfiguration based upon the intelligent agent assessment of network dynamics. Capabilities will be demonstrated in both the MOSAIC Capstone demonstration and in the C3OTM Test bed demonstrations. In FY05, will evaluate enhanced Automated Net Management tools to include integration with net management agents, enhance intelligent agents and mobile agents to operate in wireless OTM tactical network environment, and scalability of dynamic readdressing and IP multicast protocols along with network management tools in large, tactical, OTM networks. Will research, analyze, and evaluate 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.	3514	4014	4875

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Advanced Antennas: In FY03, investigated low profile antennas for ground/rotary wing aviation platforms leveraging component technologies from conformal body borne antenna efforts to provide low observable antennas covering the 225-2000MHz communication bands. Investigated the radio frequency (RF) radiation hazard safety assessments for the conformal body borne vest and helmet antennas to determine specific absorption rates (SAR) and safety compliance levels. In FY04, enhance, modify, and validate the modeling algorithms for antenna design to include the body borne, low profile and multiband antennas, platform antenna placement, cosite interference mitigation, and complete human RF Safety Assessment. In FY05, will investigate technologies for the Multi-beam Phased Array on the move antenna to enable multi-mission, simultaneous communications with the Global Broadcast System (GBS), Wide-band Gapfiller and MILSTAR satellite systems. Will investigate technologies for a family of Rotary Wing Aircraft multi-band antennas, lightweight body borne antennas (helmet and vest), and low-cost, reconfigurable, band-switched antennas to comply with JTRS communications requirements for various ground and air platforms.	2430	2100	1000
- Soldier/Squad Level Communications: In FY03, conducted performance trade-off and affordability analyses for Small Unit Operations Situation Awareness System (SUO SAS) tactical radio communications leading to the definition of JTRS Cluster 5 small form fit configuration and JTRS Software Communications Architecture (SCA)-compliant embedded network communications Soldier Radio Waveform for FCS Unit of Action (UA). In FY04, mature and integrate a miniaturized RF front-end (225-1000 MHz) and programmable radio modem with link-layer intranet processor to begin Soldier platform installation assessment and definition of functional interfaces.	2600	788	0
- Free Space Optical/Near-Optical Communications (FOCUS) and Sensors Networking: In FY03, extended FCS architecture to include maneuver layer interoperability to sensor communication relays and gateways under the Network Sensors for the Future Force (NSFF) effort, investigated Comm-Node effort for Terrestrial/Airborne System and investigated limited tracking using modulating retro reflector. Investigated advanced wireless network access control technologies. In FY04, refine sensor communications requirements; integrate protocols and waveforms into model hardware, commence design of subsystem including transmitter laser, tracking hardware, down conversion (extract data from laser) unit for FOCUS. In FY05, will conduct early laboratory experiments to establish performance against program goals and evaluation criteria for NSFF and conduct laboratory demonstration emphasizing subsystem investigation for FOCUS.	1752	3308	2067

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Adaptive Communications Networking: In FY05, will research cost effective, dynamic spectrum allocation devices and new wave forms using novel spectrum optimization techniques for reliable and secured high-bit-rate communication. Will develop the technologies, applications, and associated set of tools to define, implement, and manage network policies to provide all of the information necessary to effectively and efficiently build a Networked Common Operational Picture.	0	0	2217
- Portable Emergency Broadband System (PEBS): This one-year Congressional add investigated emerging wireless technology to enable rapidly deployable voice and data communications for connectivity between emergency personnel in the "hot zone" and to the command center. No additional funds are required to complete this effort.	1448	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	161	0
Totals	11744	10371	10159

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Y10	COMPUTER/INFO SCI TECH	3931	4010	3982	3688	3770	3793	3845

A. Mission Description and Budget Item Justification: This program investigates and matures command, control, communications (C3) software and components to increase Future Combat System (FCS) and Future Force lethality and survivability through improved commanders' decision-making and situational awareness and, where feasible, exploits opportunities to enhance Current Force capabilities. The goal of this program element is two-fold: 1) To automate the collaboration for decision making (planning and execution) so that it is synchronized, parallel and real time, and 2) to devise collaboration tools to support both the staff and the Commander. Challenges for this program include automated tools to support the flow and synchronization of data/information from humans to humans, from humans to computers, from computers to humans, as well as reducing dependence on mouse and keyboard versus other modes of computer interaction. This program element researches and applies information and communications technology to enhance understanding and speed the decision cycle for commanders operating in the mobile dispersed environment envisioned for the Future Force. Focus is on providing widely applicable solutions that can be applied across the spectrum of command and control (C2) problems. Work in this PE is related to and fully coordinated with efforts in PE 0602782(Command, Control, Communications Technology), PE 0603772(Advanced Tactical Computer Science and Sensor Technology), and PE 0603008(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 2003	FY 2004	FY 2005
- Enhance information processing techniques necessary to improve military decision making through software agent technologies, heterogeneous collaborative agent architectures, data mining, soft computing, and advanced reasoning techniques. In FY03, provided and transitioned to CERDEC technologies to facilitate concurrent Command and Control (C2) decision-making in a multi-echelon operation in order to provide more complete situation awareness to the soldier. In FY04, provide execution-centric technologies to assist Commanders in the Military Decision Making Process (MDMP). In FY05, provide technologies that ensure completeness and timeliness of decision-making in C2 operations.	1227	1936	2028

Accomplishments/Planned Program A(continued)	FY 2003	FY 2004	FY 2005
- - Design secure, stealthy, energy-efficient network protocols on a miniature radio to support the Networked Sensors, a key element of the internetted 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 FY03, conducted laboratory experiments and tested the protocols for miniature radios. Created networked sensors on a miniature radio in laboratory environment. In FY04, improve the range and energy efficacy of the network protocols for miniature radios. In FY05, conduct tests on sensor networks equipped with miniature radios.	584	440	421
- 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 (which consists of a heterogeneous mixture of individual soldiers, ground vehicles, airborne platforms, unmanned Aerial Vehicles (UAVs), robotics and unattended microsensor networks) will operate in a complex wireless environment where survivability must be maintained in spite of inherent vulnerabilities of standardized protocols and commercial technologies. In FY03, devised encryption algorithms and deployment techniques that strengthens the security of a sensor network. In FY04, conduct experiments with miniature sensors to validate robustness of algorithms. In FY05, provide suites of information protection codes to miniature sensor developers and deployers.	1060	667	653
- In coordination with CERDEC, conduct research into techniques for automated Course of Action (COA) evaluation incorporating "reasonable-time" battlefield information and the development of COA analysis decision tools through the extension of mathematics of wargaming, combat modeling and statistical methods to enhance the staff's planning capability to generate manifold options for the mobile commander in an actual battlefield engagement. In FY03, improved combat models by applying statistical techniques into wargaming. Substantially improved the analysis capability of wargame simulation. In FY04, improve techniques to generate alternate COAs automatically for analysis. In FY05, provide the TRADOC Battle Labs with tools to conduct simulations in the field.	1060	896	880
- Small Business Innovative Research/Small Business Technology Transfer Programs	0	71	0
Totals	3931	4010	3982

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	4001	4142	4102
Current Budget (FY 2005 PB)	3931	4010	3982
Total Adjustments	-70	-132	-120
Congressional program reductions		-35	
Congressional rescissions			
Congressional increases			
Reprogrammings	-70	-97	
SBIR/STTR Transfer			
Adjustments to Budget Years			-120

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602784A - MILITARY ENGINEERING TECHNOLOGY

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	54562	51577	47152	49693	51215	50932	51916
855	TOP,IMAGE INTEL&SPACE	9699	10174	10786	11796	12103	12147	12372
H71	ATMOSPHERIC INVESTIG	6211	5891	6619	6837	6960	6824	7016
T40	MOB/WPNS EFF TECH	16331	16318	17345	18289	19123	18979	19310
T41	MIL FACILITIES ENG TEC	4496	4624	4881	4942	5060	5010	5097
T42	COLD REGIONS ENGR TECH	3924	3949	4315	4446	4523	4515	4600
T45	ENERGY TEC APL MIL FAC	2849	2971	3206	3383	3446	3457	3521
T48	CENTER FOR GEOSCIENCES & ATMOSPHERIC RESEARCH	1142	1743	0	0	0	0	0
T49	UNIVERSITY PARTNERING FOR OPERATIONAL SUPPORT	3240	2517	0	0	0	0	0
T52	STATIONARY POWER AND ENERGY APPLIED RESEARCH (CA)	6670	2421	0	0	0	0	0
T53	MILITARY ENGINEERING APPLIED RESEARCH (CA)	0	969	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, exploits 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 support 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; Command, Control, Communications and Computers (C4) technology, including terrain awareness, Command and Control (C2) software, communications software and components; and Intelligence, Surveillance and Reconnaissance (ISR) technology, including signal processing, automatic target recognition, and Radio Frequency (RF) sensors/devices. This research will improve the efficiency and cost effectiveness as it relates to supporting the training/readiness/force projection missions in garrison and force sustainment missions in theaters of operation.

Research is transitioned to program element 0603734A (Military Engineering Advanced Technology), program element 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). Work in this program element is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi, and the Army Research Laboratory located at Aberdeen, Maryland.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	55304	45407	46034
Current Budget (FY 2005 PB)	54562	51577	47152
Total Adjustments	-742	6170	1118
Congressional program reductions		-488	
Congressional rescissions			
Congressional increases		7900	
Reprogrammings	-742	-1242	
SBIR/STTR Transfer			
Adjustments to Budget Years			1118

Significant Change Explanation:
FY04 - Five FY04 Congressional adds totaling $7900 were added to this PE.

Projects with no R-2As:
- ($1691) Geosciences and Atmospheric Research, Project T48: The objective of this one year Congressional add is to develop and transition technologies for enhanced operational effectiveness in Army and Air Force atmospheric science programs. No additional funding is required to complete this project.
- ($2442) University Partnership for Operational Support, Project T49: The objective of this one year Congressional add is to continue research in the area of atmospheric sciences for the purpose of providing operational solutions to environmental problems as identified by Army and Air Force users. No additional funding is required to complete this project.

- ($1410) DoD Stationary Fuel Cell Incentive Progam, Project T52: The objective of this one year Congressional add is to support the development and commercialization of domestic stationary fuel cell systems. No additional funding is required to complete this project.
- ($939) Advanced Power and Energy Program, Project T52: The objective of this one year Congressional add is to investigate fuel flexibility for solid oxide fuel cells (SOFCs), develop hybrid fuel cell concepts utilizing SOFCs, and investigate future power generation options for the military. No additional funding is required to complete this project.
- ($940) Shuttle Radar Topography Mission Data Evaluation, Project T53: The objective of this one year Congressional add is to validate the data accuracy and quality of Shuttle Radar Topography Mission elevation data to satisfy Army high resolution requirements. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
855 TOP,IMAGE INTEL&SPACE	9699	10174	10786	11796	12103	12147	12372

A. Mission Description and Budget Item Justification: This project provides advanced technologies for storing, transforming, updating, and disseminating extremely large volumes of terrain and weather effects data at, or near, real-time 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 project H71 in this program element. 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 Engineer Research and Development Center that is located at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Data Generation – In FY03, developed algorithms and demonstrated capability to identify targets and classify terrain using hyperspectral data exploitation. In FY04, test, demonstrate and deliver capabilities to identify targets and classify terrain using hyperspectral data exploitation. In FY05, will develop methods to detect and quantify small geomorphic features, estimate surface moisture, and delineate drainage features that impact FCS mobility. Will adopt and modify Commercial Off-The-Shelf (COTS) or Government Off-The-Shelf (GOTS) software that converts intelligence messages or other non-structured data into geospatial data for spatial analyses. Will transition these developments to Project Director, Combat Terrain Information System to support tactical analysis and decision making.	3782	2818	2481
Data Management – In FY03, developed automated multi-feature registration capability from multiple sensors that doubled the positional accuracy of the data. This capability was transitioned to ten government programs from various Army and Defense agencies. In FY04, develop models and other capabilities to rapidly incorporate new terrain data into a geospatial database that will improve the analysis of time-sensitive geospatial information. In FY05, will develop and release tools that automate the fusion of elevation data from various sources and registration of imagery from multiple sensors.	1746	4629	5393

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Data Analysis – In FY03, developed geospatial tools and temporal terrain reasoning tools, which provide the capability to extract the fundamental elements of course-of-action (COA) analysis. In FY04, develop terrain reasoning tools that incorporate dynamic battlespace environmental effects prediction into commander's COA analysis. Transition terrain reasoning tools into the Commercial Joint Mapping Tool Kit and Maneuver Command and Control (MC2). In FY05, will create terrain reasoning capability that incorporates time-sensitive COA information for Future Force applications addressing unit of action operations. Will develop an air maneuver network route planning capability that combines the use of terrain, weather, and sensor effectiveness using methods that can be coordinated with ground maneuver planning. Will transition these developments into the Commercial Joint Mapping Tool Kit, MC2, and Digital Topographic Support System.	2328	2616	2912
Data Representation - In FY03, developed an environmental data model for the Urban Tactical Planner using the Common Data Model framework.	1843	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	111	0
Totals	9699	10174	10786

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H71	ATMOSPHERIC INVESTIG	6211	5891	6619	6837	6960	6824	7016

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), 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 the weather data from forecast/nowcast models, the distributed four dimensional (4D) weather database, and the weather decision aids that use this data for the digital battlefield commander by 1) applying advanced computer techniques, 2) incorporating new technology in meteorological sensor and system designs, 3) researching data fusion techniques to horizontally integrate data from advanced weather sensors and non-weather sensors into decision aids for enhanced combat power on the battlefield and enhanced effectiveness of field artillery and deep attack assets. This project supports the Army's transformation to the Future Force and 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 2003	FY 2004	FY 2005
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, Unattended Ground Sensors, and robotic sensors) into model initialization, which will directly impact nowcast/very short-range forecast accuracy especially over the target area, and provide much higher resolutions over the theater of operations. In FY03, applied a test set of methods for integration of non-traditional meteorological data sources to Army meteorological forecast models. This allows for the comprehensive utilization of disparate data sources available within the confines of the battlefield to improve the decision-making and execution cycles. Began evaluation of the modified models with emphasis on target areas and short-term forecasts that will lead to enhanced lethal deployment of munitions within the target area. In FY04, evaluate and modify as needed model packages that include a microscale diagnostic model for very fine resolutions nested in a mesoscale predictive model. In FY05, evaluate models with a complete set of modifications for insertion of likely sources of meteorological data from the battlefield. Evaluate model package for very fine scale analysis that uses data from non-traditional sources likely to exist on the net-centric battlefield.	1997	1855	2112
Implement a research version of a “state of the art” operational meteorological model that has software for ingesting data from meteorological satellites, Unmanned Aerial Vehicles, and distributed ground-based sensors. Research and test the capability to host the model on battlefield fire support platforms to allow for fully autonomous artillery meteorological message generation during battle. In FY03, completed modification of the model (MM5) to accept weather data from local and non-traditional sensors for improved meteorological data collection and utilization. Served as the subject matter experts and evaluated artillery improvement algorithms using the research model. These reviews have led to a focused development and fielding of artillery specific meteorological systems. In FY04, complete and evaluate a set of artillery-tailored decision aids. Modify and evaluate the research model for its ability to accept and process data from local and non-traditional sensors. Serve as subject matter experts for developmental and operational test of meteorological systems for fire support. In FY05, evaluate the modified research model for operation on processors that simulate those likely to be available in the net centric future forces. Evaluate the gain in accuracy of the modified model.	1195	1151	1300

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Integrate distributed weather client applications and database connectivity with the Army Battle Command System or other Command, Control, Communications, Computing and Intelligence (C4I) systems identified for Future Combat Systems Command and Control "on the move" in order to utilize new weather effects decision aid technology at lower echelons through hand-held visualization devices such as Personal Digital Assistants (PDAs). Incorporate sets of weather algorithms that can be integrated into existing soldier and system embedded processors describing basic information for the individual soldier on current terrain and weather conditions, weather forecasts, weather warnings, heat stress, canteen use, and meteorological satellite imagery. In FY03, augmented the capability of the PDA to accept and process data from "reachback" databases that has led to increased capability and timeliness. Upgraded the number and application of the PDA software for weather effects decision aids providing a capability for commanders at all echelons to have immediate and timely support for the decision making and execution cycles. In FY04, mature an upgraded capability to access and process data from other battlefield processors that will have applicability to the Future Force. Evaluate the PDA software in tests that evaluate its effectiveness. In FY05, implement software on the PDA that can be used as part of a package of software for the wearable computer for soldier.	629	644	817

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Increase effectiveness of target acquisition in urban and other domains by applying advances in optical characterization research for atmospheric effects on modern small aperture sensors and lasers, and new models for the effects of nighttime light scattering due to urban light pollution on night sensors into advanced tactical decision aids for use in Reconnaissance, Surveillance and Target Acquisition (RSTA) planning, special operations, and Future Force Warrior. Integrate hyperspectral and polarimetric imagery to extend target signature analysis, improve target acquisition capabilities and evaluate polarimetric imaging techniques, including improved imager performance against camouflage and decoys. Incorporate these polarimetric imaging techniques into sensor platforms being devised for the Future Combat Systems. In FY03, evaluated environmental effects on polarimetric imaging for support of Army missile systems. Completed approximately 3,000 new rule thresholds for various weapons systems, both friendly and threat, that will be used in creating new generation of physics-based tactical decision aids. Interfaced enhanced weather effects into Army Warfare System/Joint Warfare System (AWARS/JWARS) war games for a more realistic depiction of real-time atmospheric effects on operations and systems. In FY04, integrate atmospheric propagation effects with models for natural, nocturnal and artificial illumination to improve characterizing the effects of urban environments on signatures and target acquisition; integrate direct weather impacts on signatures by using the Weather and Atmospheric Visualization Effects for Simulation suite of models. In FY05, devise optical turbulence blur and feature distortion effects models to simulate performance differences and tradeoffs in sensor optics, detector spectral responses and signal processing methods under different environments.	1069	1006	1119
Measure single particle fluorescence spectra and scattering signatures of biological and natural aerosols in the atmospheric boundary layer. In FY03, created algorithms to use these measurements to improve chemical/biological aerosol characterization capability. Characterized the natural background by using rapid aerosol agent detection techniques. In FY04, research laser based techniques for aerosol detection/classification using polarization scattering for aggregate particles. In FY05, improve other laser-based techniques for aerosols detection/classification including broadband Light Detection and Ranging (LIDAR) for size distribution and concentrations.	944	902	928

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Integrate the effects of vegetation and terrain on acoustic propagation into a battlefield decision aid and extend the acoustic decision aids to infrasonic frequencies for intelligence operations. In FY03, established an infrasound test site and devised an infrasonic signature database that will be used in the enhancement of tactical decision aids that will provide commanders with the capabilities to utilize acoustic technology for not only detection of enemy placements, but also to hide troop movements. In FY04, implement high compression techniques for acoustic and infrasonic data retrieval. Analyze acoustic and infrasonic signatures to characterize and identify the source. In FY05, create a first principle, three dimensional (3D) propagation model capable of handling dynamic atmospheric inputs and complex ground surfaces to produce high-fidelity simulated signals and realistic environmental impact for acoustic sensors.	377	320	343
Small Business Innovative Research/Small Business Technology Transfer Programs	0	13	0
Totals	6211	5891	6619

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T40	MOB/WPNS EFF TECH	16331	16318	17345	18289	19123	18979	19310

A. Mission Description and Budget Item Justification: The objective of this project is to mature technology for rapid upgrading, construction, and repair of in-theater airfields; overcoming battlespace gaps through prediction, definition, avoidance, or defeat; expedient protection for the warfighter during contingency operations; and rapid port enhancement. This research supports development of the Future Combat Systems (FCS) and Future Force by providing physics-based representation of mobility, obstacle and barrier creation, 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). Work in this project is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Force Protection - In FY03, developed systematic procedures to identify construction methods and characterize their material properties. This development will characterize buildings world-wide based on 20 structural types. In FY04, develop guidance for rapid construction of survivability and fighting positions tailored to urban environments. This effort will increase probability of survival of personnel and critical assets in urban structures by a minimum of 30% from enhanced blast and fragmentation weapons. Evaluate expedient protective concepts for PATRIOT and Joint Tactical Ground Station in support of the Program Executive Office for Air Space and Missile Defense. In FY05, will increase the number of structural types that can be rapidly assessed from 13 to 20 structural types. Will develop protection upgrades for facilities supporting Air and Missile Defense assets.	1960	4732	5203
Weapons Effects and Structural Response – In FY03, produced methods for predicting blast effects on unprotected structures and ground shock effects in different rock types, and improved techniques for predicting high velocity penetration into structural materials, such as concrete. In FY04, complete methodology to predict blast effects on structures protected by barriers. Conduct experiments measuring airblast from adjacent buildings. In FY05, will conduct investigations of one-stop breaching methods. Will produce algorithms for predicting penetration of Army weapons into multiple thin construction layers.	2613	2285	2602

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Materials and Criteria for Protective Construction – In FY03, matured elastomeric polymer structural retrofit capabilities for protection of conventional construction.	1960	0	0
Force Projection/Joint Rapid Airfield Construction - In FY03, integrated advanced construction technologies to enhance airfield construction productivity. In FY04, demonstrate improved construction techniques and C-130 capable technology. In FY05, will develop advanced stabilization techniques to reduce cure time from 30 days to 1-2 days while reducing logistical footprint. Rapid Port Enhancement - In FY03, modified the Coastal Integrated Throughput Model to include attributes and capabilities of the Theater Support Vessel and rapid port enhancement products. Determined rapid force projection and sustainment Sea Port of Debarkation enhancement requirements for future sealift operational scenarios; produce initial suite of overall port enhancement design concepts including application of “hydro-beam” technologies and integration of coastal climatological database system; produced Coastal Integrated Throughput Model Version III, including stochastic modeling capability. In FY04, perform coastal throughput assessment for rapid force projection and sustainment operations for a particular theater of operation to include assessment of capabilities to meet force projection demands associated with the Army Transformation; test database methodology for final Theater Support Vessel design capabilities and provide parameters affecting throughput to the Coastal Integrated Throughput Model. In FY05, will integrate Coastal Integrated Throughput Model into larger-scaled modeling systems and applications; conduct intermediate-scale experiments for "hydro-beam" causeway and near-shore breakwater.	3593	4569	4510
Maneuver Support – In FY03, evaluated solutions for rapidly assessing condition and predicting future performance of roads and bridges in theater of operations to expedite route planning. In FY04, identify and evaluate technologies for physically measuring critical terrain gap parameters to improve gap reconnaissance techniques. In FY05, will evaluate concepts for defeating gaps less than four meters wide through simulation and analyses. Will determine mobility performance requirements for advanced vehicle platforms such as FCS. Will quantify maneuverability within urban environments on the future battlefield. Will create hydrologic decision analysis capability for wet gaps to provide rapid in-theater maneuver assessment for the warfighter.	4082	2937	3122

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Battlespace Environment Support - In FY03, developed realistic mobility portrayals as a function of short-term changes in the ground-state to support unit movement evaluation. Provided digital reconnaissance applications to allow rapid remote main supply route assessments via TeleEngineering. In FY04, create innovative common maneuver information products for entity and aggregate level maneuver networks such as Battlespace Terrain Reasoning and Awareness (BTRA) and the One Semi-Automated Forces (OneSAF) constructive model. Mature solutions for predicting future performance of roads, bridges, and naturally occurring static obstacles to expedite throughput assessment over enhanced maneuver networks. Create logistics support models for timing, resourcing, and deconfliction over tactical routes. In FY05, will mature unique scaling and adaptive algorithms between entity and aggregate level maneuver networks including procedures to correlate and modify data structures between BTRA and OneSAF. Will mature advanced throughput models for intelligent maneuver decisions including bypass options, route planning, resourcing, and management tools. Will determine combined effects of static and dynamic obstacles on maneuver planning tools. Will provide functional components to create a common integrated obstacle overlay capability.	2123	1795	1908
Totals	16331	16318	17345

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T41	MIL FACILITIES ENG TEC	4496	4624	4881	4942	5060	5010	5097

A. Mission Description and Budget Item Justification: The objective of this project is to perform applied research necessary 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 forward basing. In addition, planned facility enhancements will achieve cost reduction in the Army facility life cycle process (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal), and the supporting installation operations. This work will improve the ability of installations to project forces to meet transformation goals and to enhance 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. 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 Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Facility Modeling and Simulation/Fort Future – In FY03, simulated force projection flow through the installation in order to provide a local optimization tool and to enable a risk-based approach to investing in mission-critical infrastructure. Developed an Installation Mission Essential Task List requirements process to directly tie resource decisions to unit mission. Modeled facility requirements to produce rapid parametric cost estimates, thereby optimizing facility programming decisions. In FY04, deliver a decision support environment that will use modeling and simulation to test and validate the ability of installation infrastructure investments to meet Future Force force projection, training readiness, facilities and anti-terrorism requirements. In FY05, will validate prediction and optimization algorithms for installation capability to support Army Installation Transformation. Will extend force projection algorithms to cover multiple, regional installations.	2203	2265	1855
Facility Engineering – In FY03, generated analytical models and design guidance for seismic rehabilitation of reinforced concrete frames with masonry infill to comply with current seismic criteria. In FY04, complete the development and recommend rehabilitation procedures for seismic upgrades to roofing diaphragms. Develop innovative strategies and business practices for life-cycle commissioning of facilities to support CBR protection. In FY05, will complete initial beta version of model to depict CBR airborne dispersion rates in military facilities, and establish performance related requirements for building envelopes. Will complete forward facility planning tools.	2293	2358	3026
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1	0
Totals	4496	4624	4881

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T42	COLD REGIONS ENGR TECH	3924	3949	4315	4446	4523	4515	4600

A. Mission Description and Budget Item Justification: This project provides 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). Work in this project is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Terrain State – In FY03, developed realistic winter mobility portrayal of terrain conditions as a function of short-term changes in the ground state to support unit movement projections. Completed a site assessment methodology and established criteria for the remedy of high moisture content soils for assault airfield construction. Developed all-season material models that simulate the mechanical behavior of different terrain materials (freezing/thawing soil), ice, and snow to improve simulation of vehicle-terrain interaction in support of the High Fidelity Ground Platform and Terrain Mechanics Modeling program. In FY04, advance terrain state modeling and incorporate region/area specific probability detection functions defining background clutter impact on sensor performance for Battlespace Terrain Reasoning and Awareness tactical decision aids. Complete assessments for strengthening indigenous soils during thaw periods for rapid all-season construction of forward theater airfields. Extend finite element modeling of tire-terrain interactions to these materials. In FY05, will develop 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. Will establish initial suite of remote site assessment, evaluation and selection decision aids for Joint Rapid Airfield Construction. Will mature and transition 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.	3100	3099	3452

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Signature Physics – In FY03, finalized high fidelity seismic propagation modeling. Modified terrain thermal model to include a wider range of manmade materials in support of the Army Research Laboratory (ARL) Command and Control in Complex and Urban Terrain program. In FY04, develop tactical complex terrain thermal modeling tools for urban and complex features. Complete assessment of acoustic propagation in forested terrain and establish a methodology for modeling propogation in complex/urban environments. Initiate high-fidelity acoustic propogation simulation and dynamic acoustic vehicle signature model and establish basis for developing generic performance criteria for unattended seismic ground sensor tactical decision aids in support of the Networked Sensors for the Future Force (NSfFF) ATD. In FY05, will complete 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 NSfFF. Will develop query and subscription based incorporation of signature physics tool set (e.g., weather induced terrain state) with the ARL Command and Control in Complex and Urban Terrain program collaboration tools.	824	824	863
Small Business Innovative Research/Small Business Technology Transfer Programs	0	26	0
Totals	3924	3949	4315

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T45 ENERGY TEC APL MIL FAC	2849	2971	3206	3383	3446	3457	3521

A. Mission Description and Budget Item Justification: The objective of this 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). Advanced energy technologies and processes are also applied to the Army's industrial base to maintain its cost-effective readiness for munitions production, and in the theater of operations to reduce 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). Work in this project is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Installation Modeling and Simulation/Fort Future – In FY03, adapted utility distribution system software models to military scenarios including mobilization (Force Projection) and response to terrorist threats such as chem/bio contamination (Force Protection). In FY04, mature dynamic risk models to analyze supply and demand of energy/environment distribution systems to include CBR terrorist threat scenarios for critical military facilities. In FY05, will develop integrated tools for judging suitability of energy infrastructure to support power projection, readiness, threat assessment, and sustainability requirements.	1852	1908	2095
Energy and Utility Systems Response to Threats – In FY03, crafted energy control system architecture and protocol compatible with facility technologies to optimize building energy performance and worker comfort and productivity. In FY04, adapt supply and demand technologies allowing for an integrated building control system that provides for a highly reliable platform for CBR protection and energy efficiency. In FY05, will mature performance requirements for building mechanical systems consistent with CBR protection metrics, and complete initial beta version of model to depict CBR water borne dispersion rates in water systems.	997	1027	1111
Small Business Innovative Research/Small Business Technology Transfer Programs	0	36	0
Totals	2849	2971	3206

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		15130	15053	15322	15622	16288	16393	16651
780	REFUGEE MANAGEMENT & TRACKING SYSTEM	2287	0	0	0	0	0	0
790	PERSONNEL PERFORMANCE & TRAINING TECHNOLOGY	12843	15053	15322	15622	16288	16393	16651

A. Mission Description and Budget Item Justification: The objective of this program is to provide the scientific and technical basis for personnel selection, leader development, and training that will ensure that the human component of warfighting can maximize the benefit of transformations in advanced technologies, weapons, and equipment (e.g., Future Combat Systems) and can perform effectively in Future Force operations and, where feasible, exploits opportunities to enhance Current Force capabilities. This applied research program will provide methods, techniques, and tools to improve the assignment procedures to ensure the right person is placed in the right job, develop improved methods for developing leader cognitive skills, and provide the behavioral science technologies required for the development of effective individual and collective (unit) training strategies. Research topics include training strategies for the digitized battlefield; strategies to maximize the training effects in simulated environments; optimum designs and utilization of simulators and training devices to achieve maximum learning at minimum cost; and modernization of the selection and classification systems to maintain warfighting capabilities for future forces. Beginning in FY 2004, a major thrust of this program will be to expand Leader Development applied research beyond the existing work on more effective methods to develop the critical thinking skills that leaders must have to make effective battlefield decisions in rapidly changing operational situations and in information-rich environments. Additional research will be initiated on developing the interpersonal skills needed by small unit leaders to rapidly form cohesive teams with continuously changing mission requirements and personnel turbulence, and to effectively operate with diverse groups (joint, multi-cultural, interagency, etc.); and on developing mentoring and coaching skills so leaders can support early development of leadership skills and adaptability in younger leaders. This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). 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).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	15358	15548	15607
Current Budget (FY 2005 PB)	15130	15053	15322
Total Adjustments	-228	-495	-285
Congressional program reductions		-132	
Congressional rescissions			
Congressional increases			
Reprogrammings	-228	-363	
SBIR/STTR Transfer			
Adjustments to Budget Years			-285

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
790	PERSONNEL PERFORMANCE & TRAINING TECHNOLOGY	12843	15053	15322	15622	16288	16393	16651

A. Mission Description and Budget Item Justification: The objective of this program is to provide the scientific and technical basis for personnel selection, leader development, and training that will ensure that the human component of warfighting can maximize the benefit of transformations in advanced technologies, weapons, and equipment (e.g., Future Combat Systems) and can perform effectively in Future Force operations and, where feasible, exploits opportunities to enhance Current Force capabilities. This applied research program will provide methods, techniques, and tools to improve the assignment procedures to ensure the right person is placed in the right job, develop improved methods for developing leader skills, and provide the behavioral science technologies required for the development of effective individual and collective (unit) training strategies. Research topics include training strategies for the digitized battlefield; strategies to maximize the training effects in simulated environments; optimum designs and utilization of simulators and training devices to achieve maximum learning at minimum cost; and modernization of the selection and classification systems to maintain warfighting capabilities for future forces. Beginning in FY 2004, a major thrust of this program will be to expand Leader Development applied research beyond the existing work on more effective methods to develop the critical thinking skills that leaders must have to make effective battlefield decisions in rapidly changing operational situations and in information-rich environments. Additional research will be initiated on developing the interpersonal skills needed by small unit leaders to rapidly form cohesive teams with continuously changing mission requirements and personnel turbulence, and to effectively operate with diverse groups (joint, multi-cultural, interagency, etc.); and on developing mentoring and coaching skills so leaders can support early development of leadership skills and adaptability in younger leaders. 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 2003	FY 2004	FY 2005
Personnel Selection and Assignment: In FY03, identified knowledge, skills, and attributes needed for Soldiers to successfully perform in future jobs (e.g., for the Future Force); validated new screening tools for Army recruiters and quantified the amount of improvement offered by these tools over the current recruiter selection system; assessed recent technological advances in job/skill performance certification; proposed the design of Army enlisted job certification measures; and validated model for predicting first-term enlisted attrition. In FY04, identify and develop predictors and measures of future enlisted Soldier job performance; validate new screening tools for station commanders and develop implementation strategies for new recruiter and station commander screening batteries; and develop prototype job certification measures. In FY05, will recommend procedures for a more flexible enlisted selection and classification system that can keep pace with changing job requirements; and will begin a formal validation, in an operational environment, of a new system for trainers and commanders to certify that Soldiers qualify on the skills necessary for effective job performance.	3949	4042	4182

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Training: In FY03, incorporated advanced simulation methods into new qualification instruction for OH-58D helicopters and tested for improved performance, safety, and reduced costs; identified requirements for automated tools to measure Command, Control, Communications, and Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) skills; identified methods to train small units to identify critical battlefield information to fully utilize capabilities of evolving Soldier systems (e.g., Objective Force Warrior); developed preliminary metrics for assessing small unit Soldier and leader performance that are flexible enough to transition as new systems are fielded; and derived principles of training and knowledge transfer for TRADOC to use in programs for acquiring digital skills. In FY04, identify the roles of simulators and live aircraft within a model of simulation-intensive collective aircrew training; formulate principles for training key C4ISR skills; and develop cutting edge training methods for new Objective Force Warrior Small Unit leader tasks and Tactics, Techniques, and Procedures (TTPs). In FY05, will evaluate prototype simulation-intensive collective aircrew training programs; will develop methods for training key C4ISR skills for Future Combat Systems (FCS) Unit of Action commanders and staffs; and will formulate principles of effective performance measurement in future environments. It will also assess the effectiveness of embedded/virtual/augmented reality approaches for small unit leader training; and will demonstrate after action review and feedback capabilities in wearable computers. ARI personnel are co-located and will collaborate with the Simulation and Training Technology Center (STTC) on these efforts.	7380	6906	7196
Leader Development: In FY03, assessed the utility of developing leader interpersonal and teamwork skills using a mix of film, animation, and role playing innovations; and implemented and evaluated multi-national teamwork training peacekeeping forces in Bosnia. In FY04, identify components of an experiential growth model of accelerated leader development; and develop techniques for small group coaching of leaders. In FY05, will develop approaches to help leaders identify their strengths and assess their growth as leaders throughout their careers; will refine measures of effective leader performance; and will create battlefield vignettes and scenarios for use in Combined Arms and Services Staff School (CAS3) and FCS.	1514	3827	3944
Small Business Innovative Research/Small Business Technology Transfer Programs	0	278	0
Totals	12843	15053	15322

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	35826	49349	21131	22371	25215	21696	19616
283	AIRDROP ADV TECH	5621	4748	2543	2288	2332	2325	2368
C60	AC60	0	3935	4285	1675	3624	0	0
E01	WARFIGHTER TECHNOLOGY INITIATIVES (CA)	2334	18492	0	0	0	0	0
E02	CHEMICAL BIOLOGICAL COMMAND	952	0	0	0	0	0	0
H98	CLOTHING & EQUIPM TECH	17076	17358	9153	13330	14049	14149	11928
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	6986	4816	5150	5078	5210	5222	5320
WA1	CENTER FOR RELIABLE WIRELESS COMM TECH	2857	0	0	0	0	0	0

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: combat clothing and personal equipment; combat rations and combat feeding equipment; and the air delivery of personnel and cargo. 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 and integration; provide wearable, conducting materials to augment data and power transmission; provide encapsulated cooling to the Soldier in extremely hot environments; and significantly 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 impact/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. Similarly, 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. It adheres 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) Food & Nutrition Research & Engineering Board. The program element contains no duplication with any effort within the Military Departments. 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 Natick Soldier Center, Natick, MA.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	34239	29421	21375
Current Budget (FY 2005 PB)	35826	49349	21131
Total Adjustments	1587	19928	-244
Congressional program reductions		-433	
Congressional rescissions			
Congressional increases		21550	
Reprogrammings	1587	-1189	
SBIR/STTR Transfer			
Adjustments to Budget Years			-244

Significant Change Explanation.
FY04 - Nine FY04 Congressional Adds totaling $21550 were added to this PE.

FY04 Congressional Adds with no R-2A:
($939) Advanced Antimicrobial Technology, Project E01: The purpose of this one year Congressional add is to research antimicrobial technology for possible application to fibers, textiles, and soldier equipment. No additional funding is required to complete this project.
($1879) Chem-Bio Protection Technology, Project E01: The purpose of this one year Congressional add is to research chemical/biological protective technology for possible application to fibers and textiles. No additional funding is required to complete this project.
($3288) Chem/Bio Reactive Nanoparticle Materials, Project E01: FY04 is the second year for this Congressional add. The purpose is to support research on a nano-based process to improve the chemical/biological protection of textiles. No additional funding is required to complete this project.
($939) Chemical Biological Command, Natick Soldier Center, Project E01: FY04 is the second year for this Congressional add

. The purpose is to improve materials for airbeam shelters. No additional funding is required to complete this project.
($4791) MERWS (Modular Extendable Rigid Walled Shelter) Composite Field Medical Facility Prototype, Project E01: FY04 is the second year for this Congressional add that was previously funded under line 183 (Manufacturing Technology). The purpose is to research medical shelter technology. No additional funding is required to complete this project.
($3194) NBC Integrated Protection Membrane – Shelters, Project E01: The purpose of this one year Congressional add is to research chemical/biological protective technology for possible application to fibers and textiles. No additional funding is required to complete this project.
($939) Shelter Extension for Future Combat Vehicle, Project E01: The purpose of this one year Congressional add is to research chemical/biological protective technology for possible application to fibers and textiles. No additional funding is required to complete this project.
($1973) Soldier Systems Center, Project E01: FY04 is the third year for this Congressional add previously under project H99. The purpose is to develop food processing methods, optimize processing parameters, and improve ration formulations for combat food and feeding processes. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
283 AIRDROP ADV TECH	5621	4748	2543	2288	2332	2325	2368

A. Mission Description and Budget Item Justification: This project researches technologies to enhance cargo airdrop and personnel capabilities. These are key to Army Transformation rapid deployment and insertion capabilities for force projection, particularly into hostile areas. Areas of emphasis include parachute technology for improved performance, precision offset aerial delivery, soft landing technologies, airdrop simulation, and low altitude/high speed airdrop systems technologies. Efforts will result in increased personnel safety, more survivable and more accurate cargo delivery and reduced personnel, aircraft, and cargo vulnerability. The goal for personnel parachute technology is to increase personnel safety by providing an auto sensing capability to trigger parachute opening in the event the parachutist is incapacitated or disoriented and therefore unable to respond to a malfunction. This project will enhance the military's capability for global precision delivery and rapid force projection and supports the rapid deployment goal of the Army Transformation. 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 US Army Natick Soldier Center, Natick, MA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Advanced Air Cargo Delivery - In FY03, optimized the design of advanced low cost autonomous controllable airdrop systems utilizing high performance computing (HPC) modeling tools; designed and conducted scaled tests on smaller and less expensive autonomous guidance navigation & control systems for low and primarily high altitude airdrop applications; completed the graphical user interface front end for Airdrop System Modeling tools. In FY04, complete the airdrop system modeling tool and refinement. Investigate material alternatives for Precision Airdrop - Medium (30,000 lbs). Identify preferred concepts and conduct component modeling. In FY05, will complete airdrop system model validation and transition high-fidelity computer modeling tool to PMForce Sustainment Systems and industry. Will evaluate sub-scale concept models for Precision Airdrop - Medium.	1790	1796	2543
Personnel Parachute Technology - In FY03, fabricated system component prototypes for automatic opening capability and conducted component-level field experiments. In FY04, conduct systems integration/human factor analysis for the parachute reserve automatic opening capability and transition to a 6.3 follow-on program.	950	469	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Standoff Precision Aerial Delivery System (PADS)- In FY03, this Congressional add advanced the near real time wind forecast/sensing capabilities on Standoff PADS, matured computer-based airdrop mission planner and tested the linkage of the PADS system via a wireless communication method to “smart” precision airdrop systems. In FY04, the purpose of this Congressional add is to improve PADS capabilities through multi-channel wind sensors, advanced wireless download capabilities and raising performance up to 35K ft Mean Sea Level (MSL). No additional funding is required to complete this effort.	2881	2391	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	92	0
Totals	5621	4748	2543

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H98	CLOTHING & EQUIPM TECH	17076	17358	9153	13330	14049	14149	11928

A. Mission Description and Budget Item Justification: This project supports the Army Transformation in the area of improved dismounted Soldier capabilities by researching and investigating technologies to improve Soldier survivability and performance. Research emphasizes: ways to significantly lighten the Soldier's load; lightweight materials for personal survivability (e.g., improved ballistic, flame, and directed energy protection, enhanced signature management); and human science, modeling and analysis tools for optimizing Soldier system clothing and equipment. The goal of the ballistic protection work is to research and mature advances in materials technology to improve the protection and performance of warrior armor systems against conventional and emerging ballistic threats. The lightweight Soldier effort will reduce the weight of dismounted warrior systems by exploiting nanotechnology and by employing virtual prototyping tools to integrate warrior "system-of-systems" concepts on the human. The goal of the project's modeling effort is to construct essential analytic tools that can be used to assess the military worth of next generation warrior systems (including Objective Force Warrior (OFW)) and evaluate alternatives. This effort will produce modeling tools having the potential to reduce program risk in the areas of prototype development and system down-selection. The load carriage optimization effort developed biomechanical methods, design guidance, and predictive analytical/statistical models addressing the human locomotion and load-bearing functions of the Soldier system. These tools will enhance the efficiency of ground maneuver and the fightability of dismounted troops. Nanotechnolgy 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 on researching conducting, flexible, wearable materials for lightweight power generating and storage devices to augment power sources for Soldier-worn computers and equipment. The objective of the novel blast protection activity is to characterize blast profiles and determine the hazard in order to provide improved protection concepts. This project leverages work performed by the Institute for Soldier Nanotechnologies supported by PE0601104A (University and Industry Research Centers) and PE0602105A (Materials Technology). A portion of this project accelerates technology development for transition to the Objective Force Warrior (OFW) program. 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.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Ballistic Protection for the Individual Warrior – In FY03, demonstrated an improved (over FY99 baseline) material system breadboard for 2nd generation multiple ballistic threat protection prototype with 25% decrease in weight (or an increase in protection or a combination, depending on user requirements). Constructed an opaque armor system with 30% reduced areal density (over FY00 baseline) against emerging fragment threat without incurring significant cost, bulk, or flexibility penalties. In FY04, establish technology with 30% reduced areal density over FY00 baseline against tungsten-carbide core projectiles (0.30 caliber or less). Establish transparent armor technology for face protection with a 30% reduced areal density for fragmentation protection that will also provide handgun protection. Research and evaluate composite material systems for novel integrated armor and load carriage components of the Objective Force Warrior system architecture that enhance Soldier mobility, thermal balance, protection, and performance. Establish enhanced assessment model to evaluate advanced fibers for potential ballistic protective materials and select those that have potential to achieve weight reductions. In FY05, will enhance fiber mechanical properties through processing/post-processing techniques and evaluate ability to meet required properties. Will begin research on material system(s) architecture incorporating advanced fibers into flexible materials and composite technology.	2900	4672	3400
Lightweight Soldier Materials & Virtual Prototyping Tools – In FY03, collected and used human system data to enhance and verify virtual prototyping tools for soldier systems with human biomechanical and performance data. Evaluated the performance of breadboard prototype panels or system components made with nanomaterials to determine technology readiness for transition to the Objective Force Warrior (OFW) program (PE63001, Project J50), and to determine the path for further nanotechnology refinement and manipulation. In FY04, complete documentation of performance of nanotechnology-based system components and enhancements of virtual prototyping tools. Accelerate and apply virtual prototyping enhancements to OFW technology components in two of four planned OFW component design cycles. Complete fatigue detection algorithms to better predict fatigue for dismounted soldiers. Complete methodologies for data extraction/transfer from Data Access and Retrieval Tool (DART) – a data repository being developed for modelers and analysts throughout DoD. Accelerate technology development in advanced materials areas including ventilation/cooling, e-textiles, and novel uniform materials for transition to the OFW program in FY05.	6600	7650	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Warrior Systems Modeling Technology – In FY03, established a capability to improve the representation of human behavior using reactive intelligent agents in modeling the close combat/Military Operations in Urban Terrain environment. Demonstrate first generation Intelligent Agent model. In FY04, deliver a small unit, force-on-force, High Level Architecture compliant model to assess the combat effectiveness of warrior components and systems. In FY05, will establish next generation intelligent agent capabilities to expand the capability to assess information inputs and decision-making at the small unit level.	2283	2000	2353
Load Carriage Optimization for Enhanced Warfighter Performance – In FY03, validated and finalized load carriage data and analysis for transition to the Warrior Systems Modeling Technology effort; developed design guidance for load carriage that improves mobility by 15%.	1400	0	0
Nanocomposites & Nanofibers for Warrior Systems – In FY03, fabricated conformal solar cell devices with a minimum 30% reduction in weight (compared to current devices with similar power levels) for use in Soldier systems. In FY04, mature technology towards lightweight and conformal prototype photovoltaic battery rechargers that could be either directly integrated into a soldier “mule” or carried by the individual soldier for renewable battery recharging for Objective Force Warrior systems. In FY05, will continue to mature a photovoltaic fiber that can be employed by warrior systems to power soldier-borne items.	1893	1700	400
Novel Blast Protection – In FY03, modeled the behavior of protective clothing materials exposed to blast using impedance theory and compared results to experimental shock tube data. Working with U.S. Army Medical Research and Materiel Command, incorporated results into a casualty model to predict interaction of blast with the thorax. Initiated analysis to define experimental needs and test device requirements. In FY04, establish fundamental understanding of blast protection and construct test device for testing protective material system concepts. In FY05, will define and develop initial protective material system concepts for Interceptor Vest (“add-on” blast protection) and Objective Force Warrior. Will conduct evaluations on material system concept(s).	2000	1000	3000
Small Business Innovative Research/Small Business Technology Transfer Programs	0	336	0
Totals	17076	17358	9153

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	6986	4816	5150	5078	5210	5222	5320

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 mature technology that reduce field feeding logistics by over 75% (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 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 Food & Nutrition 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 (USARIEM).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Equipment and Energy Technologies – In FY03, integrated and tested experimental cogenerators, refrigerators, sanitation, greywater recycling and experimental field kitchen appliances for Field-Feeding and Advanced Sustainment Technology (FAST). Completed proof of principle for thermoelectric technology to provide hot water to re-hydrate meals and cold beverages for crew sustainment in Future Combat Systems (FCS). Matured nonstick durable quasicrystalline coating technology for cookware to reduce the life cycle costs of cookware and the water consumption during sanitation. Evaluated new compact insulation technology for food containers to reduce footprint by 65%. Prepared methodology models to estimate kitchen workload reduction for future kitchens. In FY04, mature FAST technologies to include a single multi-stage burner, 2nd generation expander and heat driven refrigeration system. Design, fabricate and evaluate prototype, lightweight, cost-effective thermoelectric water heater chiller for FCS crew sustainment; transition to 6.3. Coat commercial cookware with quasicrystals. Investigate flameless catalytic combustion of JP8 fuel. Expand kitchen workload database and finalize workload/staffing computer model. In FY05, will research technology for individual beverage chiller and water heaters for the Objective Force Warrior. Will test and evaluate quasicrystalline coating technology. Will explore self-powered and solar-powered refrigerated container technology for the Battlefield Kitchen. Will develop Class I decision support tools and Field Feeding Kitchen Workload Models to optimize cost, readiness and workload.	1948	2099	2357

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Ration Preservation & Stabilization, Revolutionary Packaging & Food Safety Technologies - In FY03, evaluated various surface scanning technologies for real time ration contamination assessment. Identified pathogen technologies for maturing ration components resistant to the virulent effects of food pathogens. Prepared decision support tools to quantify/analyze annual cost impacts of current/alternative ration concepts, shelf life, rotation policies, and ration consumption mixes. In FY04, mature surface scanning technologies. Increase sensitivity of food probes to enhance antibody based pathogen sensor by 30-fold. Incorporate research on pathogen resistant technologies into ration components and evaluate viability. Select cost-effective nanotechnology-based films/packaging with optimum barrier properties. Investigate tamper evident (TE) packaging technologies at ISO-container, pallet and case level to insure security of combat rations. In FY05, will mature probes and transition to diagnostics platforms. Will mature self-hydrating membrane pouch forward osmosis technology for safe/effective re-hydration of dried beverages/rations by non-potable water sources for the future warrior. Will establish rapid, reliable, easy-to-use objective techniques for detecting ration degradation to reduce waste. Will investigate Radio Frequency Identification (RFID) technologies applicable to ration logistics, integrate into TE concept and evaluate. Will mature technology to predict combat ration quality via RFID.	2037	1691	1910
Technologies for Nutrients and Novel Delivery Systems – In FY03, investigated/identified novel component technologies such as compressed meals and gels to enhance operational effectiveness (i.e., mobility), reduce weight/volume and optimize warfighter acceptance, consumption and performance. Downselected anti-fatigue nutraceuticals for novel nutrient delivery (i.e. buccal, transdermal, gel). In FY04, investigate and integrate extrusion, protein encapsulation, dehydration, and combinations of technologies to provide novel nutrient delivery for ration components and enhanced performance. In FY05, will mature performance enhancing ration component technology such as gels, calorie-dense savory meat and vegetable bars, rehydratable bars, performance enhancing beverages and encapsulated micronutrients, and investigate oral mucosal absorption.	970	986	883
Combat Feeding Research, Soldier Systems Center - In FY03, this Congressional add established processing parameters, optimized equipment/ration formulations and conducted microbial efficacy studies for novel processing technologies (radio frequency sterilization, microwave sterilization and high pressure processing) to improve ration quality and variety. It also identified/conducted efficacy testing of nutraceuticals for transdermal and other novel delivery systems to relieve effects of stress on the warfighter. No additional funding is required to complete this project.	2031	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	40	0
Totals	6986	4816	5150

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	120935	174501	60877	69782	67732	65938	64020
841	COMPUTER-ASST MINIMALLY INVASIVE SURGERY	2002	1355	0	0	0	0	0
845	BONE DISEASE RESEARCH PROGRAM	1001	0	0	0	0	0	0
863	BTLFLD SURGICAL REPLAC	4811	2905	0	0	0	0	0
865	CENTER FOR MILITARY BIOMATERIALS RESEARCH	952	1452	0	0	0	0	0
866	CLINICAL TRIAL PLEZOELECTRIC DRY POWDER INHALATION	1619	0	0	0	0	0	0
867	DIAGNOSTICS IN TRAUMATIC BRAIN INJURY BLOOD BASED	1430	969	0	0	0	0	0
869	T-MED/ADVANCED TECHNOLOGY	3105	3356	3378	3415	3512	3574	3641
870	DOD MED DEF AG INF DIS	26760	13838	15676	16366	16042	15983	16384
873	HIV EXPLORATORY RSCH	0	10881	10819	11270	11512	11475	11433
874	CBT CASUALTY CARE TECH	8487	8668	8469	16051	13838	11914	9148
878	HLTH HAZ MIL MATERIEL	11038	11521	12116	12140	12276	12404	12637
879	MED FACT ENH SOLD EFF	8515	8740	10419	10540	10552	10588	10777
953	DISASTER RELIEF & EMERGENCY MEDICAL SVC (DREAMS)	0	10650	0	0	0	0	0
968	SYNCH BASED HI ENERGY RADIATION BEAM CANCER DETECT	16909	22026	0	0	0	0	0
96A	EMERGENCY HYPOTHERMIA	2106	2226	0	0	0	0	0
96C	DIGITAL IMAGING AND CATHERIZATION EQUIPMENT	763	969	0	0	0	0	0
96D	ENDOBIOLOGICS VACCINATION PROGRAM	952	0	0	0	0	0	0
96E	HEMORRHAGE CONTROL DRESSING	2334	2905	0	0	0	0	0
96F	PORTABLE BIOCHIP ANALYSIS SYSTEM	1714	0	0	0	0	0	0
96G	PRE-CLINICAL AND CLINICAL EVALUATION	1619	0	0	0	0	0	0

96H	RUGGED TEXTILE ELECTRONIC GARMENTS	952	0	0	0	0	0	0
96I	REMOTE ACOUSTIC HEMOSTASIS	6670	3388	0	0	0	0	0
96J	GULF WAR ILLNESS	2857	0	0	0	0	0	0
MA1	ARTHROPOD-BORNE INFECTIOUS DISEASE CONTROL	2002	0	0	0	0	0	0
MA2	DIABETES PROJECT	0	6536	0	0	0	0	0
MA3	MEDICAL AREA NETWORK FOR VIRTUAL TECHNOLOGY	3240	5712	0	0	0	0	0
MA4	SPEECH CAPABLE PERSONAL DIGITAL ASSISTANT	1905	0	0	0	0	0	0
MA5	CENTER FOR INTERNATIONAL REHABILITATION	3334	3388	0	0	0	0	0
MA6	DERMAL PHASE METER	1001	1162	0	0	0	0	0
MA8	MONOCLONAL ANTIBODY BASED TECHNOLOGY	0	1452	0	0	0	0	0
MA9	OPERATING ROOM OF THE FUTURE	2857	0	0	0	0	0	0
NA7	ADVANCED SURGICAL NAVIGATION (CA)	0	1743	0	0	0	0	0
NA8	IMPROVING SOLDIER PERFORMANCE (CA)	0	2324	0	0	0	0	0
NA9	BEHAVIORAL GENOMICS (CA)	0	1936	0	0	0	0	0
OA1	BIO-DEFENSE GENE KNOCKOUT TECHNOLOGY (CA)	0	2033	0	0	0	0	0
OA2	BIOMEDICAL ENG TECH AND ADV MATERIALS (CA)	0	969	0	0	0	0	0
OA3	CENTER FOR ADV SURGICAL & INTERVENTIONAL TECH (CA)	0	2033	0	0	0	0	0
OA4	CHRONIC MULTI-SYMPTOM ILLNESSES (CA)	0	4841	0	0	0	0	0
OA5	COMPUTATION PROTEOMICS (CA)	0	2905	0	0	0	0	0
OA6	CONJUGATE VACCINES TO PREVENT SHIGELLOSIS (CA)	0	1355	0	0	0	0	0

OA7	ELGEN GENE DELIVERY TECHNOLOGY (CA)	0	969	0	0	0	0	0
OA8	ENHANCED RES IN TRAUMA PREVENTION/TREATMENT/REHAB	0	1452	0	0	0	0	0
OA9	GENETIC ACUTE ENHANCED BIOWARFARE THERAPY PROG (CA	0	969	0	0	0	0	0
PA1	HEMOGLOBIN BLOOD OXYGEN CARRIER (CA)	0	969	0	0	0	0	0
PA2	LARGE-SCALE/POLYCLONAL/HUMAN ANTIBODY PRODUCTION	0	2905	0	0	0	0	0
PA4	WOUND HEALING PROJECT (CA)	0	3002	0	0	0	0	0
PA5	NANOFABRICATED BIOARTIFICIAL KIDNEY (CA)	0	2324	0	0	0	0	0
PA6	NATIONAL TISSUE ENGINEERING RESEARCH (CA)	0	969	0	0	0	0	0
PA7	NON-INVASIVE MEDICAL SENSORS (CA)	0	1452	0	0	0	0	0
PA8	NOVEL GROWTH FACTOR DELIVERY TECHNOLOGY (CA)	0	969	0	0	0	0	0
PA9	PROSTHETIC DEVICE CLIN EVAL AT WRAIR AMPUTEE CTR	0	2421	0	0	0	0	0
RA1	SLEEP DEPRIVATION RESEARCH AT WRAMC (CA)	0	1452	0	0	0	0	0
RA2	TARGETED NANOTHERAPEUTICS FOR CANCER (CA)	0	969	0	0	0	0	0
RA3	THERAPEUTIC VACCINES FOR BIOLOGICAL THREAT (CA)	0	969	0	0	0	0	0
RA4	TRANSPORTABLE PATHOGEN REDUCT AND BLOOD SAFETY SYS	0	1936	0	0	0	0	0
RA5	USAMRIID ANTHRAX RESEARCH (CA)	0	2421	0	0	0	0	0
RA6	VERSA HSDI (CA)	0	4115	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) supports focused research for healthy, medically protected soldiers and funds research consistent with the "Medical," "Survivability," and "Future Warrior" technology areas of the Future Force. Where feasible, it further seeks to exploit opportunities to enhance Current Force capabilities. The primary goal of medical research and development is to sustain medical technology to effectively protect and improve the survivability of U.S. forces in a variety of settings including, but not limited to: conventional battlefields, areas of low-intensity conflict, and military operations other than war.

This program element funds research for core applied technology in the following focus areas: Infectious Diseases; Combat Casualty Care; Military Operational Medicine; and Health Hazards for Materiels.

Infectious Diseases: The main focus in Infectious Diseases is the medical protection against naturally occurring diseases of military importance. This is accomplished by identifying and developing methods for infectious disease prevention and treatment including vaccines, prophylactic and therapeutic drugs.

Combat Casualty Care: Focus of applied research for the care of trauma and burns due to battlefield injuries. Research in this PE includes: organ system survival, shock treatment resulting from blood loss and infection, blood preservation, and potential blood substitutes for battlefield care. Combat Dentistry focus is on the prevention and treatment of combat maxillofacial (face/neck) injuries and essential dental treatment on the battlefield.

Military Operational Medicine: Encompasses biomedical solutions that protect soldiers and enhance their performance in the face of multiple stressors in operational and training environments. Relevant core capabilities include; a problem solving orientation, and a human physiology research focus. Representative areas of research concern include insect repellent, sleep deprivation, and nutritional needs.

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 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; and the U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL. The program element contains no duplication with any effort within the Military Departments.

NOTE: Due to database technical difficulties project X04, Molecular Genetics and Musculoskeletal Research, was left out of the resource table above. This particular project is a new FY 04 Congressional add of $8.5M. The correct program element total for FY 04 is 183,001.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	124314	58877	61072
Current Budget (FY 2005 PB)	120935	174501	60877
Total Adjustments	-3379	115624	-195
Congressional program reductions		-1497	
Congressional rescissions			
Congressional increases		118350	
Reprogrammings	-3379	-1229	
SBIR/STTR Transfer			
Adjustments to Budget Years			-195

Change Summary Explanation: FY04 - Forty-six FY04 Congressional adds totaling $129,850 were added to this PE.

FY04 Congressional Adds with no R-2As:
($1,800) Advanced Surgical Navigation, Project NA7
($2,500) USAMRIID Anthrax Research, Project RA5
($2,000) Behavioral Genomics, Project NA9
($2,100) Bio-Defense Gene Knockout Technology Program, Project OA1
($1,000) Biomedical Engineering Technology and Advanced Materials, Project OA2
($2,100) Center for Advanced Surgical and Interventional Technology, Project OA3
($1,500) Center for Military Biomaterials Research (CeMBR), Project 865
($3,000) Chitosan Hemorrhage Control Dressing, Project 96E
($5,000) Chronic Multi-sympton Illnesses, Project OA4
($3,000) Computation Proteomics, Project OA5
($1,400) Conjugate Vaccines to prevent Shigellosis, Project OA6
($1,200) Dermal Phase Meter, Project MA6
($3,000) Development of Large-scale Polyclonal Human Antibody Production, Project PA2
($1,000) Diagnostics in traumatic Brain Injury - Blood Based, Project

867
($1,000) Digital Imaging and Catheterization Equipment, Project 96C
($1,000) Elgen Gene Delivery Technology, Project OA7
($2,300) Emergency Hypothermia, Project 96A
($1,500) Enhanced Research in Trauma Prevention, Treatment and Rehabilitation, Project OA8
($1,000) Genetic Reassortment by Mismatched Repair-Enhanced Acute Biowarfare Therapy Program, Project OA9
($1,000) Hemoglobin Blood Oxygen Carrier, Project PA1
($2,400) Improving Soldier Performance, Project NA8
($3,500) International Rehabilitation Network, Project MA5
($4,250) Joint Diabetes Project, Project MA2
($1,000) Marshall Island Diabetes Reversal / Wellness Program, Project MA2
($5,900) Medical Area Network for Virtual Technologies (MANVT), Project MA3
($1,500) Medical Vanguard for Diabetes Management, Project MA2
($1,400) Minimally Invasive Surgery Program for Ohio, Project 841
($8,500) Molecular Genetics and Musculoskeletal Research Program, Project X04
($1,500) Monoclonal Human Anti-Anthrax Toxin Antibodies Development, Project MA8
($2,400) Nanofabricated Bioartificial Kidney, Project PA5
($1,000) National Tissue Engineering Research, Project PA6
($1,500) Non-Invasive Medical Sensors, Project PA7
($1,000) Novel Growth Factor Delivery Technology, Project PA8
($2,500) Prosthetic Device Technology Enhancement and Clinical Evaluation at Walter Reed Amputee Center, Project PA9
($10,000) Proton Beam Therapy, Project 968
($3,500) Remote Acoustic Hemostasis, Project 96I
($1,500) Sleep Deprivation Research at Walter Reed Army Medical Center, Project RA1
($12,750) Synchronotron-Based Scanning Research, Project 968
($1,000) Targeted Nano-Therapeutic for Advanced Breast and Prostate Cancer, Project RA2
($11,000) Texas Training and Technology for Trauma and Terrorism (T5), Project 953
($2,100) The Soldier Wound Healing Project, Project PA4
($1,000) Therapeutic Vaccines for Biological Threat, Project RA3
($1,000) Tissue Engineering and Wound Healing Research, Project PA4
($3,000) Tissue Replacement and Repair for Battlefield Injuries, Project 863
($2,000) Transportable Pathogen Reduction and Blood Safety System, Project RA4
($4,250) Versa HSDI, Project RA6

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
869 T-MED/ADVANCED TECHNOLOGY	3105	3356	3378	3415	3512	3574	3641

A. Mission Description and Budget Item Justification: This project supports focused research for the soldier contributing to casualty avoidance, casualty detection, and evacuation and treatment of casualties through application of physiological status monitoring technologies (biophysical and biochemical sensors and fusion) as outlined in the Medical and Future Force Technology Areas. Research efforts focus on developing a wearable, integrated system to determine soldier physiological status. This includes developing the ability to quickly and accurately determine when a soldier is minimally impaired but still capable of functioning. Work will also focus on identification and initial development of parallel and supporting technologies and systems, including medical informatics, medical artificial intelligence, and data mining tools. 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 by the Walter Reed Army Institute of Research, Silver Spring, MD; U.S. Army Research Institute of Environmental Medicine, Natick, MA, and the U.S. Army Institute of Surgical Research, Fort Sam Houston, TX.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Warfighter Physiological Status Monitoring - In FY03, designed prototype handheld Personal Digital Assistant-based physiological monitor for the medic, and provided final sensor specifications and physiological data management algorithms for monitoring heart rate and breathing, wound detection, heat stress, movement, and sleep. In FY04, select sensors for heat stress load and current sleep history, and integrate with Ballistic Injury Detection System and Life Signs Detection System. In FY05, will demonstrate ability to noninvasively monitor alertness in real time in operational settings, measure blood pressure, and incorporate into remote triage algorithm for Future Force Warrior Medic.	3105	3256	3378
Small Business Innovative Research/Small Business Technology Transfer Programs	0	100	0
Totals	3105	3356	3378

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
870 DOD MED DEF AG INF DIS	26760	13838	15676	16366	16042	15983	16384

A. Mission Description and Budget Item Justification: This project researches and investigates medical countermeasures to naturally occurring infectious diseases potentially affecting the "Medical" technology area of the Future Force. Infectious diseases 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, the bacterial diseases responsible for diarrhea (i.e., caused by Shigella, enterotoxigenic Escherichia coli (ETEC), and Campylobacter), and viral diseases (i.e., dengue fever and hantavirus). The program also develops improved materiel for control of arthropod (insects, ticks, etc.) disease vectors 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 (gene-based) DNA 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; 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 the lead service for infectious disease research. 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 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. This project contains no duplication with any effort within the Military Departments.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Malaria Vaccines - In FY03, evaluated candidate DNA and protein malaria vaccines as a part of a multicomponent vaccine; completed preclinical testing of an improved liver-stage malaria vaccine. FY04, produce malaria parasites for use in clinical challenge studies and test development; generate protein and virus-based vaccines; conduct safety and protection studies. FY05, will test DNA and protein vaccine candidates in preclinical trials for inclusion into multicomponent malaria vaccine.	6696	2683	3326

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Antidiarrheal Vaccines - In FY03, constructed an improved Shigella flexneri candidate vaccine; conducted preclinical studies of ETEC and Campylobacter vaccines; and produced clinical-grade lots of candidate vaccines for testing. In FY04, refine surrogate assays to measure protection by vaccines and develop better animal models for assessing vaccines. Conduct preclinical testing of candidate antidiarrheal vaccines to support Investigational New Drug (IND) applications to the U.S. Food and Drug Administration (FDA). In FY05, will continue clinical testing of candidate vaccines. Will establish an animal model for use in preclinical testing of ETEC vaccines.	8987	2447	3551
Insect Control - In FY03, selected two new insect repellent candidates to potentially replace DEET; continued field study of the dengue vector control system to demonstrate effectiveness in different environments. In FY04, perform final evaluation of selected repellent with human volunteers, compare effectiveness in human trials to other available repellents, and transition to development a new non-DEET repellent. In FY05, will complete testing of a dengue vector control system and transition to development.	2120	920	590
Scrub Typhus Vaccine and Infectious Disease Diagnostics - In FY03, tested a single-strain scrub typhus vaccine in mouse model and established a monkey model to demonstrate vaccine safety and protection. FY04, complete construction of a multistrain vaccine and test safety and protection in animal studies; identify infectious disease diagnostic components compatible for use in a joint services biological agent identification and diagnostic system. In FY05, will start preclinical testing of scrub typhus vaccine to justify FDA Phase 1 clinical trials of candidate vaccine; will develop approaches to supplement infectious disease diagnostics not compatible with joint services diagnostic system.	1699	1385	1677
Vaccines against Dengue Fever, Meningitis and Hemorrhagic Fevers - In FY03, prepared and evaluated dengue vaccines for FDA-approved clinical trials; made progress on genetic engineering of three group B meningitis strains for use in vaccine production; prepared for Phase 1 clinical trials of Hemorrhagic Fever with Renal Syndrome (HFRS) vaccine. In FY04, select the most promising new dengue vaccines for clinical trials and improve as needed; perform preclinical testing of a new component of a multistrain meningitis vaccine. In FY05, will complete construction of the second vaccine component to provide complete protection against HFRS; will submit IND application to test new component for an improved meningitis vaccine; will conduct preclinical testing of improved dengue vaccines.	4323	2036	2020

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Malaria Drug Candidates - In FY03, conducted preclinical studies of new drug candidates to prevent malaria; completed required preclinical toxicology testing of a new drug to treat severe malaria; prepared IND application for clinical testing; developed animal models that better predict human safety; continued to test new classes of drugs for antimalarial activity. In FY04, select best drug candidates in development pipeline for preclinical and clinical studies using a systematic, streamlined approach for evaluation and optimization of new chemical entities. In FY05, will continue to identify and test new lead compounds identified in discovery via target-directed functional screens coupled with rational drug design technologies; will perform toxicological studies of new drug candidates.	2935	4367	4512
Totals	26760	13838	15676

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
873	HIV EXPLORATORY RSCH	0	10881	10819	11270	11512	11475	11433

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 by 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, including small animal and non-human primate studies, initial clinical development in humans, improved diagnosis of HIV infection, and improved prognostic assessment and disease management of HIV-infected individuals. 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 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. This project contains no duplication with any effort within the Military Departments.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
HIV - In FY03, HIV program transferred to the National Institutes of Health. Program returned to USAMRMC in FY04. In FY 04, construct additional candidate vaccines that induce broader anti-HIV immune responses against various HIV subtypes found outside the United States and important in military deployments. Continue genetic analysis of HIV subtypes isolated in Africa for integration into vaccine candidates for this region. Develop HIV vaccine study populations for future field trials in Kenya and Uganda. Support global surveillance of HIV-1 to target international HIV-1 vaccine development and inform the U.S. military of the HIV threat in areas of potential troop deployment through the existing network of overseas collaborators, with special attention to surveillance in Eastern Europe and countries of the former Soviet Union. Maintain U.S. Military Clinical Intervention Network operated through Military Medical Treatment Facilities to study the frequency and impact of HIV/AIDS in/on military populations, especially when consequent to troop deployments. Identify cost-effective drugs and care strategies to control HIV infection and transmission in military populations. FY05, will perform preclinical testing of candidate vaccines. Continue genetic analysis of HIV subtypes isolated in Africa for integration into vaccine candidates for this region. Continue field trials site development in Kenya, Uganda, and expand to Tanzania, and Cameroon. Maintain global surveillance network for HIV-1 infections. Maintain U.S. Military Clinical Intervention Network operated through Military Treatment Facilities to study the frequency and impact of HIV/AIDS in/on military populations. Maintain technical watch for new antiretroviral drugs.	0	10576	10819
Small Business Innovative Research/Small Business Technology Transfer Programs	0	305	0
Totals	0	10881	10819

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
874	CBT CASUALTY CARE TECH	8487	8668	8469	16051	13838	11914	9148

A. Mission Description and Budget Item Justification: This project investigates potential treatments for weapons-induced trauma and shock caused by severe blood loss on the battlefield. 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 support low-intensity combat as well as 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. 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 include blood products; resuscitation fluids; drugs and devices to control severe bleeding; methods to minimize, repair, and prevent injury; and diagnostic and predictive indicators for remote triage and computerized, autonomous patient care. Additional goals are to reduce evacuations due to dental disease and reduce the medical footprint on the battlefield. 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 by the U.S. Army Institute of Surgical Research, Fort Sam Houston, TX, and the Walter Reed Army Institute of Research, Silver Spring, MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Freeze Dried Plasma - In FY03, demonstrated 1-year stability of freeze-dried plasma to characterize its usefulness as a clinical product; completed animal studies comparing the effect of low-volume resuscitation on survival after severe blood loss. In FY04, conduct manufacturing and testing of pilot lots of freeze-dried plasma and novel storage containers; submit investigational new drug (IND) application for freeze-dried plasma to the U.S. Food and Drug Administration (FDA); and conduct animal testing of freeze-dried plasma. In FY05, will prepare for clinical testing of freeze-dried plasma, complete studies of low-volume fluid resuscitation, and identify new candidate chemical additives for resuscitation fluids to improve outcome of resuscitated casualties; complete 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. The simulator will require no external support equipment other than a power connection.	3137	3000	2965
Blood Clotting Agents - In FY03, completed studies to determine optimum dosage of blood clotting factor VIIa, and selected best dose for subsequent studies to control severe bleeding; demonstrated that the combination of factor VIIa with other hemostatic drugs did not enhance clotting; and established a brain injury animal model for studying effects of new blood clotting agents on brain injury. In FY04, initiate animal studies of candidate drugs to evaluate potential to restore blood clotting in casualties who have abnormal clotting to increase survival of battlefield casualties. In FY05, will complete animal studies of candidate drugs to evaluate their potential to restore blood clotting in casualties who have abnormal clotting and submit IND application to FDA for candidate drug to restore blood-clotting function.	1727	1542	1462

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Brain, Tissue, and Bone Injury - In FY03, developed a large-animal model of fatal extremity injury for study of methods to manage tissue and bone injuries caused by land mines and shrapnel weapons for study of new wound management methods. Initiated an animal study of a candidate bone replacement material; demonstrated the effectiveness of two drugs to reduce surrounding tissue injury after a stroke; identified two licensed drugs with potential to treat silent brain seizures associated with brain injury; started a clinical trial of a candidate spray wound dressing; and developed consensus guidelines for tourniquet use on the battlefield. In FY04, conduct initial studies of an antimicrobial wound-cleaning device; conduct initial studies of lightweight materials and splints for fracture stabilization, and evaluate candidate neuroprotective drugs in cell culture and in an animal model of brain injury. In FY05, will down-select and conduct clinical testing of an advanced prototype wound protective barrier device; will submit an investigational device exemption application for a prototype wound protective barrier device; and will continue studies in animal models to determine the effectiveness of candidate drugs to mitigate brain injury after head trauma.	1645	1831	2122
Dental Disease and Soldier Status Monitoring - In FY03, started a Phase 1 animal toxicity study of a candidate chemical additive for meals-ready-to-eat (MREs) for prevention of dental disease; demonstrated stability of freeze-dried plasma at room temperature for up to 1 year. In FY04, conduct a Phase 2 animal toxicity study of a candidate chemical additive for MREs; adapt handheld microimpulse radar (MIR) system for heart rate and respiration detection into a wearable system. In FY05, will conduct a Phase 3 animal toxicity study of a candidate chemical additive for MREs for prevention of dental disease; will transition handheld MIR for heart rate monitoring to System Development and Demonstration.	1978	2203	1920
Small Business Innovative Research/Small Business Technology Transfer Programs	0	92	0
Totals	8487	8668	8469

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
878	HLTH HAZ MIL MATERIEL	11038	11521	12116	12140	12276	12404	12637

A. Mission Description and Budget Item Justification: This project supports "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 material used in Army combat operations and training. Specific hazards 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 (e.g., 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, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, MD; U.S. Army Research Institute of Environmental Medicine, Natick, MA; the United States Army Center for Environmental Health Research, Fort Detrick, MD, and the U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Laser Eye Hazard Protection - In FY03, evaluated drugs to minimize secondary nerve injury from battlefield lasers and refined exposure limits to minimize laser eye injury hazards. In FY04, test genomic/polemic (study of protein expression and function) derived laser eye injury treatments in non-human primates. In FY05, will develop laser eye injury triage, treatment, and protection applications.	3432	3421	4134
Restraint Technologies - In FY03, defined injury thresholds for dynamic responses in restraint systems for Army ground and air vehicles. In FY04, provide validated repeated jolt guidelines and proposed standards for safe operations of tactical ground vehicles for use in the Health Hazard Assessment program. Provide performance standards for effective military restraint systems. In FY05, will translate validated restraint and jolt standards into a biomedical valid virtual prototyping model.	1249	1358	984

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Body Armor Assessment - In FY03, fully characterized forces behind soft and hard body armor due to blunt force trauma, developed final animal and preliminary human mathematical models, began animal injury studies, and developed prototype body armor test device for body armor developers. In FY04, complete animal injury studies, validate animal model with injury data, and complete human model. In FY05, will complete behind armor blunt trauma injury prediction software for body armor developers and subsequent transition to Natick Soldier Center.	3630	3814	3720
Environmental Health Biomonitor - In FY03, designed two tests to assess the reproductive health effects of militarily relevant chemicals and mixtures. In FY04, complete integration of graphic user interface with the portable aquatic biomonitor for biologically based toxicity sampling. In FY05, will evaluate and select biomonitor components for the environmental sentinel biomonitor for rapid identification of acute toxic hazards in water.	2727	2697	3278
Small Business Innovative Research/Small Business Technology Transfer Programs	0	231	0
Totals	11038	11521	12116

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
879	MED FACT ENH SOLD EFF	8515	8740	10419	10540	10552	10588	10777

A. Mission Description and Budget Item Justification: This project supports "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 multi stressor environments form the basis for the development of behavioral, training, pharmacological, and nutritional interventions 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, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, MD; U.S. Army Research Institute of Environmental Medicine, Natick, MA; and the U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Neural Network Model - In FY03, established neural network model, tested dehydration component of model, and validated terrain coefficients in the model. In FY04, complete the model of cold, heat, and altitude stress to predict individual and unit-level performance outcomes based on environmental and operational variables. In FY05, will integrate temperature regulation and hybrid neural network models into the SCENARIO model.	2030	2310	2739
Fatigue Intervention - In FY03, provided guidance on using caffeine, modafinil, and amphetamines to fight fatigue. In FY04, establish a sleep model that predicts the effects of stimulants and naps on performance. In FY05, will demonstrate a comprehensive fatigue and performance model for group predictions of soldier performance in continuous operations.	2552	1679	2298
Psychiatric Casualty Prevention - In FY03, developed a tool to assess cognitive function in the field and developed an Army-wide suicide surveillance system. In FY04, identify factors that predict high rates of mental disorders and define the association of mental health with readiness. In FY05, will propose effective methods for psychological health screening in deployed troops, and will analyze health care databases to assess health patterns related to attrition.	2187	2448	3052

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Visual Performance - In FY03, established visual performance criteria for the integration of flat panel displays into helmet-mounted devices. In FY04, determine the effect of eyesight correction on visual performance with electro-optical devices and complete visual detection model to include complex targets and backgrounds. In FY05, will conduct comprehensive clinical and laboratory studies and assess flight performance in aviators who have refractive surgery. The results will serve as the basis for recommendations on Army aviator accession and retention standards.	1746	2222	2330
Small Business Innovative Research/Small Business Technology Transfer Programs	0	81	0
Totals	8515	8740	10419

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603001A - Warfighter Advanced Technology

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	55618	66855	68034	70609	55982	83038	83631
242	AIRDROP EQUIPMENT	3339	9550	7357	3995	4072	4153	4246
543	AMMUNITION LOGISTICS	761	937	1558	1507	1441	1472	1505
545	FORCE PROJECTION LOGISTICS	6809	0	0	0	0	0	0
557	BIOSYSTEMS TECHNOLOGY	4097	0	0	0	0	0	0
594	METROLOGY & CALIB	936	0	0	0	0	0	0
C07	JOINT SERVICE COMBAT FEEDING TECH DEMO	2177	2211	2443	2528	2589	2607	2660
J50	FUTURE WARRIOR TECHNOLOGY INTEGRATION	37499	44476	56676	62579	47880	74806	75220
J52	WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)	0	9681	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 several 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 Objective Force Warrior (OFW), an integrated Soldier system of systems providing the next generation of capabilities beyond Land Warrior Stryker for Future Force Unit of Action (UA) Soldiers. OFW will provide a lightweight, head-to-toe full spectrum protective combat ensemble, integrated with multi-functional sensors, weapons and medical monitoring capabilities. The OFW will have connectivity to other dismounted personnel, Future Combat Systems (FCS), and robotic air/ground platforms for improved situational understanding and effects. The intent of OFW is to provide the dismounted Soldier and small unit with combat overmatch capabilities for the full spectrum of Future Force missions. 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 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 Force Projection Logistics project (545) demonstrates embedded training simulations to support vehicle crews and mature logistics simulations that relate combat performance to logistics requirements. The funding for project 545 is realigned to the newly established PE 0603015A in FY 2004. The Airdrop Equipment project (242) provides enhancements to rapid deployment and force projection capability by maturing and demonstrating technology required for dropping increasingly heavier cargo to

precise locations from high altitudes and greater offset distances. The objective is increased survivability of aircraft and crews, and increased probability that materials delivered will land in a usable condition. The Joint Precision Airdrop System, a new Advanced Concept Technology Demonstration (ACTD) beginning in FY04, will demonstrate a 5-ton payload, high altitude precision airdrop with an on-board mission planning system, in partnership with the Air Force. and 545) and rapid deployment (project 242). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan , the Army Modernization Plan, the Defense Technology Area Plan, and the Training and Doctrine Command's Soldier as a System family of emerging Capability Development Documents. This program adheres to Tri-Service Reliance Agreements on clothing, textiles, food, and explosive ordnance disposal 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). This PE contains no duplication with any effort within the military departments. Work is performed by the Natick Soldier Center, Natick, MA; the Armament Research, Development, and Engineering Center, Picatinny, NJ; the Aviation and Missile Research, Development, and Engineering Center, Huntsville, AL; and the Research, Development, and Engineering Command, Fairfax, VA.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	57014	63882	68763
Current Budget (FY 2005 PB)	55618	66855	68034
Total Adjustments	-1396	2973	-729
Congressional program reductions		-7576	
Congressional rescissions			
Congressional increases		10800	
Reprogrammings	-1396	-251	
SBIR/STTR Transfer			
Adjustments to Budget Years			-729

FY04 Congressional Adds with no R-2A:
($959) Protection against Toxic Industrial Chemicals, Project J52: The purpose of this one year Congressional add is to research protective technol

ogy against toxic industrial chemicals for possible application to soldier clothing and equipment. No additional funding is required to complete this project.

($5755) Ration Packaging Material and Systems for MREs (Meals Ready to Eat), Project J52: The purpose of this one year Congressional add is to research packaging systems with potential to increase shelf life, safety, and nutrition of food products. No additional funding is required to complete this project.

($2685) ATIRCM/CMWS, Project J52: This Congressional add is being reprogrammed to PE 0604270A (Electronic Warfare Development). The purpose of this one year Congressional add is to develop common missile warning system technologies for the Advanced Threat Infrared Countermeasures system. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
242	AIRDROP EQUIPMENT	3339	9550	7357	3995	4072	4153	4246

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 decelerator, guidance and sensing (e.g., Global Positioning System (GPS)), and wind sensing technologies, precision airdrop systems have the ability to be deployed from high altitudes (up to 25,000 ft) and to deliver payloads with better accuracy, i.e. a 100 meter Circular-Error-Probable (CEP). The resulting capability is envisioned to be the delivery of up to 10,000 lbs. from up to 20 miles offset with 100 meter CEP accuracy. The 10,000 lb. precision capability will be demonstrated as part of the Joint Precision Airdrop System ACTD. An effort to increase the payload weight to 30,000 lbs will begin in FY04. Delivery from high altitudes and large offset distances improves cargo, personnel, and aircraft survivability. The efforts in this project support the Army Transformation 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 US Army Natick Soldier Center, Natick, MA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Aerial delivery of cargo - In FY03, demonstrated the system for a roll on/roll-off capability for 15,000-20,000 lb payload providing a 60% decrease in labor intensive rigging; transitioned the technology to PM Force Sustainment Systems for System Development and Demonstration. Designed full-size prototype and tested (autonomous controlled) a 1/4 scaled prototype high-altitude parachute control system. Designed and planned test of 10,000 lb. autonomous offset "just-in-time" resupply airdrop system prototype. In FY04, perform prototype design and fabrication; and start system integration with USAF high-altitude airdrop mission planning system known as Precision Aerial Delivery System (PADS) and the 10,000 lbs Army Precision Extended Glide Airdrop System (PEGASYS) for the Joint Precision Airdrop System (JPADS) ACTD. In FY05, will complete system integration; will conduct technical testing and user training; and will demonstrate a high altitude (25,000 ft. Mean Sea Level) deployable, autonomous, offset airdrop capability (goal 10-20 miles offset) with the option to deliver separate and distinct payloads (up to 10,000 lbs total) to multiple locations.	3339	3789	2175
Medium Precision Airdrop - In FY04, mature preferred concepts for Precision Airdrop - Medium (30,000 lbs) system and mature guidance navigation and control for the selected concept. In FY05, will conduct full-scale component prototyping for Precision Airdrop - Medium system.	0	4533	4682
Personnel Parachute Technology – In FY05, will demonstrate technology for a static line reserve parachute automatic opening capability providing 100% detection of total malfunctions and transition technology to PM–Clothing and Individual Equipment for System Development & Demonstration (SDD).	0	0	500
Affordable Guided Airdrop System – The purpose of this one year Congressional add is to advance the conversion and use of military inventory round cargo parachutes for autonomous control of 500-2200 lb payloads for use in high altitude deployments, reduce the systems airborne guidance unit weights and complexities and explore new concepts to increase the glide ratio of round canopies. No additional funding is required to complete this project.	0	964	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	264	0
Totals	3339	9550	7357

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
543 AMMUNITION LOGISTICS	761	937	1558	1507	1441	1472	1505

A. Mission Description and Budget Item Justification: This project develops technology that provides rapid munitions deployability, resupply, and rearm 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 demonstrates an automated rearm and resupply capability for the Future Combat System (FCS) 120mm Line of Sight/Beyond Line of Sight System. The rearm/resupply concept contains "plug-in" ammunition modules or clips and an automated upload mechanism that will enable faster rearm. A second major effort is a lightweight, high strength cargo platform system, the Modular Intermodal Platform (MIP), that facilitates logistics through its compatibility with the Theater Support Vessel; C-17 and C-130 aircraft; current and future trucks; and aerial delivery systems. The MIP'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 2003	FY 2004	FY 2005
Automated Rearm and Resupply Capability for the FCS 120mm Line of Sight/Beyond Line of Sight System - In FY03, evaluated resupply concepts and integrated with autoloader design.	761	0	0
Smart Distribution-Modular Intermodal Platform (MIP). In FY04, model performance characteristics and develop design for lightweight MIP. In FY05, will fabricate prototypes and conduct hardware and interface evaluations.	0	910	1558
Small Business Innovative Research/Small Business Technology Transfer Programs	0	27	0
Totals	761	937	1558

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
C07	JOINT SERVICE COMBAT FEEDING TECH DEMO	2177	2211	2443	2528	2589	2607	2660

A. Mission Description and Budget Item Justification: The Joint Service Combat Feeding Technology Demonstration 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 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 that will reduce logistics by over 75% (in component parts, weight, cube, fuel and water) and labor requirements by 50%, while improving the quality of food service. This project is a Department of Defense program for which the Army has Executive Agent responsibility and is performed and managed by the U.S. Army Natick Soldier Center, Natick, MA. 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 2003	FY 2004	FY 2005
Equipment and Energy Technologies – In FY03, conducted initial technology demonstration of integrated Field-feeding and Advanced Sustainment Technology (FAST) Food Service system during Quartermaster Regimental Week. Completed technology demonstrations of Remote Unit Self Heated Meal (RUSHM) showing logistical reductions (90% reduction in manpower, weight and cost) and new capability to sustain the warfighter in remote locations and transitioned to 6.4. Demonstrated a co-generator technology for legacy kitchens that reduces kitchen fuel consumption by 50% and noise by at least 10dB. In FY04, conduct multi-service demonstrations of FAST Food Service (cogeneration, integrated appliances, heat-driven refrigeration, and grey water recycling), validate metrics and transition to 6.4 for field kitchen modernization (PM Force Sustainment Systems). Demonstrate lightweight, compact insulated food container technology and transition to 6.4. Complete demonstration of shipboard food service technology for future Navy ships and subs and transition to 6.4. In FY05, will demonstrate heat-driven refrigeration for current kitchens and transition to 6.4. Will fabricate and conduct in-house testing on a prototype crew ration and beverage sustainment system for the FCS.	570	960	613
Technologies for Novel Ration Preservation & Stabilization, Revolutionary Packaging and Food Safety – In FY03, matured novel preservation/stabilization technologies (such as, compressed meal components to reduce size/weight) that were validated in FY02. Conducted hardware and software testing in preparation for DoD's first limited field demonstration of a commercial off-the-shelf technology for a Radio Frequency Identification (RFID) Total Asset Visibility (TAV) System for integrated ration monitoring, inventory and tracking. In FY04, conduct field demos of Compressed Meal technology prototypes in support of individual and/or future combat vehicle feeding platforms, optimize package/menu designs for specific user applications, and transition to 6.4. Complete field demonstration of TAV System technology, evaluate field data and transition demonstrated system to Defense Logistics Agency. In FY05, will conduct producibility tests for novel shelf-stable breakfast items to expand menu variety, while enhancing ration acceptance/consumption. Will validate/optimize diagnostic techniques to detect chemical/biological agents and/or naturally occurring food pathogens in food matrices and incorporate into biosensor detection systems. Will conduct technical demonstration of a surface scanning biosensor. Will evaluate advanced prototype film produced using nanocomposites and enhanced barrier coating technology in ration packaging.	1027	575	1441

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Technologies for Nutrients and Novel Delivery Systems – In FY03, transitioned to 6.4 mature ration and packaging technologies for specialized rations, such as the drink pouch and enhanced tube foods, to improve consumption, and reduce weight/volume. Conducted limited demonstration of First Strike Ration (FSR) technology during Operation Enduring Freedom. Conducted prototype scale-up of dairy bars and test bars with increased levels of omega-3 fatty acid; finalized bar design. Demonstrated a suite of models based on energy expenditure, physical fatigue, and rehydration rates to measure Soldier performance and mission accomplishments. In FY04, demonstrate production scale-up capability and incorporate shelf stable meat/vegetable bars and gels in prototype FSR. Conduct field demonstration of FSR technology in various operational scenarios (Army SOF /Marines) incorporating packaging and component modifications with a goal of 50% reduction in cube/weight, as compared to the MRE. In FY05, will determine bioavailability and conduct field tests of components with encapsulated protein used to control the release and absorption of protein into the warrior's system. Will conduct field demonstration to quantify the effects of glucose modulating components on increasing warfighter performance and demonstrate production scale up capability of these components. Will complete FSR technology demonstration and transition to 6.4.	580	655	389
Small Business Innovative Research/Small Business Technology Transfer Programs	0	21	0
Totals	2177	2211	2443

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
J50	FUTURE WARRIOR TECHNOLOGY INTEGRATION	37499	44476	56676	62579	47880	74806	75220

A. Mission Description and Budget Item Justification: This project matures leap-ahead technologies and systems for the Objective Force Warrior (OFW), with emphasis on systems integration and multi-functionality to enhance and improve warfighting capability while reducing Soldier load. The project demonstrates next-generation advances over Land Warrior STRYKER for use in the Future Force Land Warrior-Advanced Capability and, where feasible, exploits opportunities to enhance Land Warrior-STRYKER capabilities. The goal is to provide dismounted warfighters in the Future Force Unit of Action with significant overmatch capability in the areas of survivability, networked communications, individual Soldier and small team lethality and agility while enabling them to operate for extended periods under arduous combat conditions, with minimal loss in physical capabilities from fatigue, stress, and hardship. OFW will employ open system architectures and high-risk/high payoff technologies to yield a lightweight full spectrum integrated protective combat ensemble, integrated with multi-function sensors, networked communications/collaborative situational awareness, enhanced positioning navigation, networked fires, collaborative embedded training, medical status monitoring capabilities, and manportable ("micro") air and ground robot/sensor platforms organic to the squad. This Soldier system-of-systems will have connectivity to other dismounted personnel, Future Force platforms including Future Combat Systems (FCS), and robotic air/ground vehicles to form adaptive, distributed sensor networks for better situational understanding of local environments and threats. The project will also leverage squad relevant FCS unmanned systems (e.g., Mule) and demonstrate mission packages tailored to the squad. The OFW Concept and Technology Development (CTD) program began in FY02 with two competing industry teams developing and maturing initial OFW concepts for all Future Force Unit of Action Soldiers; then downselected to a single contractor team to conduct OFW technology design and maturation of a "common core" system of systems configuration and dismounted variant; and will culminate with a comprehensive system-of-systems capstone demonstration. Key performance goals are to demonstrate a system with fighting load of no more than 50 lbs per warfighter; the ability to operate for 24 hrs autonomously at the individual level and 72 hrs at the Unit of Action level; and integration with Warfighter Information Network-Tactical/Joint Tactical Radio System. To achieve these goals, future warrior projects and other relevant supporting Army projects have been redirected to achieve the desired capability within the decade. The project will mature and integrate Soldier technologies transitioned from 0602786A, 0602105A, 0602308A, 0602623A, 0602705A, 0602782A, 0602785A, 0602787A, 0603002A, 0603008A, and 0603607A. This project will leverage the Army's FCS and Joint Tactical Radio System/ Squad Level Communications programs, as well as other Army S&T and DoD programs to the maximum extent, in order to maximize return on investment to the Army. This project also matured and demonstrated advanced technology solutions to complex systems integration problems in the areas of multifunctional integrated head-to-toe combat ensembles during FY2003. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, the Defense Technology Area Plan, and the Training and Doctrine Command's Soldier as a System family of emerging Capability Development Documents (CDDs). The US Army Natick Soldier Center, Natick, MA manages this project.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Concept Development (CD) Phase – In FY03, matured Soldier system of systems architectures for all Future Force Unit of Action Soldiers, which are compatible with the FCS architecture and Army concepts of operations. Performed trade-off analyses, technology surveys, and technology assessments underpinned with analytical modeling and simulation. Defined specific technology projects required to meet technology goals within the timelines of the OFW Concept and Technology Development (CTD) effort. Defined initial interfaces to Future Force systems and matured system level requirements. Defined system design concept for all Soldiers in Unit of Action including a "common core" configuration that is tailorable to Soldier variants across the spectrum of the Future Force Unit of Action (UA). Constructed two mock-up prototype sets of systems to physically represent the OFW system of systems concepts for the Dismounted UA Soldier variant. Downselected and awarded the Phase II Agreement Award (Other Transaction Agreement) to a single Lead Technology Integrator (LTI) to execute the Technology Integration Phase of the OFW CTD program.	3733	0	0
OFW Technology Integration Phase Planning and Initial Development- In FY03, conducted program synchronization with down-selected Lead Technology Integrator. Established coordinated program plans. Defined a preliminary/detailed spiral design process utilizing technology integration cycles (four cycles planned) that include architectural definition, virtual prototyping, subsystem breadboard design and testing, user assessments, and modeling and simulation. Initiated initial design of OFW dismounted soldier variant incorporating a set of core technologies common to all Unit of Action Soldiers and those specific to dismounted infantry. These core technologies include: base uniform system; modular load carriage system; headgear system; computer system, communication system and power system. Defined initial system of systems architectural documents. Allocated system level and interface requirements to major subsystems/critical components. Evaluated and assessed FCS interface requirements to OFW. Completed FCS interoperability report. Conducted pilot Joint Conflict and Tactical Simulations (JCATS) to assess initial system utility.	21935	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
OFW Technology Integration Cycle I- In FY04, conduct OFW Technology Integration Cycle I, which includes the following efforts. Refine operational concepts and architecture including distribution of capabilities across small combat units. Develop technical performance measures for each design cycle; allocate subsystem weight, power and cost budgets. Develop initial Soldier Borne System (SBS) prototype to include load carriage and signature management. Conduct JCATS simulations to assess utility. Establish System Integration Lab to assess system functionality. Begin development and perform initial evaluation of OFW subsystems that include, but are not limited to, the areas listed below. Headgear systems: evaluate headgear component technology candidates including ballistic materials, hearing and vision augmentation/protection, and chemical/biological protection. Communications: define hardware/software interfaces and integration requirements for Joint Tactical Radio System (JTRS) Cluster 5 and the Soldier radio waveform. Power: define requirements (including trade-off analyses on power source candidates) and develop power sources/power management tools that meet needs for operational mission scenarios and vignettes. Lethality: define architecture and begin development of interfaces for individual weapons and networked fires. Platform interfaces: define requirements for soldier/vehicle interfaces for robotic and manned vehicles including FCS. Software: define software architecture and interfaces for information management, battlefield applications, and data security; begin software development. Warfighter Physiological Status Monitoring: assess monitoring and sensor technology developed by Army Medical Research and Materiel Command; define technical requirements for integration into Personal Area Network. Embedded training: develop concepts for embedded training; evaluate display device options.	0	19619	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
OFW Technology Integration Cycle II- In FY04-FY05 (beginning third quarter FY04 and ending second quarter FY05), conduct OFW Technology Integration Cycle II that includes the following efforts. Develop lower level specifications, detailed design of components, and trade-off decisions for system/subsystem design and architectures. Mature SBS integration from initial prototype, advancing ballistic protection and load carriage. Fabricate Cycle II SBS prototypes with limited functionality. Perform modeling and simulation analysis on updated design. Conduct System Integration Laboratory evaluations and field assessments with soldiers to obtain feedback for further SBS design refinement. Focus on continued subsystem development that includes, but is not limited to, the areas listed here. Headgear system: integrate video and processing/network/ratio surrogate; fabricate prototypes for fightability assessment, head-borne weight assessment, and bench-top testing; integrate headgear with SBS. Personal Area Network: develop proof-of-concept computer system and antenna. Communications: continue to define detailed technical hardware and interfaces specifications for integration with JTRS Cluster 5 and the Soldier radio waveform in Cycles III and IV. Power: test and validate power architecture within the Personal Area Network through testing and trade-off analyses. Lethality: continue maturation of interfaces between SBS and individual/other weapons; demonstrate connectivity to weapon mounted fire control system for beyond line of sight capability. Platform interfaces: continue to develop and refine interface specifications for unmanned and manned vehicles including FCS. Software: develop initial software modules for application program interfaces and embedded training. Warfighter Physiological Status Monitoring: integrate sensor components and subsystem into Personal Area Network; evaluate subsystem.	0	23607	23829

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
OFW Technology Integration Cycle III- In FY05, will begin OFW Technology Integration Cycle III that includes the following efforts. Will fabricate fully functional prototypes including integrated position/navigation; antennas; electronics; warfighter physiological status monitoring; and headgear system. Evaluate system functionality and perform modeling and simulation analysis. Will develop initial Limited Objective Experiments and Capstone Demonstration test plans. Will focus subsystem development on integration that includes, but is not limited to, the areas listed here. Headgear system: will integrate system including chemical/biological protection, video, and processing/network/radio technologies into the SBS. Personal Area Network: will refine architecture and computer form factor. Communications: will develop hardware and software interfaces to enable the physical integration of JTRS Cluster 5 and Soldier radio waveform. Power: will integrate power sources into the SBS. Lethality: will demonstrate integration of individual weapons with SBS. Platform Interfaces: will conduct robotic system integration tests with surrogate platforms to validate soldier control and wireless capabilities; will conduct robotic systems deployment studies; will develop sensor fusion architecture; will conduct OFW/FCS compatibility assessment.	0	0	32847
Multifunctional Head-to-Toe Combat Ensemble Subsystem - In FY03, matured concepts to the greatest extent possible as risk reduction for the OFW CTD Technology Integration Phase. Conducted early technology demonstration with troops in field environments. Continued multi-functional material technology integration for combat ensemble applications. Transitioned technologies, design concepts, and analyses to the OFW LTI teams.	4229	0	0
Personal Warfighter Navigation (Congressional add) - In FY03, established enhanced sensor fusion performance in situations where signal is lost (e.g., under canopies or in buildings). Conducted an initial demonstration to assess system attributes. No additional funding is required to complete this project.	2346	0	0
Scorpion Future Combat Helmet (Congressional add): This one-year Congressional add created an integrated combat helmet that includes a chemical biological respiratory subsystem, ballistic protective materials, and thermal management subsystems. No additional funding is required to complete this project.	5256	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1250	0
Totals	37499	44476	56676

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603002A - MEDICAL ADVANCED TECHNOLOGY

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	168093	217737	38404	46905	51529	59159	56767
800	TELEMEDICINE TESTBED	1862	1961	2023	3843	4312	4413	4513
804	PROSTATE CANCER RSCH	1001	988	0	0	0	0	0
810	IND BASE ID VACC&DRUG	8432	17935	19958	20278	21760	22211	22717
814	NEUROFIBROMATOSIS	19054	19756	0	0	0	0	0
818	ADVANCED CANCER DETECTION CTR	4762	0	0	0	0	0	0
819	FLD MED PROT/HUM PERF	535	1433	1588	1626	1656	1695	1733
840	COMBAT INJURY MGMT	5773	13412	14835	21158	23801	30840	27804
893	TISSUE REPLACEMENT	0	4247	0	0	0	0	0
929	ARTIFICIAL LUNG TECHNOLOGY	952	988	0	0	0	0	0
932	MINIMALLY INVASIVE SURGERY (CA)	0	988	0	0	0	0	0
941	DIABETES RESEARCH	10527	4939	0	0	0	0	0
945	BREAST CANCER STAMP	2218	0	0	0	0	0	0
954	DIGITAL X-RAY	0	988	0	0	0	0	0
955	ASSISTIVE TECHNOLOGY	0	1976	0	0	0	0	0
969	ALCOHOLISM RESEARCH	3334	4445	0	0	0	0	0
973	RECOMBINANT VACCINE RESEARCH	1905	0	0	0	0	0	0
97A	BIOSENSOR RESEARCH	1668	2964	0	0	0	0	0
97B	BLOOD SAFETY	7955	4050	0	0	0	0	0
97D	CENTER FOR AGING EYE	0	988	0	0	0	0	0
97E	CENTER FOR PROSTATE DISEASE RESEARCH AT WRAMC	5430	4445	0	0	0	0	0
97I	DREAMS	10479	0	0	0	0	0	0
97N	LUNG CANCER DETECTION	0	5137	0	0	0	0	0
97O	LUNG CANCER RESEARCH	8574	9384	0	0	0	0	0
97S	MOLECULAR GENETICS AND MUSCULOSKELETAL RESEARCH	8098	0	0	0	0	0	0
97T	NEUROTOXIN EXPOSURE TREATMENT	20243	25682	0	0	0	0	0

97V	POLYNITROXILATED HEMOGLOBIN	952	0	0	0	0	0	0
97W	SEATREAT CANCER TECHNOLOGY	0	1976	0	0	0	0	0
97Y	VIRTUAL RETINAL DISPLAY TECHNOLOGY	1905	0	0	0	0	0	0
MB1	ADV DIAGNOSTICS & THERAPEUTIC DIG TECH	0	988	0	0	0	0	0
MB2	BRAIN, BIOLOGY, AND MACHINE	2857	2964	0	0	0	0	0
MB3	CENTER FOR INTEGRATION OF MEDICINE & INNOV TECH	6670	11112	0	0	0	0	0
MB4	CENTER FOR UNTETHERED HEALTHCARE	952	1481	0	0	0	0	0
MB7	HEMOGLOBIN BASED OXYGEN CARRIER	4287	0	0	0	0	0	0
MB9	JOINT US NORWEGIAN TELEMEDICINE	2667	2766	0	0	0	0	0
MC3	SACCADIC FATIGUE MEASUREMENT	952	0	0	0	0	0	0
MC4	SECURE TELEMEDICINE TECH PROGRAM	1714	0	0	0	0	0	0
MC9	MEDICAL SIMULATION TRAINING INITIATIVE	952	988	0	0	0	0	0
MD1	EMERGENCY TELEMED RESPONSE & ADV TECH	1905	2964	0	0	0	0	0
ME1	CHILDREN'S HOSPICE PROGRAM	1430	988	0	0	0	0	0
ME2	CLINICAL INFORMATION SYSTEMS INITIATIVE	1142	0	0	0	0	0	0
ME3	INSTITUTE FOR RESEARCH AND EDUCATION	3999	3655	0	0	0	0	0
ME4	LASER FUSION ELASTIN	4048	0	0	0	0	0	0
ME5	MEDICAL VANGUARD FOR DIABETES MANAGEMENT	2381	0	0	0	0	0	0
ME6	MOBILE INTEGRATED DIAGNOSTIC/DATA ANALYSIS SYSTEM	952	1186	0	0	0	0	0
ME7	RURAL TELEMEDICINE DEMONSTRATION PROJECT	952	1976	0	0	0	0	0
ME8	STABLE HEMOSTAT	1668	2964	0	0	0	0	0
ME9	BEHAVIORAL/COMPARATIVE GENOMICS	2906	1976	0	0	0	0	0

MF1	3D IMAGING & GENOMIC ANAL - BREAST CANCER MGT (CA)	0	1680	0	0	0	0	0
MF2	ADVANCED PROTEOMICS (CA)	0	1186	0	0	0	0	0
MF3	BATTLEFIELD RESPIRATOR AND VENTILATOR (BRAV) (CA)	0	1481	0	0	0	0	0
MF4	BIO-MEDICAL ENGINEERING CENTER (CA)	0	1186	0	0	0	0	0
MF5	BIOMEDICAL INFORMATION TRANSFER (BIT) (CA)	0	988	0	0	0	0	0
MF6	DENDRITIC NANOTECHNOLOGY RESEARCH (CA)	0	2964	0	0	0	0	0
MF7	ELECTRICAL IMPEDANCE SCANNING DEVICE (CA)	0	988	0	0	0	0	0
MF8	EMERGING TECHNOLOGIES CENTER (CA)	0	1481	0	0	0	0	0
MF9	GENOMIC MEDICINE AND GENE THERAPY (CA)	0	3358	0	0	0	0	0
MG1	GYNECOLOGIC DISEASE PROGRAM (CA)	0	4198	0	0	0	0	0
MG2	INTEGRATED INFORMATION SYSTEM (CA)	0	988	0	0	0	0	0
MG3	MEDICAL TRAINING TECH ENHANCEMENT INITIATIVE (CA)	0	988	0	0	0	0	0
MG5	NATIONAL FUNCTIONAL GENOMICS CENTER (CA)	0	4939	0	0	0	0	0
MG6	NOVEL SAFE EFFECT VACCINES FOR BIODEFENSE/CANCER	0	6717	0	0	0	0	0
MG7	ON-LINE MEDICAL TRAINING (CA)	0	1729	0	0	0	0	0
MG8	OPERATING ROOM OF THE FUTURE (CA)	0	1976	0	0	0	0	0
MG9	PENNINGTON BIOMEDICAL CENTER (CA)	0	1778	0	0	0	0	0
MH1	PICTURE ARCHIVING AND COMMUNICATIONS SYSTEM (CA)	0	3457	0	0	0	0	0
MH2	PROJECT COLLABORATION MATERIAL (CA)	0	988	0	0	0	0	0

MH3	PROTEOMICS CENTER (CA)	0	3358	0	0	0	0	0
MH4	RAPID BIO-PATHOGEN DETECTION TECHNOLOGY (CA)	0	1481	0	0	0	0	0
MH5	REGIONAL ANESTHESIA AND PAIN MGMT INITIATIVE (CA)	0	1186	0	0	0	0	0
MH6	RUGGED TEXTILE ELECTRONIC GARMENTS (CA)	0	2964	0	0	0	0	0
MH7	STUDY OF HUMAN OPERATOR PERFORMANCE (CA)	0	988	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) supports focused research for healthy, medically protected soldiers, and funds research consistent with the "Medical" and "Survivability" technology areas of the Future Force and the Food and Drug Administration (FDA). Where feasible, the research exploits opportunities to enhance Current Force capabilities. 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. This program element funds advanced technology development in three major areas: Core Infectious Diseases Vaccine and Drug Program; Combat Injury Management; and Field Medical Protective devices. Serving as the Lead Agent for Infectious Disease Research, the DoD Core Vaccine and Drug Program provides pharmaceutical grade drugs and vaccines for development that are effective protectants, treatments, and antidotes against military disease threats. This PE also funds new technologies and demonstrations in combat casualty care with the overarching goal of reducing battlefield deaths and stabilizing evacuees in austere medical environments. Other critical areas include Soldier performance under various environmental and physiological stressors as well as the impact of the soldiers' well being from materiel hazards. Overall, this PE funds studies and demonstrations of biomedical products designed to protect, sustain, and enhance soldier performance in such settings. 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 Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; U. S. Army Medical Institute of Chemical Defense (USAMRICD), Aberdeen Proving Ground, MD; U. S. Army Medical Institute of Infectious Diseases (UASMRIID), Fort Detrick, MD; U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; U.S. Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL and for infectious disease research, the Naval Medical Research Center (NMRC), Silver Springs, MD. The program element contains no duplication with any effort within the Military Departments.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	166406	35168	38686
Current Budget (FY 2005 PB)	168093	217737	38404
Total Adjustments	1687	182569	-282
Congressional program reductions		-1862	
Congressional rescissions			
Congressional increases		185250	
Reprogrammings	1687	-819	
SBIR/STTR Transfer			
Adjustments to Budget Years			-282

Change Summary Explanation:FY04 - Fifty-four FY04 Congressional adds totaling $185,250 were added to this PE.

FY04 Congressional adds with no R-2As:
($1,700) 3D Imaging and Genomic Analysis Breast Cancer Management, Project MF1
($1,000) Advanced Diagnostics & Therapeutic Digital Technologies, Project MB1
($1,200) Advanced Proteomics, Project MF2
($2,000) Assistive Technology and Research Center at National Rehabilitation Hospital, Project 955
($1,500) Battlefield Respirator And Ventilator (BRAV), Project MF3
($9,500) Biology, Education, Screening, Chemoprevention and Treatment (BESCT) Lung Cancer Research Program (M.D. Anderson Cancer Center), Project 97O
($1,200) Bio-Medical Engineering Center for Research on Bioterrorism Agents, Project MF4
($1,000) Biomedical Information Transfer (BIT), Project MF5
($4,100) Blood Safety, Project 97B
($3,000) Brain, Biology, And Machine, Project MB2
($11,250) Center for Innovative Minimally Invasive Technology (CIMIT), Project MB3
($4,500) Center for Prostate Disease Research, WRAIR, Project 97E
($1,500) Center for Untethered Healthcare, Project

MB4
($1,000) Military Low Vision Research, Project 97D
($2,000) Comparative Functional Genomics Initiative, Project ME9
($3,000) Dendritic Nanotechnology Research, Project MF6
($1,000) Electrical Impedence Scanning Device, Project MF7
($1,500) Emerging Technologies Center, Project MF8
($3,400) Genomic Medicine Gene Therapy, Project MF9
($4,250) Gynecologic Disease Program, Project MG1
($3,700) Institute For Research And Education, Project ME3
($1,000) Integrated Information System, Project MG2
($1,000) Intravenous Membrane Oxygenator, Project 929
($5,000) Joslin Diabetes Project, Project 941
($2,800) Joint US-Norwegian Telemedicine Program, Project MB9
($1,000) Medical Modeling and Simulation Through Synthetic Digital Genes, Project MC9
($1,000) Medical Training Technology Enhancement Initiative, Project MG3
($1,000) Minimally Invasive Surgery Modeling and Simulation, Project 932
($1,200) Mobile Integrated Diagnostic and Data Analysis System (MIDDAS), Project ME6
($3,000) National Bioterrorism Civilian Medical Response Center (CIMERC), Project MD1
($5,000) National Functional Genomics Center, Project MG5
($20,000) Neurofibromatosis Research Program, Project 814
($4,500) Neurology Gallo Center - Alcoholism Research, Project 969
($26,000) Neurotoxin Exposure Treatment Research Program (NETRP) Parkinson's & Neurological Disorders, Project 97T
($6,800) Novel Safe and Effective Vaccines for Biodefense and Cancer, Project MG6
($1,750) On-Line Medical Training, Project MG7
($2,000) Operating Room of the Future, Project MG8
($1,000) Pediatric Hospice Program at Walter Reed Army Medical Center, Project ME1
($1,800) Pennington Biomedical Center Personnel Readiness and Performance Initiative, Project MG9
($3,500) Picture Archiving and Communications System (PACS), Project MH1
($1,000) Portable Digital X-Ray, Project 954
($1,000) Project Collaboration Material, Project MH2
($1,000) Prostate Cancer Research - Gallo Center, Project 804
($3,400) Proteomics Center, Project MH3
($1,500) Rapid Bio-Pathogen Detection Technology, Project MH4
($1,200) Regional Anesthesia and Pain Management Initiative (RAPMI), Project MH5
($3,000) Rugged Textile Electronic Garments for Combat Casualty Care, Project MH6

($2,000) SEATreat, Project 97W
($3,000) Stable Hemostat, Project ME8
($1,000) Study of Human Operator Performance (C-SHOP), Project MH7
($3,000) Technologies for Metabolic Monitoring, Project 97A
($4,300) Tissue Development on Elastin Biomatrixes, Project 893
($5,200) VCT Lung Scan, Project 97N
($2,000) Idaho Rural Telemedicine Demonstration Project, Project ME7

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
800 TELEMEDICINE TESTBED	1862	1961	2023	3843	4312	4413	4513

A. Mission Description and Budget Item Justification: This project supports the "Medical" technology area of the Future Force by developing and demonstrating 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. It funds development, evaluation, and demonstration of prototype advanced technology concepts and materiel for provision of enhanced Force Health Protection. 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 U.S. Army Research Institute of Environmental Medicine, Natick, MA, performs work in this project. This project contains no duplication with any effort within the Military Departments.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Telemedicine ACTD - In FY03, completed an assessment of operational utility and developed a detailed program report for the Office of the Secretary for Defense Advanced Systems and Concepts, U.S. Army Medical Research and Materiel Command (USAMRMC), and the Combatant Commander sponsor. Transitioned products and operational concepts with identified utility and value to applicable programs of record or appropriate combat developers.	1862	0	0
Sleep Restriction Impact on Performance and Recovery - In FY04, determine and quantify amount of recovery sleep needed following sleep restriction. In FY05, will determine and quantify the performance-sustaining efficacy of caffeine across 48 hours of sleep deprivation through human trials.	0	1904	2023
Small Business Innovative Research/Small Business Technology Transfer Programs	0	57	0
Totals	1862	1961	2023

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
810	IND BASE ID VACC&DRUG	8432	17935	19958	20278	21760	22211	22717

A. Mission Description and Budget Item Justification: This project matures and demonstrates medical countermeasures to naturally occurring infectious diseases potentially affecting the Future Force. Infectious diseases pose a significant threat to operational effectiveness and forces deployed outside the United States. Countermeasures will protect the force from infection during sustained operations by preventing hospitalizations and evacuations from the theater of operations. Of major importance to the military are the parasitic disease malaria, the bacterial diseases responsible for diarrhea (i.e., caused by Shigella, enterotoxigenic Escherichia coli (ETEC), and Campylobacter), and viral diseases (i.e., dengue fever and hantaviruses). The program also develops improved materiel for control of insect/arthropod disease vectors and addresses a variety of other threats to deployed and mobilizing forces, including meningitis, viral encephalitis, and hemorrhagic fevers (e.g., 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 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 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 the lead service for infectious disease research. 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 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. This project contains no duplication with any effort within the Military Departments.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Malaria Vaccines - In FY03, completed clinical testing of DNA-based malaria vaccines. Assessed partially protective Repeated sequence from cirumsporozoite protein; Cell epitope; Hepatitis B surface antigen, Hepatitis B surface antigen (RTS, S) protein vaccine in combination with other falciparum proteins, DNA vaccines and other components for enhanced effectiveness. Continued development of additional vivax candidate vaccines. In FY04, conduct FDA Phase 1 and Phase 2 trials of several candidate malaria vaccine components such as Merozoite Surface Protein – 1 and apical membrane antigen – 1 with the goal of defining the vaccine technology and components for broadly protective malaria vaccine. In FY05, will test and select malaria blood stage vaccine components for integration into lead malaria vaccine candidate; will continue clinical testing of malaria vaccine components.	2133	5330	6050
Diarrheal Vaccines - In FY03, successfully completed Phase 1 clinical trial of a Shigella sonnei vaccine, initiated Phase 1 clinical testing of Shigella dysentriae vaccine, and initiated FDA required testing of vaccine components for a multi-agent Invaplex Shigella vaccine. Continued safety and efficacy testing of a candidate vaccine against ETEC diarrhea. Worked toward FDA approval of Phase 1 clinical testing of a protein based Campylobacter vaccine. In FY04, complete Phase 1 clinical trials of multi-agent Shigella vaccine. Conduct Phase 1 clinical studies of Campylobacter vaccines. In FY05, will continue clinical testing of lead Campylobacter vaccine; will initiate Phase 1 clinical trials of additional component of multi-agent Shigella vaccine.	1064	4222	3986
Dengue, Meningitis and Hemorrhagic Fever with Renal Syndrome Vaccines - In FY03, started FDA IND applications for clinical trials of dengue DNA and Hemorrhagic Fever and Renal Syndrome (HFRS) vaccines. In FY04, start Phase 1 clinical trials of dengue DNA and inactivated dengue and HFRS vaccines. Start Phase 2 clinical trials of dengue and HFRS vaccines and conduct initial clinical studies of a group B meningococcal vaccine. In FY05, will begin preclinical testing of new molecularly modified dengue virus and tetravalent DNA vaccine candidates, will continue Phase 2 testing of HFRS vaccine, and initiate IND for new group B meningococcal vaccine.	2843	4275	4916

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Antimalarial Drug Candidates - In FY03, completed ongoing preclinical testing of Artesunate antimalarial drug candidate to treat severe malaria and revised testing plan based on FDA guidance; initiated IND application to start clinical testing. Conducted initial preclinical testing in animals of several candidate drugs that prevent malaria and selected best for initial clinical testing. In FY04, complete all FDA-required preclinical toxicity testing of Artesunate and begin Phase 1 clinical testing; move new candidate drugs for prevention of malaria into preclinical testing and down-select best candidate for clinical testing. In FY05, will complete additional clinical testing of Artesunate. Will continue to test drugs to prevent malaria in preclinical trials and select drugs to take to clinical trials.	2298	2048	3012
Insect Vector Control and Infectious Disease Diagnostics - In FY03, obtained Army and foreign human use review board approvals for field testing of Dengue Vector Control System (DVCS). In FY04, test DVCS at multiple field sites; identify critical infectious disease diagnostic components for use in a joint services biological agent identification and diagnostic system. In FY05, will continue testing DVCS and component product improvements for FY 06 transition of those DVCS components into advance development; will develop approaches to supplement infectious disease diagnostics not compatible with joint diagnostic system.	94	1647	1994
Small Business Innovative Research/Small Business Technology Transfer Programs	0	413	0
Totals	8432	17935	19958

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
819 FLD MED PROT/HUM PERF	535	1433	1588	1626	1656	1695	1733

A. Mission Description and Budget Item Justification: This project supports "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. Specific support includes medical development of tools for assessing weapon system user health risks, diagnostic tools, and treatments to rapidly diagnose and treat laser eye injuries on the battlefield, injury prediction tools for assessing soldier survivability and designing effective individual protective equipment, drugs to sustain soldier performance during continuous operations, and tools for assessing health risks to soldiers in operational environments. 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 by the Walter Reed Army Institute of Research, Silver Spring, MD; and U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Health Risk Contaminant Detection System/Health and Injury Prevention - In FY03, developed a refined concept demonstration biomonitoring system for detecting chemical contaminants in water for independent evaluation and established a prototype reproductive toxicity test based on preliminary results. Developed health risk assessment software as a method to assess health risks for soldiers exposed to repeated impacts received during tactical operations and accidents in ground vehicles and helicopters. In FY04, demonstrate and validate an Environmental Protection Agency approved nucleic acid-based coliform bacterial detection system to ensure safe drinking water for military preventive medicine teams. In FY05, will conduct testing of a protective drug to decrease or eliminate laser retinal injury in soldiers.	535	1392	1588
Small Business Innovative Research/Small Business Technology Transfer Programs	0	41	0
Totals	535	1433	1588

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
840	COMBAT INJURY MGMT	5773	13412	14835	21158	23801	30840	27804

A. Mission Description and Budget Item Justification: In FY03 through FY07, this project matures and demonstrates new technologies in support of Medical Mission Package (Future Combat Systems (FCS) Increment II) with new candidate intravenous clotting drugs; an assisted critical care support system for far-forward management and transport of casualties; advanced technologies for treating extremity injuries to bone and flesh; freeze-dried plasma that lightens logistical load and provides treatment of hemorrhage; and effective means to enable the combat medic to perform remote triage of battlefield casualties that are widely dispersed on the Future Force battlefield and to thereby maximize field medic resources. In FY03 through FY09, this project matures and demonstrates a handheld device, the "Warrior Medic," that enables the combat medic to quickly link with and assess casualty vital signs and other markers of injury and that provides casualty management guidelines for the medic and an agent that enables field medical personnel to quickly and nonsurgically control internal bleeding. In FY04 through FY09, this project matures and demonstrates new technologies in support of Medical Mission Package (FCS Increment IV) with 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 critical care system for enhanced management, transport, and survival of stabilized casualties 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. The project funds prototypes of non-system-specific medical materiel items for far-forward medical management of trauma in combat casualties, including preclinical testing of candidate drugs and biologic compounds and devices/equipment to obtain data necessary for Food and Drug Administration (FDA) approval for human use. Focus areas include testing and demonstrations in drugs and devices to enhance the body's clotting function; strategies and products to optimize casualty resuscitation; novel blood products and medical devices to improve survival and reduce the logistics burden; compact dental technologies and systems for enhanced dental care in the combat zone; and neuroprotective drugs to minimize consequences of head injury. 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 by the U.S. Army Institute of Surgical Research, Fort Sam Houston, TX, U.S. Army Research Institute of Environmental Medicine, Natick, MA, and the Walter Reed Army Institute of Research, Silver Spring, MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Pain, Hemorrhage, and Injury Control - In FY03, demonstrated effective eradication of two blood-borne pathogens in a small animal model; conducted animal studies of candidate drugs to enhance blood clotting, and demonstrated the safety of nasally administered ketamine for control of severe pain in a Phase 1 clinical study. In FY04, select a set of sensors that detect ballistic wounding and life signs, integrate with hydration, and sleep status sensors; conduct a Phase 2 clinical trial and initiate a Phase 3 clinical trial to license nasal ketamine for control of pain on the battlefield; study the effectiveness of candidate hemorrhage control agents (gel, foam, liquid) in controlling severe internal bleeding; evaluate wound-protectant device and improved tourniquet device in animals and submit investigational device exemption application to the FDA; conduct proof-of-concept studies of a small antimicrobial wound-cleaning device; conduct proof-of-concept studies of lightweight materials and splints for fracture stabilization; research medical simulation and training requirements; design a methodology to support combat medic training for this highly distributed environment, including treatment of patients exposed to Chemical, Biological and Nuclear weapons. In FY05, will complete algorithms for integration of a set of sensors for detection of ballistic wounding, life signs, and hydration and sleep status into the prototype Future Force Warrior ensemble; will complete Phase 3 clinical trial of nasal ketamine for control of pain on the battlefield; will demonstrate in animals the effectiveness of a handheld device that stops bleeding with sound waves; will study in animals the effectiveness of candidate drugs to enhance blood clotting and restore normal blood clotting; will conduct Phase 1 clinical tests of an improved tourniquet; will conduct tests to select the best wound-cleaning device; and conduct animal tests of lightweight materials for splints.	3646	8396	8817
Physiological Status Monitoring - In FY03, demonstrated signal compatibility and non-interference of Land Warrior power system with two candidate life-signs detection systems and the ballistic impact detection system; demonstrated Microimpulse Radar (MIR) vital signs monitor capability to accurately detect and record life-signs data through clothing during physical exertion and reduction of extraneous data caused by motion. In FY04, format MIR monitor into a wearable prototype for continuous soldier monitoring through clothing. In FY05, will transition handheld MIR vital signs monitor to System Development and Demonstration.	187	682	1668

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Resuscitation Fluids/Acoustic Hemorrhage Control - In FY03, conducted animal studies of "hypotensive" (keeping blood pressure low) resuscitation comparing commercially available candidate resuscitation fluids in two animal models and demonstrated superiority of one candidate fluid. In FY04, conduct clinical studies to select the best commercially available resuscitation fluid(s). In FY05, will conduct studies in animals of a handheld device for use at the battalion aid station that stops bleeding with sound waves.	1528	3279	3534
Dental Disease/Freeze Dried Plasma and Other Combat Injury Related Issues - In FY03, conducted preliminary studies of a system for inactivating infectious agents in both whole blood and red blood cells; and conducted preclinical studies of candidate freeze-dried plasma lots which showed stability in storage for 1 year and showed stable physical and chemical properties after freeze-drying. In FY04, complete development of a new penetrating head injury (PHI) model. Conduct studies of candidate packaging systems for freeze-dried blood products that will enhance delivery and storage of blood products in the field. Initiate development of formulation and application methodology of an anticavity/antiplaque food additive to prevent dental disease. In FY05, will conduct clinical studies of freeze-dried plasma. Will complete development of formulation and application methodology of an anticavity/antiplaque food additive to prevent dental disease. Will conduct neuroprotection drug studies in the PHI model to identify a drug to improve survival and residual brain function in casualties with brain injury.	412	666	816
Small Business Innovative Research/Small Business Technology Transfer Programs	0	389	0
Totals	5773	13412	14835

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603003A - AVIATION ADVANCED TECHNOLOGY

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	42388	84966	69549	90566	106966	118762	122530
313	ADV ROTARYWING VEH TECH	22875	55044	52500	76537	92390	89416	85886
435	AIRCRAFT WEAPONS	2153	965	4051	4073	3316	4099	5035
436	ROTARYWING MEP INTEG	6948	4790	5841	1997	2931	16742	22908
447	ACFT DEMO ENGINES	6364	6832	7157	7959	8329	8505	8701
B97	A/C AVIONICS EQUIPMENT	4048	4395	0	0	0	0	0
BA7	AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	0	7902	0	0	0	0	0
BA8	VECTORED THRUST DUCTED PROPELLER (CA)	0	5038	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 in support of the Future Force and Joint Vision 2020, and, where feasible, exploits opportunities to enhance Current Force capabilities. Based on the Army transformation, this PE is focused to investigate technologies applicable to unmanned systems, while providing opportunities for technology insertion into Current Force manned system. Unmanned rotary wing vehicles bring unprecedented agility, maneuverability, and lethality to the Future Force while providing improved survivability and reduced sustainment costs. Within this PE, aviation technologies will be matured and integrated into realistic and robust demonstrations. Emphasis will be placed on maturing unmanned attack, reconnaissance, and lift capabilities and teaming them with Future Force manned systems. Technologies that enable increased 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. This PE provides technical support and technology transition to Unmanned Aerial Vehicles (UAVs), to include the A-160 Hummingbird, the Unmanned Combat Armed Rotorcraft (UCAR), the Organic Air Vehicle (OAV), and the Micro Air Vehicle (MAV). This PE also supports Future Force manned aviation systems. Related applied research is conducted under PE 0602211A (Aviation 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 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	41924	72083	70327
Current Budget (FY 2005 PB)	42388	84966	69549
Total Adjustments	464	12883	-778
Congressional program reductions		-5346	
Congressional rescissions			
Congressional increases		18550	
Reprogrammings	464	-321	
SBIR/STTR Transfer			
Adjustments to Budget Years			-778

Significant Change Explanation.
FY04 - Seven FY04 Congressional adds totaling $18550 were added to this PE.

FY04 Congressional Adds with no R-2As:
($4267) Radar Surveillance and Assimilation Network, Project B97: The purpose of this one year Congressional add is to mature airborne situational awareness for unmanned and manned air platforms through an integrated system for the assimilation of data from multiple sources to track, de-conflict, or intercept UAV and other airborne targets. No additional funding is required to complete this project.

($958) Broad Area Unmanned Responsive Re-Supply Operations, Project BA7: The purpose of this one year Congressional add is to demonstrate the utility of UAV for logistics operations, through the flight demonstration of the optionally piloted Kaman BURRO helicopter. No additional funding is required to complete this project.

($2398) Locust USA Heavy Fuel Burning Engines for UAV's, Project BA7: The purpose of this one year Congressional add is to mature a small heavy fuel engine for UAV application and to further address scalability of the design. No additional funding is required to complete this project.

($1630) Reconfiguration Tooling System, Project BA7: The purpose of this one year Congressional add is to demonstrate a reconfigurable tooling system capable of delivering a complete composite repair system that incorporates tool creation and composite curing for rapid repair and replacement

of mission critical parts at the depot level. No additional funding is required to complete this project.

($2685) UAV and Micro Air Vehicle Dynamometer, Project BA7: The purpose of this one year Congressional add is to modify the current air dynamometer designs to enable testing of UAV engines on the Army's existing equipment and to explore alternative compression systems for dynamometer / engine applications. No additional funding is required to complete this project.

($4891) Vectored Thrust Ducted Propeller Compound Helo, Project BA8: The purpose of this one year Congressional add is to assess the potential for a VTDP helicopter to improve the speed, range and survivability of a UH-60 Black Hawk helicopter while reducing ownership cost. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
313	ADV ROTARYWING VEH TECH	22875	55044	52500	76537	92390	89416	85886

A. Mission Description and Budget Item Justification: The Advanced Rotary Wing Vehicle (RWV) Technology project matures and demonstrates rotary wing unmanned and manned platform technologies for the Future Force, and, where feasible, exploits opportunities to enhance Current Force capabilities. It is envisioned that the Future Force will need unmanned and manned rotorcraft systems that have significantly increased / improved lift, range, survivability, and mission capability with an overall reduction in logistics and cost of operation. Key to this effort is the demonstration of vertical takeoff and landing (VTOL) UAVs for the Future Force. The critical technologies to support these capabilities will be matured through Technology Demonstrations (TDs) of prototype UAVs, rotors, active controls, structures, drive train, integrated architecture and threat protection. The near-term demonstration of VTOL UAVs will focus on the A-160 Hummingbird and the Organic Air Vehicle (OAV), to include the Micro Air Vehicle variant, for Reconnaissance, Surveillance and Target Acquisition (RSTA) capability. The far-term demonstrations will focus on the Unmanned Combat Armed Rotorcraft (UCAR) teamed with manned and other unmanned airframes. UCAR is a joint program--cost shared 50/50--with the Defense Advanced Research Projects Agency (DARPA) and is planned to transition to Program Executive Officer Aviation at the completion of its 6.3 funded phases. These demonstrations will focus on military operations and the application of military specification on these maturing systems. 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 team to use 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 manned and unmanned systems. The Rotorcraft Drive Systems for the 21st Century (RDS21) TD will provide a 35% increase in power-to-weight ratio, 20% reduction in both production and Operating and Support (O&S) costs and a 12 decibel (dB) reduction in noise for the drive-systems of both manned and unmanned rotorcraft. These technologies are a significant contributor to Future Force capability and will enable a 40% increase in payload for the AH-64 Apache, a 20% increase in range for the UH-60 Black Hawk, and over a 25% increase in range for the CH-47 Chinook. 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 2003	FY 2004	FY 2005
Integrated UAV Operations – [Includes Airborne Manned Unmanned System Technology (AMUST), Manned Unmanned Common Architecture Program (MCAP), and Unmanned Aerial Vehicle Autonomous Collaborative Operations (UACO).] - In FY03, integrated architecture on Lot 7 AH-64D Longbow Apache and Army Airborne Command and Control System (A2C2S) UH-60 Black Hawk. Conducted hot bench test to ensure proper function on operational processors and with aircraft communications system. Designed embedded mission avionics architecture for use on manned and unmanned rotorcraft based on market driven commercial-off-the-shelf electronics and well-supported open systems specifications and standards. Conducted simulations of airborne UAV control capability to obtain user feedback. In FY04, complete architecture detailed designs and system integration tests, and initiate flight-test of the manned-unmanned architecture on both the AH-64D Longbow Apache and A2C2S UH-60 Black Hawk, individually and jointly. Conduct system level demonstration of common architecture between manned and unmanned rotorcraft. Conduct data analysis of demonstration results. Complete development of UAV control capability in the Longbow Apache and A2C2S Black Hawk and conduct flight tests. In FY05, will complete flight tests and data analysis, will publish systems architectures, and will coordinate updates to the Joint Technical Architecture-Army as appropriate. Will start development of advanced autonomy and collaboration algorithms for UAVs.	9389	12853	7475
A-160 Hummingbird - In FY03, conducted initial A-160 functional and environmental ground-test of Phase I subsystems. Performed continuous flight tests with first two (Phase 0) A-160s. In FY04, conduct system flight-testing to test-fix-test of airframe and components at gross weights up to 4,000 pounds and altitudes up to 20,000 feet. Conduct environmental testing in ice, sand and salt. Review A-160 flight test results, including initial mission equipment package (MEP) integration with electro-optic/infra-red (EO/IR) sub-systems. Conduct functional and environmental ground-test results for Phase I subsystems and Ground Control Station. Validate baseline Phase I configuration and capabilities. In FY05, will conduct continuous air vehicle system flight tests at gross weights up to 5,000 pounds, altitudes up to 30,000 feet, and rotor speeds up to 100%. Will refine the Ground Control Station, airframe and mission equipment packages, to include EO/IR flight demonstration with four A-160s (two Phase 0 and two Phase I). Will validate revised Phase I configuration and capabilities.	5000	10000	15000

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Unmanned Combat Armed Rotorcraft (UCAR) - The UCAR program goal is to demonstrate an armed VTOL UAV that is survivable; can identify targets at 6-10 km and can recognize dismounted infantry at 2-6 km; has a flyaway cost that is 20%-40% of Comanche; and has an operating and sustainment cost that is 20%-50% of Apache. Applied Research for UCAR was conducted in FY02 and FY03 in PE 0602211A Aviation Technology. In FY04, complete UCAR Phase II, Preliminary Design. Industry teams will identify best technical approach considering mission effectiveness, lethality, system performance, autonomous operations, and command and control. In FY05, will begin UCAR Phase III, Development and Test. Industry teams will conduct detailed design of best technical approach, and execute critical design review. Will conduct bench testing of critical systems/subsystems as identified in the Risk Management and Mitigation Plan. Will define design characteristics/attributes as required to satisfy system performance requirements. Will conduct bench testing and design support testing of critical UCAR system components. Will fabricate two full-scale system demonstrators. Will design and build an air or ground based control console. Will conduct UCAR ground and initial tie-down and light testing to demonstrate and characterize system performance.	0	14000	20000

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Rotorcraft Structures [Survivable, Affordable Repairable Airframe Program (SARAP)] - In FY03, incorporated advanced structures technologies into prototype manned and unmanned designs to improve rotary-wing airframe weight, cost, supportability, and survivability. Evaluated and selected non-destructive inspection and depot / field repair methods for advanced composite structures. Matured low-cost, lightweight structural concepts and drafted damage tolerance certification methodology for fatigue critical composite components. In FY04, conduct major effort of the SARAP with manned and unmanned rotary-wing virtual prototype models and simulations that reduce airframe weight by 25% and cost by 40%. Implement predictive risk management process to select highest payoff technologies for full-scale development and demonstration. Validate probabilistic building block qualification methodology. Model and simulate ballistic and rocket propelled grenade (RPG) threats and susceptable structure. Fabricate virtual prototype (full digital definition and simulations / models) validation hardware for ballistic, static, and crash testing. In FY05, will validate manned and unmanned virtual prototype models and simulations with full-scale hardware fabrication and test to improve weight, cost, supportability, and survivability. Will conduct full-scale hardware ballistic, static, fatigue, and crash testing to validate virtual prototype models and simulations. Will transition SARAP structural technologies, concepts, and methodologies to current and developmental manned and unmanned rotary wing systems such as H-60, H-47, H-53, A-160 and UCAR.	3600	9907	4083
Drive Train [Rotorcraft Drive System for the 21st Century (RDS21)] - In FY03, conducted rig testing to establish Face Gear design and durability of high speed clutch. In FY04, fabricate full-scale test hardware and full-scale RDS-21 split torque/face gear demonstration hardware and composite housing. In FY05, will conduct goal demonstration testing (weight/durability/noise) of RDS-21 demonstrator.	4886	4955	5942
Slowed Rotor Demonstration. In FY04, demonstrate the principle of a slowed main rotor that is optimized for minimum drag, utilizing a vertical takeoff and landing gyro-copter.	0	1780	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1549	0
Totals	22875	55044	52500

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
435 AIRCRAFT WEAPONS	2153	965	4051	4073	3316	4099	5035

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 and Joint Vision 2020 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. Integration of advanced missiles, rockets, guns, fire control, advanced target acquisition and pilotage sensors, and directed energy weapons, including non-lethal capabilities. 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 with on-board systems, vehicle flight characteristics and weapon system are matured and demonstrated. The project will mature Low Cost Precision Kill (LCPK) rocket system using a 2.75-inch rocket with a laser seeker sensor and the project will evaluate other technologies for providing rotorcraft combat enhancements. 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 2003	FY 2004	FY 2005
Weapons Integration. Includes Low Cost Precision Kill (LCPK), a laser guided 70MM (2.75 inch) folding fin aerial rocket and Loitering Electronic Warfare Killer (LEWK). In FY03, conducted AH-64D airborne evaluation of the LCPK guided rocket. Provided technical support to LEWK ACTD. In FY04, provide support to Hunter Standoff Killer Team ACTD to mature an Integrated Operational Picture system architecture for actively tasking sensor platforms and weapons. In FY05, will investigate precision location of threat radar systems from UAVs. Will conduct initial prototype design of integrated, autonomous engagement systems. Will investigate unmanned teaming and cueing for collaborative engagements.	2153	937	4051
Small Business Innovative Research/Small Business Technology Transfer Programs	0	28	0
Totals	2153	965	4051

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
436 ROTARYWING MEP INTEG	6948	4790	5841	1997	2931	16742	22908

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 Foce 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 and Joint Vision 2020 by providing mature technology to enhance near-real time situational awareness for unmanned and manned rotary wing vehicles. The Airborne Manned and Unmanned System Technology (AMUST) program provides intelligent software and integrates advanced technologies in sensors, displays, communication and controls necessary to team airborne manned and unmanned vehicles to maximize the teams' lethality, survivability, and operational tempo in support of the maneuver commander. The manned, unmanned team will be capable of performing reconnaissance, surveillance, target acquisition and attack while maintaining constant tactical situation awareness. Integration of state-of-the-art approaches in artificial intelligence, intelligent agents, sensors, avionics, communications, pilot vehicle interfaces, and autonomous assistants will enable an manned-unmanned team that enhances Army aviation battlefield effectiveness. This project supports the Hunter Standoff Killer Team (HSKT) Advanced Concepts Technology Demonstration (ACTD). 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 will be matured to maximize 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 2003	FY 2004	FY 2005
Airborne Manned and Unmanned System Technology (AMUST) [Includes UAV Network Teaming and Hunter Standoff Killer Team (HSKT) Advanced Concepts Technology Demonstration (ACTD).] - In FY03, integrated Tactical Common Data Link into manned and unmanned platforms to enable common control. Flight tested AMUST teaming technology on an AH-64D Longbow Apache, an A2C2S UH-60 Black Hawk, and a Hunter UAV as part of HSKT ACTD. Generated interface control documents to integrate HSKT hardware in a System of Systems construct for AH-64D Longbow Apache, A2C2S UH-60 Black Hawk, Hunter UAV, and F/A-18. With the user, matured tactics, techniques, and procedures (TTPs) and training concepts for HSKT System of Systems. Tested and evaluated wideband radio frequency network as possible airspace management aid. Enabled technology transition to Future Force systems. In FY04, mature an Integrated Operational Picture system architecture for actively tasking sensor platforms and systems to build and maintain an Integrated Operational Picture that supports targeting and situation awareness among commanders and warfighters. In FY05, will demonstrate, in simulation, the architecture and algorithms to build an Integrated Operational Picture. Will mature TTPs in simulation to formulate a sensor-to-shooter solution for time-critical targets at desired sensor resolution. Will support the Manned Unmanned Common Architecture Program to complete demonstration of common architecture between manned and unmanned rotorcraft. Will support the Survivable, Affordable, Repairable Airframe Program to validate manned and unmanned prototype models and to complete live fire, static, fatigue and crash testing to validate models.	5419	3706	5841
Airborne Manned/Unmmanned Systems Technology (AMUST) - The objective of this one year Congressional Add is to complete the development and testing of the RF network for the AMUST program. No additional funding is required to complete this project.	0	964	0
UAV Data Link. This one-year Congressional Add developed a Wideband Wireless Network to support AMUST. No additional funding is required to complete this project.	1529	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	120	0
Totals	6948	4790	5841

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
447	ACFT DEMO ENGINES	6364	6832	7157	7959	8329	8505	8701

A. Mission Description and Budget Item Justification: The Aircraft Demonstration Engines project matures 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, wherer feasible, exploits opportunities to enhance Current Force turbine engines. This project supports the Future Force and Joint Vision 2020 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 Joint Turbine Advanced Gas Generator (JTAGG) efforts are all fully coordinated / aligned with the phases / goals of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) program and industry. IHPTET / JTAGG 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. This provides significantly increased range and payload capabilities for future unmanned and manned rotorcraft and sustainment upgrades for current engines, with significant Operation and Support cost savings. The Small Heavy Fuel Turbine Engine program is focusing on maturing and demonstrating advanced, affordable turbine engine technology in the 700 horsepower class. Significant improvements in specific fuel consumption and power-to-weight ratio will provide a heavy fuel engine capability for applications such as the A-160 and Future Combat Systems (FCS). 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Joint Turbine Advanced Gas Generator (JTAGG) and Integrated High Performance Turbine Engine Technology (IHPTET) - In FY03, completed assembly of JTAGG III gas generator build, which includes a forward swept rotor, a split-inducer impeller and un-cooled ceramic low pressure turbine blades. Affirmed via component testing / analysis progress towards the JTAGG III goals of 120% increase in shaft horsepower to weight ratio, 40% decrease in SFC, and 35% reduction in production and maintenance costs. In FY04, complete fabrication of test hardware and perform integrated engine component demonstration for program goal achievement.	6364	200	0
Small Heavy Fuel Turbine Engine - In FY04, design a 700 horsepower engine demonstrator with goals of: -20% SFC, +50% horsepower to weight ratio, and 35% cost reduction. Begin engine component fabrication to support rig tests and full engine demonstration. In FY05, will build and test components of 700 horsepower heavy fuel turbine engine.	0	6451	7157
Small Business Innovative Research/Small Business Technology Transfer Programs	0	181	0
Totals	6364	6832	7157

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	61206	53737	67622	74572	61701	68913	76618
232	ADVANCED MUNITIONS DEM	57837	27748	48177	41605	44237	45638	47567
43A	ADV WEAPONRY TECH DEMO	3369	6568	99	111	123	129	131
L94	ELECTRIC GUN SYS DEMO	0	19421	19346	19356	0	0	0
L96	HIGH ENERGY LASER TECHNOLOGY DEMO	0	0	0	13500	17341	23146	28920

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates affordable, smaller and/or lighter advanced weapons and munitions technologies to increase battlefield lethality and survivability for the Future Combat Systems (FCS) and the Future Force. Within Project 232 specific efforts include: FCS 120mm Line Of Sight (LOS) Beyond Line Of Sight (BLOS) System Advanced Technology Demonstration (ATD) and the Mounted Combat System (MCS) Ammunition System Technologies (MAST); Mid Range Munition (MRM); Advanced Light Armament for Combat Vehicles; Objective Non-Line Of Sight (NLOS) Mortar Technology; and High Energy Laser Technology Demonstrations. MAST will mature technologies to enhance the capabilities of FCS Increment 1 120mm LOS/BLOS armament system and munition suite. Objective NLOS Mortar Technology demonstrates a 120mm breech loaded recoiling mortar for under armor application. The Fire Control-Node Engagement Technology (FC-NET) program will mature a common fire control system for FCS gun and missile weapon systems. Advanced Acoustic Seismic Sensors provides networked acoustic/seismic sensors and aero-acoustic propagation models for the Networked Sensors for the Objective Force ATD. Beginning in FY04, Project L94 will mature enabling technologies for an Electromagnetic (EM) Gun armament system, leading to key sub-system demonstrations in FY06. EM Gun has the potential to revolutionize the future battlefield by its unique performance characteristics, including hypervelocity lethality effects and greatly reduced logistics burden. Efforts beginning in FY05 include: Common Smart Submunition; Lightweight Dismounted Mortar Weapon; Future Intelligent Munition; and MCS Ammunition Technologies. Beginning in FY06, FCS Armament Munitions will mature technologies used for affordable sub-munitions, smart mortar munitions and lighter weight launchers for the next generation of armaments and munitions. Also, in FY06 a new project, L96, designed to integrate a solid-state laser device into a high-energy laser weapon system will begin. This program adheres to Tri-Service Reliance Agreements on conventional air-surface weaponry, with oversight provided by the Joint Directors of Laboratories. Work in this PE is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), PE 0602618A (Ballistics Tech), PE 0604802A (Weapons and Munitions - Engineering Development), and PE 0602307A (Advanced Weapons 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). The program element contains no duplication with any effort within the Military Departments. This work is performed by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), at Picatinny Arsenal, New Jersey.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	63230	47752	72404
Current Budget (FY 2005 PB)	61206	53737	67622
Total Adjustments	-2024	5985	-4782
Congressional program reductions		-463	
Congressional rescissions			
Congressional increases		6650	
Reprogrammings	-2024	-202	
SBIR/STTR Transfer			
Adjustments to Budget Years			-4782

Significant Change Explanation.
FY04 - Three FY04 Congressional adds totaling $6650 were added to this PE.

FY04 Congressional Adds with no R-2As:
($964) Micro-Electromechanical System (MEMS) Reliability Assessment Program, Project 43A: The purpose of this one year Congressional add is to assess the reliability of MEMS devices. No additional funds are required to complete this project.

($4097) Technology Demonstration for the Prevention of Material Degradation, Project 43A: The purpose of this one year Congressional add is to demonstrate technologies for the prevention or minimization of the effects of material degradation on Army materiel. No additional funds are required to complete this project.

($1350) Development Mission Integration, Project 43A: The purpose of this one year Congressional add is to provide demonstrations of integrated armament technologies for armament systems to include integration activities on surrogate ground/air platforms. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
232	ADVANCED MUNITIONS DEM	57837	27748	48177	41605	44237	45638	47567

A. Mission Description and Budget Item Justification: This project matures and demonstrates munitions enhancement for the FCS 120mm LOS BLOS System ATD and Mounted Combat System (MCS) Ammunition System Technologies (MAST) and matures emerging technologies in lightweight structures, smart materials, acoustic/seismic sensors and in-flight update architectures. Mid Range Munition (MRM) is a gun launched precision munitions capable of defeating high value heavy armor and other targets out to 8+km. The objective of this accelerated effort is to modify existing munitions components, including reducing the size of the guidance and control elements, and demonstrate the MRM BLOS capability for FCS increment I. MAST will mature technologies to enhance the capabilities of FCS Increment 1, 120mm LOS/BLOS armament system and munition suite. LOS/BLOS/NLOS Gun Technologies will apply advanced recoil mechanism and lightweight materials to gun systems to enhance range performance while driving overall system weight lower. The Advanced Light Armament for Combat Vehicles (ALACV) program will mature air bursting munitions and advanced kinetic energy penetrators for medium caliber applications. Lightweight Dismounted Mortar Weapon and Objective Non Line Of Sight (NLOS) Mortar Technology will be demonstrated under this project. The 81mm dismounted mortar effort will ease man transportability and reduce soldier combat load through an improved design and the application of lightweight advanced materials and structures. The 120mm breech loaded mortar will provide requisite FCS NLOS firepower performance levels with a design optimized for lightweight and thermal balance. Future Intelligent Munition (FIM) and Common Smart Submunition (CSS) efforts will pursue critical subsystem evaluations leading to final system demonstrations. FIM will provide a special purpose munition for unmanned terrain dominance with significant reduction in logistic burden and cost due to fewer munitions required per area coverage. CSS offers increased operational efficiency through multiple kills per munition and affords greater flexibility for carrier applications and enables utilization of a variety of delivery systems. FC-NET will provide a common software package that will recommend weapon-target pairings for missiles and guns and will be expandable to include future weapon types. Advanced Acoustic Seismic Sensors demonstrates networked acoustic/seismic sensors for target tracking and cueing of secondary sensor 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). ARDEC, Picatinny Arsenal, New Jersey and the Army Research Laboratory, Aberdeen Proving Ground, MD perform in-house efforts.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Objective NLOS Mortar Technology: In FY03, performed thermal and dynamic stability analyses for mortar optimization; selected mortar technical approach and completed preliminary designs. In FY04, build and assemble the breech loaded mortar and begin single shot firing. In FY05, live fire tests will be conducted to demonstrate rates of fire commensurate with threshold requirements.	2978	2281	1975
ALACV: In FY03, demonstrated integrated medium caliber air bursting projectile lethality of four-fold increase in lethal area over traditional point-detonating warhead against personnel targets. Demonstrated 30% increase in behind armor effects using advanced penetrators.	2100	0	0
120mm LOS BLOS System: In FY03, demonstrated firing of multi-role cannon with swing chamber and case telescoped ammunition cartridge; demonstrated, at subscale, feasibility of achieving 25% increase in energy (retaining current sensitivity) using Gen II Electrothermal Chemical (ETC) propellant; demonstrated fire control software & hardware in a System Integration Laboratory; conducted testing of auto ammo handling system and load/unload sequence reliability; completed turret design. Demonstrated defeat of advanced threat armor at extended ranges with integrated novel penetrator & composite sabot. Demonstrated all remaining MRM subsystems/ systems in a relevant environment; fabricated guidance and control hardware and seeker/sensor hardware and conducted high-g testing. In FY04, conduct lethality testing of KE novel penetrator against heavy armor; demonstrate prototype MRM projectile in a guide-to-hit test conducted at ambient temperature that shall launch, survive, deploy, sense, maneuver and hit a target at 5km; conduct Rail Gun tests of multi-mode sensor components for Enhanced MRM; conduct secondary armament turreted slew system and firing demonstration. In FY05, will fabricate dual mode seeker for MRM, complete software development, conduct high-g test and conduct MRM Captive Flight Test.	51809	22957	16494
MCS Ammunition Systems Technologies (MAST): In FY05, will complete fabrication, assembly and conduct subsystem air frame and warhead testing of Line Of Sight-Multi Purpose (LOS-MP) munition. Will integrate warhead and fuzing subsystems into airframe and demonstrate LOS MP against air burst and concrete wall targets at Government Proving Grounds (TRL6). Will complete initial design, fabricate and conduct initial airframe testing at ambient temperature of Enhanced KE (TRL4).	0	0	12884

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Networked Sensors for the Future Force (NSfFF) ATD: In FY04, demonstrate acoustic algorithm in real-time system and acoustic/seismic propagation model; integrate suite of acoustic/seismic sensors in the Networked Sensors for the Future Force ATD; develop low cost, distributed and networked unattended ground sensors. In FY05, will demonstrate the acoustic & seismic propagation and sensor system model on a platform to conduct an initial evaluation of a sensor emplacement tactical decision aid for optimum system performance; will integrate and demonstrate sensor systems in the NSfFF ATD.	0	995	988
FC-NET: In FY03, adapted software to Fire Control Computer and supported feasibility demonstration. In FY04, optimize algorithms and architecture to support demonstration in a simulated environment and initiate transition of Netted Effects to Objective Force Warrior (OFW). In FY05, will provide full functional Netted Effects Software configured for insertion into OFW architecture to support capstone demonstration.	950	747	741
Common Smart Submunition: In FY05, will conduct tower tests to verify and validate performance metrics for detection, discrimination and classification of potential targets in benign and countermeasured scenarios.	0	0	7688
NLOS-C Non Lethal Personnel Suppression: In FY05, will conduct non-lethal malodorant effectiveness and dispersion analysis; will refine design based on analysis; will conduct initial gun launch and payload dispense test.	0	0	3950
Lightweight Dismounted Mortar Weapon: In FY05, will conduct engineering evaluations and ballistically demonstrate a full-scale, lightweight barrel prototype.	0	0	3457
Small Business Innovative Research/Small Business Technology Transfer Programs	0	768	0
Totals	57837	27748	48177

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
L94	ELECTRIC GUN SYS DEMO	0	19421	19346	19356	0	0	0

A. Mission Description and Budget Item Justification: This project demonstrates state of the art technology of major electromagnetic armament sub-systems at a tactical scale. The project provides a comprehensive mission area analysis/utility assessment, and will resolve system level issues including synchronization/compatibility of twin rotating machines, technology scalability, thermal management, and full-energy system performance. Electromagnetic guns have the potential to revolutionize the future battlefield by their unique performance characteristics, such as hypervelocity and stealth launch, their elimination of vulnerable propellants, their synergistic relationship with hybrid electric vehicles, and by their significant reduction in sustainment burden. 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). ARDEC, Picatinny Arsenal, New Jersey and the Army Research Laboratory, Adelphi, Maryland perform in-house efforts.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Electric Gun System Demo: In FY04, prepare detailed subsystem designs for Pulsed Power Supply (PPS), launcher, and Integrated Launch Package (ILP); mature models and simulations to demonstrate component, end-to-end and system-level performance; conduct a full-scale kinetic energy penetrator hypervelocity lethality assessment; order long-lead items. In FY05, will perform critical material/component evaluations including tests on composite rotors and barrels, low-density and high-strength metals, insulation systems, thermal management systems, high energy/high power switches; will fabricate and test subscale launcher and ILP; will fabricate components for prototype PPS rotating machines; will design pulse power supply torque management system and mount; will design and fabricate full scale launcher, mount, recoil, and ILPs, including both kinetic energy and high-explosive projectiles; will interface system simulation with FCS Simulation and Modeling for Acquisition, Requirements, and Training (SMART) process and will begin preparations for armament sub-system demonstrations.	0	18855	19346
Small Business Innovative Research/Small Business Technology Transfer Programs	0	566	0
Totals	0	19421	19346

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603005A - Combat Vehicle and Automotive Advanced Technology

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	304885	270656	203126	157373	161795	184293	186166
221	COMBAT VEH SURVIVABLTY	40566	45155	27479	20326	21190	23240	23597
440	ADV CBT VEHICLE TECH	22226	1976	16326	0	48157	60277	56244
441	COMBAT VEHICLE MOBILTY	35758	35495	31283	54707	57495	75644	79760
497	COMBAT VEHICLE ELECTRO	4403	6661	5831	9868	9618	13108	13407
502	HAECO II	1170	0	0	0	0	0	0
506	METAL MATRIX COMPOSITES	1406	0	0	0	0	0	0
515	ROBOTIC GROUND SYSTEMS	8309	7337	12056	22334	23305	9942	11024
533	GROUND VEHICLE DEMONSTRATIONS	0	14175	0	0	0	0	0
539	MOBILE PARTS HOSPITAL	7025	0	0	0	0	0	0
53B	FUEL CELL AUX POWER UNITS FOR LINE HAUL TRUCKS	2809	0	0	0	0	0	0
53D	NAC DEMONSTRATION INITIATIVES (CA)	2529	46228	0	0	0	0	0
53E	IMPACT TRUCK PROGRAM	3278	0	0	0	0	0	0
53F	NAC STANDARD EXCHANGE OF PRODUCT MODEL DATA	2341	0	0	0	0	0	0
53G	FUTURE COMBAT SYSTEMS (FCS)	162000	112659	109360	48188	0	0	0
C66	DC66	3105	970	791	1950	2030	2082	2134
CA3	CORROSION PREVENTION AND CONTROL PROGRAM	2388	0	0	0	0	0	0
CA4	VEHICLE BODY ARMOR SUPPORT SYSTEM	2388	0	0	0	0	0	0
CA5	FUEL CATALYST RESEARCH EVALUATION	936	0	0	0	0	0	0
CA6	INTEGRATED PROGRAM MANAGEMENT FRAMEWORK	936	0	0	0	0	0	0
CA7	RAPID PROTOTYPING	1312	0	0	0	0	0	0

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 realize the Army's vision and enable transformation to the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Army S&T continues to play an important role in the Future Combat Systems (FCS) program by providing critical technology solutions for enhanced capabilities in current force vehicles, FCS Increment 1, as well as capability-enhancing technologies for FCS Increment 1 Spirals and Increment 2. Supporting FCS remains the highest priority for Army S&T and is the primary effort funded in this PE; therefore a significant portion of the FY03-FY05 funds supports the collaborative Army/Defense Advanced Research Projects Agency (DARPA) FCS program. FCS Memoranda of Agreement (MOA) between the Army and DARPA delineate the collaborative enabling technologies, 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) and intra-vehicular digital 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 Future Tactical Truck Systems (FTTS) Advanced Concept Technology Demonstration (ACTD) will demonstrate, through hardware, modeling and simulation, high payoff vehicle technologies coupled with current and Future Force sustainment concepts in a User operational environment. The ACTD will integrate technologies including advanced propulsion (hybrid electric), vehicle intelligence (C4ISR, diagnostics, prognostics), mobility (electromechanical suspension, electronically controlled active braking) and intelligent load handling. The Crew Integration and Automation Testbed (CAT) Advanced Technology Demonstrator (ATD) demonstrates multi-mission capable crew stations required for the versatility of the Future Force. The Robotic Follower ATD (Project 515) will mature and demonstrate an unmanned ground system capability for the FCS and the Objective Force Warrior. The intent is to reduce the soldier's equipment burden, increase survivability and reduce the logistics burden. The Integrated Survivability ATD (Project 221) identifies the integration issues associated with upgrading FCS baseline survivability capabilities to meet FCS objective system survivability requirements, while monitoring individual technologies for direct transition opportunities into System Development and Demonstration. 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, and electric weapons and protection systems. In the mid-term, electromagnetic (EM) armor will be matured and demonstrated. In the longer term, vehicle energy and power levels will be increased to accommodate advanced electric weapons (e.g., lasers, high power microwave and electric guns) and advanced electric-based protection systems. Project 441 will demonstrate critical power, propulsion and electric systems, including energy storage, power distribution and pulse forming networks (PFNs). This PE adheres to Tri-Service Reliance Agreements on advanced materials, fuels and lubricants, and ground vehicles with oversight and coordination provided by the Joint Directors of Laboratories. Work in this program element is related to, fully coordinated with PE 0602601A (Combat Vehicle and Automotive Technology) and 0602618 (Ballistics Technology). The PE is coordinated with the 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, Transportation and DARPA. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this PE is performed by the Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	264795	210856	205245
Current Budget (FY 2005 PB)	304885	270656	203126
Total Adjustments	40090	59800	-2119
Congressional program reductions		-2333	
Congressional rescissions			
Congressional increases		63150	
Reprogrammings	40090	-1017	
SBIR/STTR Transfer			
Adjustments to Budget Years			-2119

Significant Change Explanation.
FY03 - Funds realigned to support DARPA efforts for the Future Combat Systems (FCS) Lead System Integrator (LSI) to continue in preparation for Milestone B.

FY04 - Twenty Six FY04 Congressional Adds totaling $63150 were added to this PE.

FY04 Congressional Adds with no R-2A:
21st Century Truck, Project 53D ($8055)
Advanced Army Modular Composite Bridge, Project 533 ($2015)
Advanced Collaborative Technologies, Project 53D ($2014)
Advanced Thermal Management Controls, Project 53D ($964)
Advanced Thermal Management System, Project 53D ($1918)
Aluminum Lightweight Structures Initiative, Project 533 ($959)
Battery Charging Technology, Project 53D ($959)
Center for Advanced Vehicular Systems, Project 533 ($719)
Chemical Warfare Agent Detection Devices, Project 533 ($1439)
Electrochromatic Material Windows, Project 53D

($2397)
Electrochromatics Research, Project 53D ($2446)
Fastening & Joining Technologies, Project 533 ($959)
Fuel Cell Technology, Project 53D ($2685)
High Power Density & Efficiency OPOC Engine & Electric Power Cell, Project 53D ($1151)
IMPACT (Action pending to change name to HAMMER / THOR) , Project 53D ($4315)
Mechanically Assisted Spare Tire Carrier (MASTC) for the HMMWVs, Project 53D ($1630)
Mobile Parts Hospital, Project 53D ($4028)
NAC Standardized Exchange of Product Data (N-STEP) , Project 53D ($3357)
Pacific Rim Corrosion Research Program, Project 533 ($2493)
Rapid Optimization of Commercial Knowledge (ROCK) for FCS, Project 53D ($2158)
Tactical Vehicle Design Tools, Project 533 ($959)
Turbo Fuel Cell Engine, Project 53D ($4891)
Ultra Reliability for Combat Systems, Project 533 ($959)
Ultra-High Performance Hybrid Structures and Armors, Project 533 ($3260)
US Army Hydrogen Infrastructure, Project 53D ($1918)

Projects with FY04 Congressional Adds and no R-2A are not defined due to space limitations.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
221	COMBAT VEH SURVIVABLTY	40566	45155	27479	20326	21190	23240	23597

A. Mission Description and Budget Item Justification: This project matures and demonstrates combat vehicle survivability technologies essential for FCS and the Future Force as well as providing a potential upgrade path for 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. Initial AP efforts demonstrate technologies needed for a system that is effective against Chemical Energy (CE) anti-tank guided missiles (ATGMs), rocket propelled grenades (RPGs) and tank fired high explosive anti-tank (HEAT) munitions. The goal of the AP against CE effort is to demonstrate hard kill, physical interruption with a countermeasure (CM) warhead and soft kill, EW spoofers and jammers while the vehicle is on-the-move (OTM). Defeat of Kinetic Energy (KE) threats offers a substantial challenge due to size and speed of the threat. The goal of the AP against KE effort is to defeat KE with a multi-purpose hard kill CM warhead. The project uses component technologies from PEs 0602601A, 0602120A, 0602618A and 0602624A. 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, smart and ceramic armors integrated with advanced composite and laminate structures. Lightweight, integrated armor technologies, including components from PE 0602601A, 0602618A and 0602105A, will be demonstrated by ballistic testing of quarter vehicle sections to validate performance versus weight as required for frontal and side armor protection. The signature management effort will improve existing multi-spectral signature modeling tools, characterize hardware performance, and provide inputs to FCS virtual prototyping. The technical goal is to achieve an 80% signature reduction in a validated virtual combat vehicle concept. Multi-spectral combat vehicle signature models will be validated using hardware samples with measured signature characteristics and will be used to assess FCS platform designs 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 TARDEC, Warren, MI.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Active Protection against CE - In FY03, designed and implemented threat tracking radio detection and ranging (RADAR) and countermeasure launcher stabilization algorithms required for OTM operation of a limited capability AP system; conducted approximately 80 field demonstrations to support the FCS Milestone B decision; demonstrated live threat AP hard kill of ATGM, RPG and tank fired HEAT live threat defeat(s) from a moving test vehicle; completed live threat EW soft kill of ATGMs from a moving vehicle; designed a more capable countermeasure warhead and cueing sensor RADAR for hemispherical threat detection. In FY04, demonstrate the full capability hemispherical CE AP system against advanced tank fired HEAT threats, ATGMs, RPGs and Faller/Flyers; design and integrate EW countermeasures into a multi-function jam head; design and demonstrate explosive countermeasure; develop tracking RADAR and countermeasure launcher components for improved performance; conduct testing with the system integrated on a moving test vehicle in an operational environment; mature stabilization algorithms for objective vehicle speeds. In FY05, will mature OTM algorithms for EW; field test Multi-Function EW Countermeasure; field test OTM full hemispherical, integrated AP/EW system.	31471	8437	7324
Active Protection against KE - In FY03, tested and validated multiple explosive formed pentrator (MEFP) countermeasure warhead and tested blast concept countermeasure warhead against KE, CE and ATGM flying threats; designed and tested warhead fusing technologies for blast warhead; designed fuse for MEFP warhead; improved model fidelity to represent MEFP and blast warheads. In FY04, downselect KE AP subsystem to be demonstrated for the Integrated Survivability ATD and FCS; conduct comprehensive tests of complete integrated countermeasure interceptor; upgrade AP tracking RADAR to incorporate KE capability. In FY05, will complete KE/CE AP system design, fabricate and integrate with tracking RADAR, interceptor and launcher onto a testbed; demonstrate effectiveness, accuracy and robustness of KE capable interceptor in static fly out field testing.	5500	13702	6307
Active Protection against close-in threats (Full Spectrum Active Protection Close In Layered Shield: FCLAS) – In FY04, install prototype system on a test platform, including integrated FCLAS round, launcher and smoke controller; and demonstrate performance on the move. In FY05, will demonstrate an improved FCLAS soldier-machine interface and demonstrate system modularity; modify existing sensor to increase effectiveness against RPG's, Dual Purpose Improved Conventional Munitions (DPICM); investigate FCLAS configurations for other possible applications including man portable surface to air missiles and smart mines.	0	8954	5635

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Signature Management In FY03, delivered proof of principle virtual prototyping signature field test capability to FCS Lead System Integrator; performed breadboard testing to quantify field performance and commenced FCS signature modeling predictions. In FY04, develop enhanced modeling capability including exhaust plume signature effects and integration with synthetic imagery; optimize field performance of hardware for FY05 model validation tests. In FY05, will perform full-scale validation tests; develop and validate full capability signature management virtual models; provide robust signature modeling capability to Research Development and Engineering Command's Modeling Architecture for Technical and Research Experimentation (MATREX) (formerly Joint Virtual Battlespace).	3595	4954	5079
Ballistic Protection for FCS - In FY04, complete electro-magnetic (EM) armor component maturation, build vehicle quarter section ballistic targets and range test these fully integrated 3rd generation armor/structure designs against FCS objective threats; demonstrate armor/structural capability at FCS weights and determine armor/structural reliability. In FY05, will conduct ballistic range tests to optimize and validate the best achievable integrated armor packages for lightweight test platforms; complete integration of armor appliqué solutions for FCS objective threats.	0	7975	3134
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1133	0
Totals	40566	45155	27479

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**440**

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
440 ADV CBT VEHICLE TECH	22226	1976	16326	0	48157	60277	56244

A. Mission Description and Budget Item Justification: This project demonstrates the operational potential, technical feasibility and maturity of advanced combat and tactical vehicle technologies through integrated demonstrations of subsystems, systems, and systems of systems. Computer simulations and hardware demonstrations (subscale and full scale) are conducted to accomplish a rapid and seamless transition of advanced technologies into systems applications. In FY 2002, funds from this project were transferred to PE 0603005, project 53G for FY 2004 – FY 2006, to fund the DAPRA/Army FCS Partnership – accounting for the lack of continuity in the funding stream. In FY 2003, funds were transferred into this project to support the Future Tactical Truck System (FTTS) Advanced Concept Technology Demonstration (ACTD) in FY 2005. The FTTS ACTD will build tactical maneuver sustainment and utility vehicle demonstrators and evaluate them in a User field environment. The demonstrators will evaluate future tactical vehicle technologies which may include high power density engines, hybrid electric propulsion, electric traction motors, advanced power distribution & control, advanced battery electrical storage, independent & variable height suspension, semi-active/selectable damping suspension, advanced digital driver displays & controls, in addition to looking at virtual vehicle structure & cab designs for survivability and mine protection. New methods and techniques for material handling will also be considered. The demonstrations will be supported by virtual prototyping through the use of 3D CAD models and analysis. These technologies and components will be assessed for applicability to the current fleet of tactical vehicle 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 TARDEC, Warren, MI.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Future Tactical Truck System (FTTS) ACTD – In FY05, will build multiple maneuver sustainment and utility vehicle demonstrators/prototypes; test vehicles in a User field environment to evaluate performance and military utility; perform Cost as an Independent Variable Analysis; perform virtual prototyping through the use of 3D models and analysis. This effort uses technology matured in PE 0602601 Project AH77.	0	0	16326
Water Recovery from Vehicle Exhaust for FCS - In FY03, conducted maturation and demonstration of a system to recover water from vehicle exhaust gases using technology being matured in PE 0602601 Project AH91.	2617	0	0
Future Scout and Cavalry System (FSCS) Vehicle Demonstration – In FY03, this one-year Congressional Add continued risk reduction and subsystem maturation activities on sensor packages and associated algorithms to improve sensor capability on a manned, ground reconnaissance system developed under the FSCS Advanced Technology Demonstration (ATD) program which completed in FY02. No additional funds are required to complete this project.	8299	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Digital Human & Virtual Reality for FCS – In FY03, this one-year Congressional Add matured digital human modeling/simulation tools and applications that currently do not exist and are needed to analyze & evaluate the human interface for digital models of vehicle systems. No additional funds are required to complete this project.	3550	0	0
Composite Body Parts CAV Technology Transition – In FY03, this one-year Congressional Add implemented manufacturing trials to variations of HMMWV doors, 5 ton truck hood, HMMWV hood front corners, and 2 1/2 and 5 ton truck doors and conducted 12-month field evaluations. No additional funds are required to complete this project.	2220	0	0
Turbo Fuel Cell Engine – In FY03, this one-year Congressional Add matured materials, manufacturing processes, and tube interconnections for solid oxide fuel cell tubes, which are the core of a turbo-charged fuel cell vehicle engine. No additional funds are required to complete this project.	947	0	0
Future Force Cost Module – In FY03, this one-year Congressional Add matured a collaborative information and budget software tool for application to the management of programs being matured for the Future Force. No additional funds are required to complete this project.	3646	0	0
Advanced Thermal Management System – In FY03, this one-year Congressional Add matured advanced pumping technologies for parasitic reduction combined with advanced cooling technology for thermal control. No additional funds are required to complete this project.	947	0	0
Composite Army Vehicle (CAV) – The purpose of this one-year Congressional Add is to transition composite material and manufacturing processes developed for the Composite Armored Vehicle (CAV) to the tactical wheeled vehicle fleet, as well as develop these same materials and processes for use in FCS. No additional funds are required to complete this project.	0	1919	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	57	0
Totals	22226	1976	16326

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
441	COMBAT VEHICLE MOBILTY	35758	35495	31283	54707	57495	75644	79760

A. Mission Description and Budget Item Justification: This project develops and tests advanced mobility and electric component technologies for next generation combat vehicles and will demonstrate increased vehicle performance and capability. It enables light, agile, deployable, fuel efficient and survivable ground combat vehicles needed for FCS and the Future Force. The main efforts funded by this project are Hybrid Electric Vehicle (HEV) FCS Propulsion Technologies, FCS Engine, Advanced HEV Technologies, Fuel Cells, and Pulse Power. HEV 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/silicon carbide electronics. Demonstrations of these items will be conducted in the Power and Energy Hardware in the Loop Systems Integration Laboratory (P&EHIL-SIL) that simulates combat vehicle power and performance characteristics. HEV offers improved automotive performance, significant reduction in fuel consumption (20-50% savings over today's combat vehicles), silent watch and silent mobility, and vehicle design flexibility. The P&EHIL-SIL will demonstrate electrical power and energy sources, significantly enhanced control methodologies and electrical architectures (enabled by high-speed switching) to provide on-board power management. These efforts support the DoD Power and Energy Initiative. The goal of the FCS Engine effort is to mature and demonstrate prime power (engines) for hybrid combat vehicles with a goal to double the power density (horsepower per cubic foot (hp/cu.ft.)) of a comparable, state-of-the-art, militarized commercial engine. The Army matures high power density engines because commercial engines lack robustness and power density required for Army vehicles. The goal of the effort is to demonstrate a prototype engine system with power density of no less than 6 hp/cu.ft. in FY05 for FCS Increment 1and an 8 to 10 hp/cu-ft power density propulsion systems for integration into FCS Increment 2. A fuel cell initiative is being pursued to accelerate the maturation and application to military vehicle power generation as an alternative to the reciprocating engine for prime power after 2010. The Advanced HEV Technologies will seek further increases in vehicle mobility, efficiency and mission capability without increasing vehicle weight and volume. This effort will apply advanced technologies (traction wheel motors, active suspension, high temperature electronic components, regenerative brakes, thermal management, lightweight track and band track) to next generation vehicles and identify changes in vehicle performance. (Army efforts in hybrid electric drive leverage two prior joint Army/DARPA programs, Combat Hybrid Propulsion System (CHPS) and the Electric Drive Vehicle Demonstration Program, and component technologies from PE 0602601A and PE 0602618A.) The objective of the Pulse Power effort is to mature pulse power component technology options and demonstrate compact pulse power components that enable revolutionary survivability and lethality applications. The goal is to accelerate maturation of high power density, capacitor-based PFNs for electro-magnetic (EM) armor and weapons for FCS Increment 2 and beyond. 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 TARDEC, Warren, MI in conjunction with Army Research Laboratory (ARL), Adelphi, MD.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
HEV FCS Propulsion –. In FY03 accelerated maturation and demonstration of hybrid electric/hybrid technologies to support FCS Increment I; downsized components to fit the FCS-class manned ground combat vehicles (<20 tons) using a volume goal of 80 cubic feet for the power pack; configured PEHIL-SIL (previously the CHPS SIL) for FCS component testing; demonstrated power levels, control techniques and unique hybrid electric power architectures at the 600 volt level; tested traction motors; matured electric suspension to increase speed over cross country terrain by 70%; documented findings/results and transitioned mature components and subsystems to FCS Lead System Integrator. In FY04, implement strategy for upgrading hybrid electric, band track, and suspension technologies for potential FCS insertion; advance power densities of compact FCS components to objective (goal) power levels (200 kW per cu.m). In FY05, will evaluate advanced hybrid electric components in an integrated environment (SIL) and an integrated moving test rig along with band track and advanced suspension system for ruggedness and performance. Emphasis will be on demonstrating significantly increased hybrid electric system power density in the SIL; advance modeling and simulation capability to include real time power and energy System of Systems vehicle analyses.	13834	8838	8875
FCS Engine - In FY03, demonstrated the power density potential of the three competing engines through preliminary hardware testing in the laboratory. In FY04, downselect to one engine that will undergo performance improvement, mechanical durability testing and 50 hour NATO durability demonstration; optimize engine for hybrid electric application and reconfigure the design for FCS vehicle application. In FY05, will conduct 400 hours of laboratory NATO durability demonstration.	14673	9961	10884

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Advanced HEV Technologies - In FY04, demonstrate improved electric traction motor with reduced weight and volume characteristics; mature hi temperature all-Silicon Carbide (SiC) motor inverter for 10 kW level for improved power density; test improved Li-Ion batteries at 600 volts for improved efficiency and reduced volume; mature and demonstrate Si/SiC 50 kW DC-DC converter for higher frequency and reduced volume; mature all SiC 10 kW DC-DC converter and scale to 50 kW; and adapt lab capabilities to emulate full electric hybrid system for FCS Sprials or Increment 2. In FY05, will demonstrate 10-50 kW high temperature all-SiC motor inverter; advance Li ion battery technology; demonstrate improved traction motor and active electric suspension for FCS Spirals or Increment 2; continue to advance the performance and maturity of component technologies to allow integration and characterization at the subsystem and system level; perform optimization and validation in collaboration with the HEV FCS Propulsion efforts; provide upgrades to power and energy modeling and simulation efforts.	0	9231	6100
Pulse Power - In FY04, mature and demonstrate high energy density capacitors, high power density/high temp Silicon/Silicon Carbide pulse chargers; and high action, fast rise-time output switches. In FY05, will incorporate components into high-energy density, dual mode PFN for EM Armor and evaluate the PFN in the P&E HIL SIL; fabricate and demonstrate modular, high-action solid state output switches in P&E HWIL SIL. This is a collaborative TARDEC/ARL effort.	0	4867	3789
Fuel Cell Power Initiative: In FY04, conduct laboratory assessment of fuel cell technology state-of-the-art to quantify capabilities and limitations for combat vehicle prime power source consideration; award study contracts for the most power-dense conventional internal combustion and fuel cell prime power packages. In FY05, will complete prime power studies and select two conventional and two fuel cell approaches for advanced development; initiate design development for laboratory hardware integration, performance demonstration, and durability maturation to achieve future combat vehicle propulsion system power density requirements.	0	1619	1635
Hybrid Electric Vehicles – This one year Congressional add built light (hybrid electric HMMWV) and medium (hybrid electric FMTV) HEV demonstration platforms for field evaluation by the warfighter to determine the impact the advanced technologies will have on the warfighters' ability to reduce the logistics footprint while meeting mission requirements. No additional funds are required to complete this project.	4911	0	0
Tracked Hybrid Electric Vehicle – This one year Congressional add demonstrated the system integration and synergistic effects of Command & Control electronics integrated into a hybrid electric vehicle having on-board power generation and storage with a battery management system. No additional funds are required to complete this project.	936	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Hybrid Electric Drive: This one year Congressional add supported a systems engineering study that assessed hybrid electric drive systems on military and commercial trucks that identified the technologies and configurations within the design space that will support both a military and commercial requirement. No additional funds are required to complete this project.	1404	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	979	0
Totals	35758	35495	31283

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
497	COMBAT VEHICLE ELECTRO	4403	6661	5831	9868	9618	13108	13407

A. Mission Description and Budget Item Justification: This project matures and demonstrates intra-vehicle electronics hardware and software, producing a multifunctional crew station that will result in increased crew efficiencies/performance and/or reduced crew size for potential upgraded capabilities of current force and FCS vehicles. In addition, the project advances open system architectures for ground combat vehicles that will allow the vehicle crew station to be adapted for a variety of FCS and Future Force ground platforms. The primary effort is the Crew Integration and Automation Testbed (CAT) Advanced Technology Demonstration (ATD), which focuses on automation of crew functions and integration of advanced electronic architecture compatible with automotive and system platform requirements. Products include simplified/user friendly, responsive controls for unmanned ground and air systems, and up to 30% reduction in software and modified commercial power architecture. Vehicle demonstrations to evaluate configurations of multi-role crew stations that will 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 are scheduled in FY03 and FY06. Goals include a 30% reduction in software cost, a ten-fold increase in architecture throughput, and full mission rehearsal via embedded simulation that will be relevant to FCS. In FY05-FY09, efforts will focus on increased capabilities for potential FCS spiral or increment insertion. These efforts will include increased levels of autonomy for both manned and unmanned systems, an advanced user interface supporting improved and 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. In addition to the CAT ATD, the Human-Robot Interaction (HRI) effort will mature a common user interface that maximizes multi-functional soldier performance of primary mission tasks by minimizing required interactions and workload in the control of ground and air unmanned systems and minimizes unique training requirements. It will mature advanced models, metrics, and design guidelines for optimal mounted and dismounted soldier-robotic 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 optimize 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 common interface will increase situational awareness and understanding and provide FCS mounted and dismounted troops control for all unmanned assets. The Advanced Mobile integrated Power System (AMPS) will mature commercial and military power technologies in the area of power generation, energy storage devices, and smart power switching components to develop smart architecture/components to allow management of dynamic power allocation and graceful degradation of loads.. The AMPS open architecture will allow integration and use of emerging commercially developed automotive systems and sub-systems (e.g. 42VDC, 120 VAC, etc.). This effort will integrate and demonstrate diagnostic health monitoring for energy storage, smart battery management, starter-alternator combinations, fuel cells, power control modules, and reusable switching software. 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 TARDEC, Warren, MI in conjunction with Army Research Laboratory - Human Resources Engineering Directorate

(ARL-HRED), Aberdeen, MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Crew Integration and Automation Testbed (CAT) ATD: In FY03, conducted both virtual and live unmanned combat experiments using an advanced crew station configuration; demonstrated two-crew operation of armor and scout crew tasks; demonstrated 1to 1 control of unmanned ground assets; demonstrated on- and off-road indirect vision driving capability; matured an in-vehicle crew training and mission rehearsal system. In FY04; define cognitive decision aids; continue integration and field testing of advanced crew station configurations; refine component technologies for an electronics architecture and embedded simulation system; add system automation features to the commander's aid, such as the ability to infer operator's intent; integrate UAV control and route planning aids into the Soldier-Machine Interface (SMI); augment combat vehicle driver's aid to use pedestrian and/or dismounted soldier camera vision identification for improved safety and workload reduction; perform trade studies that include technology assessment to support a distributed digital indirect vision system for closed hatch combat vehicle driving operations; integrate the Embedded Combined Arms Team Training – Mission Rehearsal intelligent agent/real time tutoring system for combat operations and training into the CAT ATD Embedded Simulation System (ESS) for experimentation in a militarily relevant environment; extend the ESS to support mission rehearsal capabilities for dismounted soldiers; In FY05, will participate in command and control robotic experiments at Ft. Dix, NJ between 4Q FY04 and 1Q FY05; continue to investigate technology to mix live and virtual imagery, enabling on-the-move embedded simulation and mission rehearsal; implement and test ground vehicle autopilot capability using an upgraded Autonomous Mobility Sensor (AMS) suite; mature a distributed workload management system across manned/unmanned assets that support the FCS network centric concept by integrating FC-Net weapon/target	4403	5487	3963
Technology for Human-Robot Interactions (HRI) in Soldier-Robot Teaming: This is a joint effort between TARDEC and ARL-HRED. In FY05, will leverage ARL-HRED FY04 task identification/analysis and cognitive modeling to implement baseline intelligent agent software that reduces and automates the soldier workload to control ground and air unmanned assets; develop a baseline scalable interface that reduces mounted and dismounted soldier training burden.	0	0	1368
Advanced Mobile Integrated Power System (AMPS): In FY04, investigate and develop advanced smart 42V power alternator, smart energy storage devices, and smart power architecture; demonstrate power architecture concept using modeling & simulation. In FY05, will adapt and develop advanced power distribution, power modules, and smart switching technologies; demonstrate AMPS in a System Integration Laboratory; update AMPS modeling & simulation.	0	500	500

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Enhanced Combined Arms Team Training: - In FY04, with RDECOM STC, develop the vehicle requirements, architecture specification, and vehicle Soldier-Machine Interface. Integrate these efforts into the Crew Integration and Automation Test bed for testing.	0	500	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	174	0
Totals	4403	6661	5831

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**515**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
515	ROBOTIC GROUND SYSTEMS	8309	7337	12056	22334	23305	9942	11024

A. Mission Description and Budget Item Justification: This project matures and demonstrates unmanned ground vehicle technologies for the FCS and other Future Force ground systems. The main focus is on demonstrating sensor technologies/perception hardware, software and robotic control technologies that are required to enable unmanned ground vehicle (UGV) systems to maneuver with minimal human intervention, on-and off-road, at militarily significant speeds. Mature technologies are incorporated in UGV technology demonstrators, whose performance can be evaluated for multiple tactical and logistics applications. Technical challenges addressed include: obstacle avoidance, perception limitations, intelligent situational behaviors, command and control, frequency of human intervention, and adverse weather operation. In the near term, the Robotic Follower ATD focuses on UGVs that follow other vehicles directly or follow a designated path, requiring little human intervention. The Demo III experimental UGV (XUV) and a converted Stryker Infantry Carrier variant (robotic Stryker) serve as test vehicles. The goals for the ATD are: 5-200km separations between leader and follower, 160-750km range, obstacle detection for objects 0.3 x 1sq.m. in size, and minimum operator intervention (1 per km @20km/hr). This ATD is a cooperative effort between TARDEC and the Army Research Laboratory (ARL), using component technologies matured in PE 0602618A. In the near term, this ATD provides critical information on design and performance of robotic technologies and demonstrations of Follower UGVs for FCS Increment I. Potential applications include re-supply vehicles and Soldier "mules" that may be used to reduce each Soldier's carried load by 40-50 pounds. In the farther term, the project will advance UGV technologies to enable semi-autonomous and autonomous operation and to expand the missions to which UGVs contribute in FCS Increment 2 and beyond. The Armed Robotic Vehicle (ARV) Robotic Technologies (ART) effort will mature a set of automated tactical behaviors that are consistent with the unmanned platform missions in the FCS Unit of Action. These behavior algorithms will be integrated with sensor hardware, components that enable advanced mobility and UGV survivability and appropriate mission modules onto surrogate ARV demonstrator(s) to support FCS enhancement (via spiral insertion and/or for Increment 2.) Potential missions/functions include perimeter security, medical supply and evacuation, scout/reconnaissance and remote weapons delivery. This project was established by the Army in recognition of the increasing maturity of robotics technology, growing user interest in unmanned platforms, and an urgent need to make the force lighter, more agile strategically and tactically and more survivable. The approach builds upon previous and ongoing investments such as the Demo III program, conducted under the Joint Robotics Program Office, and the DARPA UGCV 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 Technology Area Plan (DTAP). Work in this project is performed by TARDEC, Warren, MI, in conjunction with the Army Research Laboratory, Adelphi, MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Robotic Follower Increment 1: In FY03, successfully demonstrated robust leader follower capability both on and off roads and participated in the Lead Systems Integrator's Unmanned Combat Demo; obtained speeds of 65km/hr on primary roads and cross-country following speed of 20km/hr; completed software build of geometric planning and road following; conducted warfighter experiments, testing and demonstrations (at Fort Bliss, TX Feb-March 2003) of on-road, high speed, line of sight follower; completed cross country, low speed follower for the dismounted soldier using XUV. In FY04, mature sensor data/map registration and trail detection technologies to obtain following speeds of 40km/hr cross-county; integrate enhanced autonomous mobility algorithms and next generation perception sensor from ARL Semi-autonomous Robotics for FCS effort; mature robotic virtual construction and test environment to enable hardware in the loop modeling and simulation.; conduct engineering evaluations and soldier operational testing of follower capability in logistic and tactical mission scenarios. In FY05, will mature/incorporate intelligent situational behavior to significantly increase separation times and distances and assist in prevention of communication loss or mobility kill; mature/integrate vehicle tracking capability to enable operation within traffic; mature pedestrian detection capability to enable safe operation amongst pedestrian traffic; conduct engineering evaluations and soldier operational testing of follower capability in logistic and tactical mission scenarios; participate in command and control robotic experiments at Ft. Dix; conduct urban operations experiment at Fort Knox MOUT facility in 4Q.	8309	7123	6883
Armed Robotic Vehicle Technologies - In FY05, will create a tactical behavior suite that allows the unmanned system to act decisively while maneuvering around the battlefield (i.e. reacting to indirect fire with appropriate tactical maneuver); ensure that the unmanned systems have comparable maneuverability to the manned (mounted and dismounted) systems that will be operating them; demonstrate tactical behavior suite and maneuverability in a simulated setting prior to the technology being integrated into the surrogate ARV demonstrators.	0	0	5173
Small Business Innovative Research/Small Business Technology Transfer Programs	0	214	0
Totals	8309	7337	12056

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**53G**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
53G	FUTURE COMBAT SYSTEMS (FCS)	162000	112659	109360	48188	0	0	0

A. Mission Description and Budget Item Justification: This project funds the Army's share of the Army/Defense Advanced Research Projects Agency (DARPA) collaborative FCS technology development program. From Feb 2000 through Sep 2003, the FCS program was executed through an Army/DARPA Memorandum of Agreement (MOA), with DARPA having the lead in the Concept and Technology Development (CTD) Phase. This project provided the Army's share of funds for the FCS Lead System Integrator and for several DARPA enabling technology efforts. Due to acceleration of the program from the original schedule, funding was added to FY03 over the original MOA amount. The Under Secretary of Defense (AT & L) approved the Army's request for FCS to enter into System Development and Demonstration (SDD) phase through a MS B decision in May 2003. This decision approved the Army's evolutionary acquisition strategy for FCS to improve capabilities over time through increments and spirals. The Army/DARPA collaboration will continue through 2006 to help ensure advanced technology improvements continue to push FCS toward objective capabilities. The technologies developed under this project will be inserted into the FCS acquisition program through a spiral development process. Funds in this project are provided to DARPA for selected collaborative projects focused on enabling technologies for FCS, and are executed by DARPA in accordance with project-specific Memoranda of Agreement. In FY05 a portion of the funds in this project will be used for technology development needed to transition deferred systems into FCS. The FY04 and FY05 funds will support technologies in three major thrust areas – 1) Find The Enemy, 2) Autonomy with Intent and 3) Affordable Combat ID. 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.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
FCS Design/Demonstration (CTD Phase): In FY03, funded Army's share of FCS Lead Systems Integrator efforts: finalized detailed design for threshold FCS; planned and conducted key tests and capstone demonstrations of the Network and other critical elements to support MS B decision; validated M&S tools created specifically for FCS and used these to support the May 2003 MS B decision; and supported successful transition of FCS into SDD.	90000	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Enabling Technologies (CTD Phase): In FY03, provided funds to DARPA for Army's share of technology maturation of programs listed below. More specific information on the DARPA programs and their accomplishments/plans can be found in the DARPA exhibits. NetFires: Designed, built and demonstrated missiles launched out of a container to provide non-line-of-sight lethality for FCS. In FY03, transitioned program management to Army. Maneuver Command, Control, and Communications: Evaluated novel cooperative engagement, cooperative survivability and command and control strategies to help TRADOC determine FCS-based tactics, techniques and procedures. BLOS Surveillance and Targeting Systems- JigSaw: Designed, built and demonstrated a Laser Detection and Ranging (LADAR) system that will allow warfighters to "see" through dense vegetation and under a jungle canopy. In FY03, evaluated LADAR system in limited field-testing. Perceptor: Matured and demonstrated sensors and perception algorithms for autonomous navigation of unmanned ground vehicles (UGVs). In FY03, upgraded perception prototypes and examined performance in degraded conditions. Unmanned Ground Vehicle: Designed, built and demonstrated 600 kilogram and 6000 kilogram UGVs to perform a variety of functions in the FCS-equipped force. In FY03, evaluated UGVs in limited field test. A-160 Hummingbird - In FY03, conducted initial functional and environmental ground-tests. Performed 11 flight tests totaling 4.7 flight hours, at airspeeds up to 112 knots and altitudes up to 4,000 feet. MAV/OAV - In FY03, fabricated and conducted tethered test flight with 9-inch MAV. Conducted test flights with autonomous waypoint navigation with 29-inch OAV.	72000	0	0
Enabling Technologies for Spiral Development: In FY04 and FY05; Conduct enabling technology efforts focused on three critical areas: 1) Find the Enemy, 2) Autonomy with Intent, and 3) Affordable Combat Identification. Find the Enemy will provide capabilities to better defeat camouflage, concealment, and deception and exploit situational awareness through improved sensors, assured communications, intelligent decision aids, and data fusion. Autonomy with Intent will focus on improving unmanned systems' (UAVs and UGVs) ability to function while minimizing soldier workload and interaction. Affordable Combat Identification will increase force survivability by improving identification of battlefield entities for high OPTEMPO in complex terrains and intermingled forces. Efforts included: Man-portable (Class I) UAV ACTD; Organic Air Vehicle (OAV) (Class II) UAV, Multi-cell Command and Control; Armed Recon UGV; and Mobile Networked Multiple-input, Multiple-output Communications.	0	109376	109360
Small Business Innovative Research/Small Business Technology Transfer Programs	0	3283	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Totals	162000	112659	109360

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technolo**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		8700	11339	9946	14352	14910	11152	6494
257	DIGITAL BATTLEFLD COMM	2721	1087	0	0	0	0	0
588	HIGH ALTITUDE AIRSHIP ACTD	0	2913	2898	0	0	0	0
592	SPACE APPLICATION TECH	5979	7339	7048	14352	14910	11152	6494

A. Mission Description and Budget Item Justification: The name of this program element (PE) was changed in FY03 to Space Applications Technology. This program matures and demonstrates advanced space technology applications for 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 Control ground-to-space surveillance, negation and battle management 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 program 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 program provides Space Control advanced technology risk reduction capability for ground-to-space surveillance and space object negation (disrupt, degrade, deny, and destroy) system development. Additionally, it matures airship structure, propulsion, flight control, and power generation technologies to carry heavy multi-mission payloads for airship long dwell time at 70,000 feet in High Altitude Airship ACTD. 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. Funding for non-space related efforts, including Command, Control, and Communications (C3), was realigned to PE 0603008A in FY03.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	6814	10379	13073
Current Budget (FY 2005 PB)	8700	11339	9946
Total Adjustments	1886	960	-3127
Congressional program reductions		-97	
Congressional rescissions			
Congressional increases		1100	
Reprogrammings	1886	-43	
SBIR/STTR Transfer			
Adjustments to Budget Years			-3127

Significant Change Explanation.
FY03 - Funds increased to support the High Altitude Airship ACTD and the Space Surveillance STO.
FY04 - Funds realigned ($3127K) to higher priority requirements.

FY04 Congressional Adds with no R-2A:
($1056) Dynamic Re-Addressing and Management for the Army (DRAMA), Project 257. The purpose of this one year Congressional Add is to fund research in dynamic re-addressing and management of communications. No additional funding is required to complete this project. This add will be executed through the Communications Electronics Research Development and Engineering Center (CERDEC) and aligned with PE 0602782A, Command, Control, and Communications Technology.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technolo**	**588**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
588	HIGH ALTITUDE AIRSHIP ACTD	0	2913	2898	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). This High Altitude Airship (HAA) ACTD will demonstrate capabilities to fly un-tethered at 70,000 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, Office of Home Land Security, and 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 2003	FY 2004	FY 2005
- In FY04, mature and integrate HAA ACTD airframe, power generation, propulsion flight control, and C2 subcomponent technologies, define payload interfaces, conduct subcomponent ground test, and complete airship flight qualification. In FY05, complete airship and payload integration; demonstrate airship/payload prototype for one month at 70,000 feet.	0	2828	2898
- Small Business Innovative Research/Small Business Technology Transfer Programs	0	85	0
Totals	0	2913	2898

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technolo**	**592**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
592	SPACE APPLICATION TECH	5979	7339	7048	14352	14910	11152	6494

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 Control ground-to-space surveillance, negation and battle management 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 Control advanced technology risk reduction capability for ground-to-space surveillance and space object negation (disrupt, degrade, deny and destroy) 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 2003	FY 2004	FY 2005
- In FY03, completed Long Wave Infrared/Acoustic Optical Tunable Filter performance assessment.	46	0	0
- In FY04, perform initial testing and algorithm assessment of the Distributed Imaging Radar Technology concept using existing synthetic aperture radar. In FY05, verify the algorithms; detect and locate moving targets using distributed radar and space-time coded aperture waveforms; and initiate miniaturization of high fidelity and stabilized radar receiver/exciter hardware for Upper Tier and space platform application.	0	3176	3589
- In FY05, assess All Weather Radio Frequency (RF) Launch Detection signatures for rockets, artillery, and mortars. Initiate characterization algorithm development and broadband high/low RF receiver design for real time processor applications.	0	0	2554
- In FY03, continued maturing formal Space Surveillance software coding of algorithms; completed initial software development and user interface design. Demonstrated threat assessment techniques on ground-to-space surveillance radar processor. In FY04, complete hardware/software integration, test, and demonstrate near real time threat assessment in a simulated operational environment; and transition technology to Army Space Support Team Tactical Set.	3172	2500	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- In FY04, conduct detailed Space Control technical assessments to reduce ground to space surveillance response times and to optimize performance levels for stability and active tracking of space objects. Develop and refine space surveillance algorithm compression techniques with multiple data to exploit real time events. Quantify stability and tracking performance parameters. In FY05, incorporate error models to enhance space survillance algorithm accuracy and prediction, and identify optimal technology base for dynamic stability and active tracking capabilities.	0	1466	905
- In FY03 initiated airship platform design and defined technical requirements for project 588 High Altitude Airship ACTD.	2761	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	197	0
Totals	5979	7339	7048

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603007A - Manpower, Personnel and Training Advanced Technolo**

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	7606	8921	7288	6981	7166	7190	7277
792	PERSONNEL PERFORMANCE & TRAINING	4366	4871	7288	6981	7166	7190	7277
79A	PERSONNEL & TRAINING ADV TECH INITIATIVES (CA)	3240	4050	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program is to mature and demonstrate advanced technologies to enhance performance to ensure that the "human component" of warfighting keeps pace with the transformations in systems, weapons, equipment, and requirements to meet the goals of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. A key goal of this program is the reduction of training and other personnel costs through the development of more effective training strategies that optimize the advantages of live, virtual, and constructive simulations. Advanced technology development efforts include designing new ways to efficiently develop collective training methods and materials; developing and demonstrating training methods and programs that improve mission performance; devising strategies to use distributed training technologies to conduct multi-site training, assessment, and feedback; and evaluating the effectiveness of compressed gunnery training strategies for the Reserve Component. This program also develops leader development tools that capitalize on the various synthetic environments, game technologies, and delivery media (web, Personal Digital Assistant (PDA), etc), that facilitate the advancement of leader knowledge, skills, and abilities (KSAs), and that can provide “experiences” to leaders earlier in their career development cycle. This program will develop self-development tools that do not currently exist that enable leaders to take full advantage of their schoolhouse experiences, that develop cognitive flexibility, and that accelerate the preparation of leaders for their next level of assignment; and will design innovative methods and technologies to improve leader decision-making, develop effective leaders for small team operations, and prepare Battle Commanders to operate within the evolving technological complexity envisioned for Future Force operations. This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). 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).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	7663	4931	7158
Current Budget (FY 2005 PB)	7606	8921	7288
Total Adjustments	-57	3990	130
Congressional program reductions		-77	
Congressional rescissions			
Congressional increases		4100	
Reprogrammings	-57	-33	
SBIR/STTR Transfer			
Adjustments to Budget Years			130

Significant Change Explanation.
FY04 - Two FY04 Congressional adds totaling $4100 were added to the PE.

FY04 Congressional Adds with no R-2As:
($959) Ground Systems Team Training, Project 79A: The objective of this one-year Congressional Add is to investigate Soldier involvement in ground system team tasks and to identify critical coordination tasks. No additional funding is required to complete this project.

($2973) Ground Systems Team Training Advanced Technology, Project 79A: The objective of this one-year Congressional Add is to develop prototype Ground Systems Team Training (GSTT) that will improve the coordination effectiveness of Army ground systems teams and unit leaders in mission planning and execution. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603007A - Manpower, Personnel and Training Advanced Technolo**	**792**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
792	PERSONNEL PERFORMANCE & TRAINING	4366	4871	7288	6981	7166	7190	7277

A. Mission Description and Budget Item Justification: The objective of this program is to mature and demonstrate advanced technologies to enhance performance to ensure that the "human component" of warfighting keeps pace with the transformations in systems, weapons, equipment, and requirements to meet the goals of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. A key goal of this program is the reduction of training and other personnel costs through the development of more effective training strategies that optimize the advantages of live, virtual, and constructive simulations. Advanced technology development efforts include designing new ways to efficiently develop collective training methods and materials; developing and demonstrating training methods and programs that improve mission performance; devising strategies to use distributed training technologies to conduct multi-site training, assessment, and feedback; and evaluating the effectiveness of compressed gunnery training strategies for the Reserve Component. This program also develops leader development tools that capitalize on the various synthetic environments, game technologies, and delivery media (web, Personal Digital Assistant (PDA), etc), that facilitate the advancement of leader knowledge, skills, and abilities (KSAs), and that can provide “experiences” to leaders earlier in their career development cycle. This program will develop self-development tools that do not currently exist that enable leaders to take full advantage of their schoolhouse experiences, that develop cognitive flexibility, and that accelerate the preparation of leaders for their next level of assignment; and will design innovative methods and technologies to improve leader decision-making, develop effective leaders for small team operations, and prepare Battle Commanders to operate within the evolving technological complexity envisioned for Future Force operations. This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). 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 2003	FY 2004	FY 2005
Training: In FY03, generated guidelines and techniques for enhanced use of Web-based methods for individual and small group instruction; evaluated existing training techniques and tools for training unit-of-action level forces using virtual simulation experiments; and investigated the amount of simulator training needed to reach proficiency for live-fire qualification on small arms. In FY04, determine the best combination of simulator and live-fire training to maximize small arms marksmanship proficiency; develop prototype training support packages and conduct trial implementations to expand/refine the Command, Control, Communications, and Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) training techniques and collective performance measurement approaches; and modify interactive distributed training environments based on the training needs of operators and staff in the Future Force. In FY05, will demonstrate exemplar intelligent tutoring systems for distributed training environments; and will demonstrate prototype tools to manage and adapt training for multiple unit requirements, delivery platforms, and systems.	1995	2441	2543
Leader Development and Personnel Performance: In FY03, generated and pre-tested scenarios and role plays designed to help leaders train and develop team members and assess team performance. In FY04, demonstrate mentoring programs or tools that help mid-level unit leaders train and assess leadership skills and adaptability in their subordinates; investigate tools and methods for leaders to use to improve unit climate and teamwork; demonstrate modules for teaching critical thinking skills supported by automated coaching and on-line diagnostic and feedback techniques for company grade leaders; and begin assessing potential benefits from personnel stabilization under Unit Manning. In FY05, will determine the most effective methods for leaders to use that will allow them to establish and maintain a positive unit climate and develop unit cohesion in times of personnel turbulence, stress, and changing operational requirements; will evaluate web-based modules for training leaders' critical thinking; will identify small group modifications to "Think Like a Commander" – Excellence in Leadership (TLAC-XL); and will demonstrate computer-based coaching for experiential development of interpersonal skills. ARI will be supported by Institute for Creative Technologies (ICT) and will leverage ICT's expertise in immersive simulation environments.	1017	2367	4745
Army Aircrew Coordination Training: The objective of this one-year Congressional Add was to complete the development of enhanced training and skill sustainment tools, both Web and simulation-based, for enhancing aircrew coordination training; and to incorporate aircrew coordination training program into distributed interactive simulation and simulation-based aviation training exercises. No additional funding was required to complete this project.	1354	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	63	0
Totals	4366	4871	7288

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603008A - Electronic Warfare Advanced Technology

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		28662	59170	41760	47260	49687	42494	44950
TR1	TAC C4 TECHNOLOGY INT	13883	12245	17840	22908	25174	15864	16208
TR2	DIGITAL BATTLEFLD COMM	14779	37443	23920	24352	24513	26630	28742
TR8	C3 DEMONSTRATIONS (CA)	0	9482	0	0	0	0	0

A. Mission Description and Budget Item Justification: The name of this program element (PE) was changed in FY03 to Command, Control, and Communications Advanced Technology. The goal of this PE is to provide a secure, mobile, wireless network that operates in diverse and complex terrain all the time, in all environments for the Army's Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. Technologies will be matured in this PE to address this challenge with distributed, mobile, secure, self-organizing communications networks. A key goal of the work is to demonstrate the capability to seamlessly integrate 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 annual Command, Control, Communications, and Computers Intelligence, Surveillance and Reconnaissance (C4ISR) On-The-Move (OTM) demonstrations to measure the battlefield effectiveness for Future Combat Systems (FCS) 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. Adaptive Joint C4ISR Node (AJCN) Advanced Concept Technology Demonstrations (ACTD) makes a significant contribution to this program by providing 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 force spread over wide areas.

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). It is related to, and fully coordinated with, efforts in PE 0602782A (Command, Control and Communications Technology), PE 0203740A (Maneuver Control Network), PE 0203726A (Advanced Field Artillery Tactical Data Network), PE 0602783A (Computer and Software Technology), PE 0602702E (Tactical Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and PE 0603789F (C3I Technology Development). Work is performed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	26931	40347	41982
Current Budget (FY 2005 PB)	28662	59170	41760
Total Adjustments	1731	18823	-222
Congressional program reductions		-554	
Congressional rescissions			
Congressional increases		19600	
Reprogrammings	1731	-223	
SBIR/STTR Transfer			
Adjustments to Budget Years			-222

Significant Change Explanation.
FY04 - Four FY04 Congressional adds totaling $19600 were added to the PE.

FY04 Congressional Adds with no R-2A:
($5369) Networking Environment for C3 Mobile Services (NECMS), Project TR8: The purpose of this one year Congressional add is to demonstrate a field communication system for mobility testing and the phased implementation of an automated Data Collection/Sensor architecture for rapid assessment of developing C4 systems. No additional funds are required to complete this project.

($2876) Portable Emergency Broadband Systems, Project TR8: The purpose of this one year Congressional add is to mature an in-building position location capability, and reduce the hardware size for increased portability. No additional funds are required to complete this project.

($960) Galaxy Vue Image, Video and Data Compression Technology, Project TR8: The purpose of this one year Congressional add is to demonstrate near/real time video compression technology to enable real-time high resolution, live feed of tactical data/video for dismounted Soldiers and Unmanned Aerial Vehicles. No additional funds are required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**	**TR1**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
TR1	TAC C4 TECHNOLOGY INT	13883	12245	17840	22908	25174	15864	16208

A. Mission Description and Budget Item Justification: This project matures key communications, mobile networking, and information assurance technologies for the Dismounted Soldier; Future Combat Networks, embedded network communications, and the Future Force. The project enables commanders and individual soldiers to survive and fight by providing secure, reliable, mobile communications network solutions that function in complex and diverse terrain. The Soldier/Squad-Level Communications program will leverage and mature the DARPA Small Unit Operations Situation Awareness System (SUO SAS) communications technology to provide a Joint Tactical Radio System (JTRS) Software Communications Architecture (SCA) compliant waveform. This effort addresses the size, weight and power issues for sensors, network munitions, and dismounted soldier communications. The Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC) program matures and demonstrates Quality of Service and resource allocation technologies for the network. The Multi-Dimensional Assured, Robust, Communications for an OTM (MARCON-I) Network effort matures and integrates directional networking technologies that address the barriers of insufficient bandwidth and limited spectrum to provide the warfighter with a robust, efficient, high capacity Anti-Jam Low Probability of Intercept (AJ/LPI) directional communications network. The On-The-Move (OTM) SATCOM and Advanced Antennas programs utilize protocols developed in the MOSAIC effort. OTM SATCOM enables mobile satellite communications through the application of blockage mitigation algorithms, thus enabling a robust reachback capability and a reduced in theatre footprint. Advanced Antennas matures a family of efficient and affordable antennas across a wide spectrum (30 MHz to 44 GHz) for increased throughput and range. This will include a robust and dynamic reachback capability to enable Global Information Grid (GIG) connectivity. The Tactical Wireless Network Assurance 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. The National Security Agency provides management of these critical security components that provide centralized remote control and visualization of network security health.

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- MOSAIC ATD: In FY03, enabled and participated in the FCS Lead System Integrator (LSI) field demo of scaleable mobile networks with enhanced Quality of Service (QoS) at the C4ISR testbed. Conducted laboratory demonstration of the integration of the bandwidth adapting protocols, voice over Internet Protocol (IP), IP QoS, mobile networking protocols and communications technologies. Enhanced and modified MOSAIC communications and mobile ad-hoc networking protocols to support self organized wireless 15-20 node cluster with QoS (specified by latency, delayed jitter, and bit error rate). Integrated and evaluated enhanced mobile networking protocols and end-to-end quality of service mechanisms in a laboratory/field environment. Demonstrated robust wireless network access controls with validation on three mobile nodes to mitigate wireless intrusions attacks close to 60% of the time. Conducted research to detect intrusions into mobile tactical networking environment. In FY04, demonstrate ad hoc mobility, reduced network initialization and recovery time, in a 20-25 node wireless OTM network with 56kbps-3 Mbps. Perform integration of all MOSAIC networking and QoS technologies. Model and demonstrate the integrated network with an airborne node, space based assets, and terrestrial networks.	8000	6969	0
- Soldier/Squad-Level Communications: In FY04, mature lightweight Joint Tactical Radio System (JTRS) Core Framework to support Soldier Radio Waveform insertion into JTRS Cluster 1 and 5 configurations based upon DARPA Small Unit Operations Situation Awareness System (SUO SAS) technology. Perform laboratory test and functional design verification. Produce network-on-chip design of a dual channel modem. In FY05, will perform initial validation of Software Communications Architecture compliance of Soldier Radio Waveform and integrate into software programmable radio prototype. Will mature a re-programmable Application Specific Integrated Circuit (ASIC) (Network-on-a-Chip) implementation for modem and networking processor components and integrate in laboratory brassboard environment to demonstrate size, weight, and power consumption reduction for Objective Force Warrior communications.	0	1500	8550
- OTM SATCOM: In FY03, matured and demonstrated Wideband OTM blockage mitigation protocol for rapid recovery from signal blockage due to buildings, foliage, etc. Completed field-testing of Milstar OTM narrowband blockage mitigation protocol in a variety of field environments. Used Milstar OTM terminal to characterize representative field environments and to validate assumptions used in protocol design and modeling and simulation. In FY04, integrate Wideband OTM capability into the FY04 MOSAIC ATD and C4ISR Testbed demonstrations, integrate blockage mitigation algorithms and demonstrate them on CERDEC/SPAWAR Ka-band OTM Terminal. Mature Milstar OTM blockage mitigation approach for networks of MILSTAR terminals.	2849	1968	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Advanced Antennas: In FY03, matured technologies that reduced the number of antennas and the visual signature for a ground vehicular Joint Tactical Radio System (JTRS) Network Multiband OTM antenna covering the 30 to 2500 MHz frequency band. In FY04, demonstrate reduction in interference caused by collocation of equipment on the same vehicle (also known as cosite) for reconfigurable VHF antenna and reduce three beam phased array receive antenna signature. In FY05, will perform technical evaluation and integration for: (1) Multibeam Phased Array antenna technologies, maintain simultaneous multibeam OTM links over rolling terrain; (2) multiband antennas for rotary wing platforms, reduce range degradation due to cosite interference and platform interactions; (3) body borne helmet and vest antennas (at a 1 to 5 Km range) and perform RF assessment to ensure integration of environmental/ radiation safety; (4) Multiband reconfigurable band switched antenna technologies, tuned IAW JTRS interface operating between 30-450 MHz with reduction in cosite interference; (5) Low Profile antennas on ground and rotary wing platforms with reduced visual signature at 300 ft.	870	1000	3000
- Tactical Wireless Network Assurance (TWNA): In FY03, developed network assurance mechanisms to deter intruders and recognize attempts to attack/exploit mobile wireless systems and networks. In FY05, will mature and test advanced network assurance via Tactical Public Key Infrastructure (PKI, a secure protocol) on dynamic wireless ad hoc networks. Will expand wireless intrusion detection to detect cyber attacks against distributed mobile hosts and networks that exploit mobile wireless protocols more than 60% of the time. Will mature and test database access control and authentication of mobile data elements that restrict unauthorized modification to mobile code. Will mature and perform laboratory testing of adaptive security alert correlation, visualization and response to tactical wireless network security events in near-real time. Other work related to this project is performed under PE 63606 project 608 and PE 63270 project K16.	2164	0	2795
- Multi-Dimensional Assured, Robust, Comms for OTM Network (MARCON-I): In FY04, begin architecture design trades and technology analysis for directional networking. Leverage DARPA FCS-Communications program for directional networking technologies and extend these technologies to work as a JTRS Software Communications Architecture compliant waveform. In FY05, will begin system design and waveform development of a directional networking capability. Will conduct Modeling & Simulation (M&S) to support directional networking waveform development. Will conduct evaluation of QoS policy management technologies.	0	500	3495
Small Business Innovative Research/Small Business Technology Transfer Programs	0	308	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Totals	13883	12245	17840

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**	**TR2**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
TR2	DIGITAL BATTLEFLD COMM	14779	37443	23920	24352	24513	26630	28742

A. Mission Description and Budget Item Justification: This project matures and demonstrates an integrated C4ISR On-The-Move (OTM) (sensor to shooter) capability for Future Combat Systems (FCS), 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 FCS 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. Three key programs support the second goal: 1) Adaptive Joint C4ISR Node (AJCN) ACTD for mobile airborne communication nodes; 2) Network Sensors for the Future Force (NSFF) Communications solution, enabling adaptable, self healing, low power, integrated communication nodes for unmanned sensor networks and 3) Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC), providing mobile protocols and seamless handoff (quality of service addressed in TR-1) capabilities to ensure the right information at the right time at the right place. The C4ISR OTM test bed provides a venue for the early demonstration of emerging C4ISR technologies that will increase the survivability and lethality of FCS platforms. The demonstrations will expand both the functionality and complexity of the integrated C4ISR system-of-systems, including the participation of Joint, Current, and dismounted elements and provides an evolutionary view of integrated C4ISR functionality and its impact on Battlefield Effects. AJCN ACTD seeks to provide assured communications for UoA. It provides 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 force spread over wide areas. AJCN also has the capability to perform signals intelligence, information warfare and electronic attack missions simultaneously. AJCN matures technology under the DARPA Adaptive C4ISR Node program and leverages Joint Service funds from OSD, DARPA and the Air Force. AJCN started in FY03 with Army contributions commencing in FY04. The AJCN will host communications waveforms (JTRS compliant) for extended range voice and data and enable interoperation between different types of radio platforms. It also enables data to be relayed between deployed manned/unmanned sensors and decision makers. The NSFF Communications improves survivability by networking unattended sensors for real time local situation awareness and targeting. Several efforts enable efficient routing and low power ad-hoc communications for the sensor suite, including the DARPA Small Unit Operations (SUO) and Sensor Information Technology (SensIT) programs as well as technologies matured by the Army Research Laboratory (ARL). The MOSAIC ATD facilitates battle command mobility, by providing multiple wireless solutions and seamless handoff to different networks for user flexibility in varied terrain over wide areas with improved network robustness.

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 Communications-Electronics Research Development and Engineering Center (CERDEC), Fort Monmouth, NJ, and the Army Research Laboratory, Adelphi, MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- C4ISR On-The-Move Demonstration: In FY03, conducted a series of technology evaluations to demonstrate the ability to perform command and control (C2) for the Future Combat System (FCS) and the Future Force while on the move. Efforts included: live demonstrations of networked C4ISR, supported by the modeling and simulation (M&S) of sensors, networks, and C2 capabilities, in conjunction with the FCS Lead System Integrator (LSI) and TRADOC, to show battlefield effects (metal on target) enabled by integrated C4ISR. Supported the generation of the technical data necessary to support specification development for FCS. In FY04, conduct Joint technical demonstrations of integrated C4ISR technologies focusing on ISR fusion, a common operating picture, weapons-target pairing, combat identification, and rapid battle damage assessment. Collect and analyze performance data and use M&S to support field evaluations with TRADOC's Unit of Action (UofA) Battlelab. In FY05, will demonstrate emerging C4ISR architectures in a Joint and Coalition environment in conjunction with the LSI and UofA Battlelab. This will assist TRADOC in developing and refining tactics, techniques, and procedures (TTP's) for emerging C4ISR technologies. Will assess the impact of evolving software defined radios and waveforms on C4ISR FCS networks and assess overall network performance in conjunction with C2, ISR and battlefield effects networks.	7500	10803	12659

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- AJCN ATCD: In FY04, design and integrate a multifunction aerial payload capability (increase data throughput from 288 to 900 kbps with range extension form 20 to 30 km) that provides integrated communications relay, signals intelligence (SIGINT), electronic warfare and information operations capabilities. Perform modeling and simulation of payload performance to mitigate risk in technology maturation. Conduct interim Joint Military Utility Assessment. Integrate MOSAIC ATD networking communications capabilities so that range extension and continuous coverage between disparate units can be achieved. Host software defined radio (JTRS compatible) waveforms, demonstrating voice and data interoperation between different types of radio platforms (from 3 to 9 waveforms). Enable data to be relayed between deployed manned/unmanned sensors and the users of that data. Integrate capability into both Army (2 Hunter with payload of 200lbs or less) and Air Force (2 KC-135) platforms to demonstrate scalability of capability. In FY05, will conduct joint military utility assessment of technology. Will demonstrate increased bandwidth and frequency range operating at multiple independent levels of security. Will integrate Ku band transmitter into platform payload. Will incorporate additional software defined radio waveforms such as tactical common data link and HAVEQUICK. Will mature interference cancellation, co-site channel interference, and SIGINT capabilities. Will conduct technical assessment to verify metrics are met and participate in Joint Forces Command exercises to demonstrate the capability on the operational platforms in the field environment.	0	10000	7000
- MOSAIC ATD: In FY03, MOSAIC ATD integrated and demonstrated automated network management technologies to provide dynamic network control and to minimize manpower. Completed modeling and simulation for scalability of individual network protocols to larger networks. In FY04, demonstrate a 20-25 node ad hoc mobility and heterogeneous Quality of Service exit demonstration.	4379	4253	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Networked Sensors for the Future Force (NSFF) Communications: In FY03 NSFF Comms updated the communications architecture for unattended sensors. Conducted a 10-node demonstration using the Small Unit Operations Situation Awareness System radio prototypes with the NSFF Low Probability of Detection waveform. Conducted the SLICE NSFF System Requirements and Design Reviews. In FY04, demonstrate a 20 node (scalable to 100 node thru simulation) robust, self-healing, jam-resistant, Low Probability of Intercept/ Low Probability of Detection, energy-efficient (less than 500 milliwatt) network with networking protocols for internode unmanned ground sensor communications with a range of 200 meters and sensor to gateway connectivity to 3 kilometers. Mature low cost, JTRS software compliant architecture (SCA) compatible sensor communications breadboard models. In FY05, NSFF Comms will integrate and test a 50-node network with advanced sensors providing situational awareness to demonstrate communications range 200-400m and sensor connectivity of 3-10km.	700	1700	4261
- Countermine Test Bed: In FY03, conducted a series of technology evaluations to demonstrate sensor systems working cooperatively to locate mines and distribute the information with future Command and Control (C2) applications. Conducted initial data collection with three proposed aircraft/sensor systems (Organic Aerial Vehicle (OAV), Tactical Unmanned Aerial Vehicle electro-optic infrared sensor (TUAV-EO/IR), and mod UAV (small-unmanned helicopter). Designed software to allow the change detection work station (CDWS) to output imagery and messages.	2200	0	0
- Applied Communications & Information Networking (ACIN): The objective of this one year Congressional add is to mature and demonstrate emerging commercial communications technologies in the areas of Information Assurance, Software Defined Radio, Modeling and Simulation, Subterranean Communications, Ultra Wideband Amplifier, and SATCOM On-the Move. No additional funds are required to complete this effort.	0	9642	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1045	0
Totals	14779	37443	23920

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	0	15658	18072	20736	21063	23212	23249
HB5	IMMERSIVE ENVIRONMENTS DEMONSTRATIONS (CA)	0	3161	0	0	0	0	0
S28	INSTITUTE FOR CREATIVE TECHNOLOGY (ICT)-ATD	0	251	1641	5206	5202	5208	5206
S29	MODELING & SIMULATION - ATD	0	2248	2908	2032	2375	4502	4548
S30	JOINT VIRTUAL BATTLESPACE	0	3517	0	0	0	0	0
S31	RDEC FEDERATION	0	3517	13523	13498	13486	13502	13495
S33	TRAINING AND SIMULATION SYSTEMS INITIATIVES (CA)	0	2964	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. Technology demonstration is focused in four major areas. First, the Immersive Training Demonstrations project incorporates advanced modeling and simulation (M&S) and training and leader development technology into training demonstrations that have an emphasis on urban operations. Second, the Modeling & Simulation project will demonstrate a framework for future embedded training and simulation systems for the FF to include Future Combat Systems (FCS) and dismounted warrior systems. Third, the Joint Virtual Battlespace (JVB) project develops and demonstrates the overarching M&S architecture that facilitates force-on-force modeling, supports the play of systems models, provides access to measures of effectiveness, and contributes to and works within the total FF. Fourth, the Research Development and Engineering Command (RDEC) Federation project will provide operational instances of interoperable component engineering-level simulations and models that conform to the JVB architecture specification to support and augment testing and training of the FF. Work in this program element is related to and fully coordinated with efforts in PE 0603238A, Project 177 (JT ALS PS DEMO); PE 0602308A, PE0603001A, Project 545 (Force Projection Logistics); and PE0601104A, Project J08 (Institute for Creative Technology). This PE was established to transition maturing technology from PE0601104A, Project J08 (Institute for Creative Technology) and PE 0602308A, Project C90 (Advanced Distributed Simulation) and Project D02 (Modeling and Simulation for Training and Design) into demonstration 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 is performed by the Research Development and Engineering Command (RDE Command), Orlando, FL, (S28 & S29), and Fairfax, VA (S30 & S31).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	0	18649	20379
Current Budget (FY 2005 PB)	0	15658	18072
Total Adjustments	0	-2991	-2307
Congressional program reductions		-9133	
Congressional rescissions			
Congressional increases		6200	
Reprogrammings		-58	
SBIR/STTR Transfer			
Adjustments to Budget Years			-2307

Significant Change Explanation.
FY04 - This PE received two FY04 Congressional adds totaling $6200 and FY04 Congressional reductions totaling $9133.
FY05 - Funds realigned to higher priorities.

FY04 Congressional Adds with no R-2A:
($3069) Immersive Simulation and Training Research/ICT, Project HB5: The purpose of this one year Congressional add is to demonstrate immersive technology research environments at Fort Sill. No additional funding is required to complete this project.

($2878) CAVE Automated Virtual Environment, Project S33: The purpose of this one year Congressional add is to mature research in the use of the Cave Automated Virtual Environment to support simulation modeling for acquisition, requirements and training for new system development and test. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S28**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
S28	INSTITUTE FOR CREATIVE TECHNOLOGY (ICT)-ATD	0	251	1641	5206	5202	5208	5206

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 transition basic and applied research 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 (RDE Command), Orlando, FL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Immersive Techniques. In FY04, investigate approaches to integrate immersive evaluation techniques into training and leader development technology demonstrations. Demonstrations will incorporate advanced artificial intelligence techniques for after action review and enhanced sound capability for individual soldier simulations. In FY05, will use immersive environments created for training and simulation systems to facilitate the integration of new algorithms and techniques into the after action review processes allowing self-assessment of mission accomplishment. Will demonstrate a prototypical highly immersive multi-sensory environment that provides mixed reality (real and synthetic) objects for training and mission rehearsal.	0	243	1641
Small Business Innovative Research/Small Business Technology Transfer Programs	0	8	0
Totals	0	251	1641

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S29**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
S29	MODELING & SIMULATION - ATD	0	2248	2908	2032	2375	4502	4548

A. Mission Description and Budget Item Justification: This project will mature and demonstrate affordable next generation training and simulation systems that focus on virtual threats, asymmetric warfare, network-centric operations, and embedding training capabilities and technologies into operational go-to-war Future Force (FF) systems to include Future Combat Systems (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 homestation 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 (Immersive Training Demonstrations) of this PE 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; C4ISR network analysis to support distributed simulations; and vehicle system interface requirements. This project was set up 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 (RDE Command), Orlando, FL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Embedded Techniques. In FY04, develop an embedded computer generated force simulation concept to support embedded training and mission planning and rehearsal. Conduct an exercise with live and virtual training systems demonstrating robotics asset control to provide increased mission capabilities. Mature and experiment with simulations of C4ISR networks that will accommodate both operational and training network traffic. In FY05, integrate mounted and dismounted soldier embedded training systems to demonstrate and assess capabilities for small unit training and rehearsal. Demonstrate an intelligent tutor to provide instructional assessment and feedback to individual crew members utilizing embedded training system. Optimize computer generated force software to reduce demand for tactical bandwidth.	0	1732	2427
Transformational Training. In FY04, integrate and demonstrate technology for constructive and virtual simulation from joint armed services to demonstrate the learning and training needed to significantly increase the training capability of the joint forces. In FY05, interface with Joint Forces Command's (JFCOM) Distributed Continuous Experimentation Environment and conduct experiments to provide feedback on the performance and training effectiveness of the next generation simulation systems in a joint training context.	0	451	481
Small Business Innovative Research/Small Business Technology Transfer Programs	0	65	0
Totals	0	2248	2908

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S30**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
S30	JOINT VIRTUAL BATTLESPACE	0	3517	0	0	0	0	0

A. Mission Description and Budget Item Justification: Projects S30 (Joint Virtual Battlespace) and S31 (RDEC Federation) will provide the foundation for the MATREX modeling and simulation (M&S) architecture. This 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 Future Force (FF) tactical network systems, the information that flows through that network, and the impact of this information on force effectiveness. These assessments are needed for smart and timely acquisition decisions on FF and Future Combat Systems (FCS) component technologies. In FY05, the unity of effort essential to ensure compatibility among the complementary inter-related technologies of Projects S30 and S31 will be achieved when Project S30's core integrated modeling and simulation architecture development efforts are merged with Project S31's collaborative environment and M&S component development efforts to create a single integrated MATREX development effort within Project S31. The core integrated modeling and simulation architecture development efforts of Project S30 include Enterprise Services, middleware tools, standardized component interfaces, command and control structures, terrain, weather, and battlefield emissions propagation and sensing advanced technology development efforts as well as the integration of the "best of breed" high-resolution engineering-level component models developed in Project S31. In combination, these technologies provide the user with a tailorable, scalable, distributed M&S system that addresses both human and hardware-in-the-loop C4ISR centric force-on-force scenarios that will also serve as an integral part of a future Army Collaborative Environment under the auspices of the Simulation and Modeling for Acquisition, Requirements and Training (SMART) initiative. In FY03 this effort was funded in PE 0603238, Project 177 (JT ALS PS Demo). 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 (RDE Command), Fairfax, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Modeling Architecture for Technology, Research, and EXperimentation (MATREX). In FY04, enhance the architecture through the integration of the lethality, vulnerability, armament, and environmental servers and the enhancement of the sensors and human factors models and the command, control, and communications grid. Develop enhanced tools for accelerating the integration of new component capabilities to assist in system-of-systems design trade-offs. Provide software Version 0.5 to the FCS Lead System Integrator (LSI) for integration in the System of Systems Virtual Framework (SVF) environment. Further develop architecture to support NCW simulation to include a common operational picture, intelligence effects, communication effects, command & control, and platform modeling.	0	3415	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	102	0
Totals	0	3517	0

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S31**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
S31	RDEC FEDERATION	0	3517	13523	13498	13486	13502	13495

A. Mission Description and Budget Item Justification: Projects S30 (Joint Virtual Battlespace) and S31 (RDEC Federation) will provide the foundation for the Modeling Architecture for Technology, Research, and EXperimentation (MATREX) modeling and simulation (M&S) architecture. This 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 Future Force (FF) tactical network systems, the information that flows through that network, and the impact of this information on force effectiveness. These assessments are needed for smart and timely acquisition decisions on FF and Future Combat Systems (FCS) component technologies. In FY05, the unity of effort essential to ensure compatibility among the inter-related technologies of Projects S30 and S31 will be achieved when Project S30's core integrated modeling and simulation architecture development efforts and its associated funding are merged with Project S31's collaborative environment and M&S component development efforts to create a single integrated MATREX development effort within Project S31. Through FY04 and beyond, Project S31's development efforts include the creation of a distributed virtual laboratory that will be used to conduct collaborative distributed simulation experiments, studies, and analysis to facilitate acquisition decisions using the Simulation and Modeling for Acquisition, Requirements and Training (SMART) process, as well as 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 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 Unit of Action (UA) within the context of a Unit of Employment (UE), enhancing the user's ability to study the Measures of Effectiveness of interest. Additionally, MATREX will develop a Distributed Virtual Laboratory (DVL) to network geographically dispersed M&S assets, and therefore reduce the Army's cost of test, 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 core integrated modeling and simulation architecture development efforts of Project S30 that will be merged with Project S31 in FY05 include Enterprise Services, middleware tools, standardized component interfaces, command and control structures, terrain, weather, and battlefield emissions propagation and sensing advanced technology development efforts as well as the integration of the "best of breed" engineering-level component models developed in Project S31. In combination, these technologies provide the user with a tailorable, scalable, distributed M&S system that addresses both human and hardware-in-the-loop C4ISR centric force-on-force scenarios that will also serve as an integral part of a future Army Collaborative Environment under the auspices of the SMART initiative. In FY03 this effort was funded in PE 0603238, Project 177 (JT ALS PS Demo). 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 (RDE Command), Fairfax, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S31**

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Modeling Architecture for Technology, Research, and EXperimentation (MATREX). In FY04, establish a Distributed Virtual Laboratory (DVL) environment to enable all sites to connect through a secure distributed network. Enhance human performance and command and control modeling and facilitate collaboration with the logistics community, Army Test and Evaluation Command (ATEC), Army Training and Doctrine Command (TRADOC), and other Services. In FY05, will integrate tactical sensors, command and control, and propagation servers. Will conduct Joint experiments, assess and incorporate interfaces for additional high-resolution, component level models and simulations, and continue development of methodologies to incorporate asymmetric warfare. Will deliver software Version 1.0 to FCS Lead System Integrator (LSI) for integration in the System of Systems Virtual Framework (SVF) environment for the evaluation of emerging tactical systems.	0	3415	13523
Small Business Innovative Research/Small Business Technology Transfer Programs	0	102	0
Totals	0	3517	13523

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603103A - Explosive Demilitarization Technology**	**D51**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
D51	EXPLOSIVES DEMIL TECH	0	24842	9706	9865	10042	10083	10291

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 resource recovery and recycling (R3) and 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 R3 and treatment and seeks alternatives over that of open burning/open detonation (OB/OD). There are currently nearly 400,000 tons of these materials requiring disposition with a forecast of 475,000 tons and over 275,000 missiles and missile components to flow through the stockpile by FY2005-2006. 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 Joint Ordnance Commanders Demilitarization Subgroup and seeks to leverage support from the Department's Environmental Security Technology Certification Program (ESTCP), the Strategic Environmental Research and Development Program (SERDP), the Joint DoD/DOE Munitions Program, and complementary Service science and technology programs. Each project is required to include a federal laboratory sponsor and is provided peer review by the Joint Working Group. The PM Demilitarization R&D IPT and the DoD/DOE Technology Coordination Users Group is utilized to assess and review ongoing and emergent demilitarization requirements for use in planning future investments for this program. The program supports the R&D Technology goals of the PM Demilitarization Strategic Plan, which focuses on technology transfer opportunities and the technical review and data evaluation from ongoing projects and advanced demonstrations. The Explosive Demilitarization Technology Program was previously managed under PE 0603104D8Z. 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 2003	FY 2004	FY 2005
Test Site Demonstration Program (TSDP): In FY04, continue testing the Contained Burn Chamber for tactical missiles; complete optimization studies; continue demonstration/validation of Advanced Molten Salt Technology; continue Maturation of an integrated Cryo-fracture/Plasma Arc process and initiate detailed design and equipment fabrication; continue Joint Program integration. In FY05, will continue development of Molten Salt Technology for transition to Systems Development and Demonstration.	0	2175	3566
Advanced Removal/Conversion (AR/C): In FY04, mature technologies for conversion of propellant to fertilizer, flashless powder and slurry explosives, and explosive D conversion to TATB (triamino-trinitrobenzene); complete integration of induction heating meltout into a flexible work cell pilot plant and begin fabrication of prototype equipment; optimize advanced cutting technology using water jets and lasers; continue biodegradation studies on wastewater from waterjet and autoclave de-mil processes; mature HMX recovery technology. In FY05, will complete equipment fabrication for the induction heating meltout flexible work cell prototype and begin installation; will complete wastewater biodegradation studies; will investigate ultrasonic removal technology.	0	1580	2567
Advanced Automated Munitions Disassembly (AAMD): In FY04, continue AAMD efforts in the areas of robotic disassembly of projectiles; demonstrate and validate robotic disassembly workcells matured for the ADAM projectile and the 8 inch RAP round; initiate design of workcells for other improved conventional munitions (ICMs) and cluster bomb units (CBUs) as well as their sub-munitions. In FY05, design of robotic workcell hardware for selected ICMs and CBUs will be completed; will initiate equipment fabrication.	0	1182	1481
In FY04, mature large rocket motor (LRM) washout technology. In FY05 will complete maturation of LRM technology.	0	684	651
Advanced Destruction Systems (ADS): In FY04, complete demonstration of enhanced furnaces for conventional munitions and energetic materials; complete optimization of the fixed/mobile detonation chamber prototypes.	0	1232	0
Maturation of Analytical Tools and Instrumentation (ATI) for optimization of de-mil processes: In FY04, continue ATI maturation focusing on NIR-based analyzers for explosives and propellants; initiate maturation of Design for De-mil AT's. In FY05, will continue expansion of ATIs for explosives and propellant evaluation and optimize for recovered items; will continue design maturation of De-mil AT tools.	0	485	592
Hot Gas Decontamination(HGD):In FY04, demonstration/validation of the HGD system will be completed. In FY05, demonstration of a Hydrothermal Oxidation(HTO) prototype system will be continued on various feed materials at a selected location.	0	980	849

Accomplishments/Planned Program B(continued)	FY 2003	FY 2004	FY 2005
The purpose of this one year Congressional add is to support the Missile Recycling Center at Anniston. No additional funds are required to complete this project.	0	2100	0
The purpose of this one year Congressional add is to support the Tactical Missile Reuse/Demililitarization at Letterkenny Army Depot. No additional funds are required to complete this project.	0	1750	0
The purpose of this one year Congressional add is to support the Reclamation of Class 1.1 Rocket Propellant. No additional funds are required to complete this project.	0	2000	0
The purpose of this one year Congressional add is to support Innovative Demil Technologies. No additional funds are required to complete this project.	0	2100	0
The purpose of this one year Congressional add is to support HMX Requalification Program. No additional funds are required to complete this project.	0	1000	0
The purpose of this one year Congressional add is to support the Explosives Demil Technology Program. No additional funds are required to complete this project.	0	1000	0
The purpose of this one year Congressional add is to support the Thin Layer Chromotography Program. No additional funds are required to complete this project.	0	2100	0
The purpose of this one year Congressional add is to support the Demilitarization of Obsolete Munitions. No additional funds are required to complete this project.	0	1750	0
Demilitarization and Destruction of Conventional Ammunition. The purpose of this one year Congressional add is to support the Demilitarization and Destruction of Conventional Ammunition. No additional funds are required to complete this project.	0	1000	0
The purpose of this one year Congressional addition is to support the Bluegrass Supercritical Water Oxidation (SWCO) Program Demonstration. No additional funds are required to complete this project.	0	1000	0
Small Business Innovative Research/Small Business Technology Transfer Programs.	0	724	0
Totals	0	24842	9706

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603103A - Explosive Demilitarization Technology**	**D51**

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	0	9349	9860
Current Budget (FY 2005 PB)	0	24842	9706
Total Adjustments	0	15493	-154
Congressional program reductions		-214	
Congressional rescissions			
Congressional increases		15800	
Reprogrammings		-93	
SBIR/STTR Transfer			
Adjustments to Budget Years			-154

Significant Change Explanation.
FY04 - Ten FY04 Congressional adds totaling $15800 were added to the PE.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603105A - MILITARY HIV RESEARCH**	**H29**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H29	MED PROTECT AGNST HIV	0	14059	6641	6842	6993	6999	6996

A. Mission Description and Budget Item Justification: This project supports the medical technology area of the Future Force by conducting concept exploration of candidate vaccines to include safety and efficacy in model systems and to prepare and conduct clinical studies and, where feasible, exploits opportunities to enhance Current Force capabilities. 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. Preclinical trials and Phase 1, 2, and 3 clinical trials are performed as required for vaccine licensure with U.S. Food and Drug Administration. This program is jointly managed through an Interagency Agreement by the U.S. Army Medical Research and Materiel Command (USAMRMC) and the National Institute of Allergy and Infectious Diseases. 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 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. This project contains no duplication with any effort within the Military Departments.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603105A - MILITARY HIV RESEARCH**	**H29**

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
HIV - In FY03 the HIV program transferred to the National Institute of Health (NIH). Program returned to USAMRMC in FY04. In FY04, produce clinical-grade quantities of candidate vaccines against HIV subtypes D and A. Start Phase 1 study of a candidate DNA/Adenoviral HIV vaccine(s) in East Africa and other new and improved HIV vaccine candidates. Identify appropriate populations for advanced development of selected candidate vaccines in East Africa. Establish diagnostic capabilities needed to differentiate vaccine-induced immune response from HIV infection in clinical trials. Improve tests needed to assess HIV vaccine-induced immune responses. Conduct preclinical studies of candidate HIV vaccines in animal models to determine safety and induction of immune response before studies are begun in humans. Conduct a multicenter clinical study to investigate HIV drug resistance. Begin Phase 2 clinical testing for HIV vaccine candidates for transition to advanced development by FY06. In FY05, will continue multiyear DNA/Adenoviral HIV vaccine Phase I clinical testing begun in FY04 to demonstrate safety and immunogenicity.	0	6456	6641
The objective of this one year Congressional add is to fund applied HIV research. No additional funding is required to complete this project	0	7193	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	410	0
Totals	0	14059	6641

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	0	6733	6746
Current Budget (FY 2005 PB)	0	14059	6641
Total Adjustments	0	7326	-105
Congressional program reductions		-121	
Congressional rescissions			
Congressional increases		7500	
Reprogrammings		-53	
SBIR/STTR Transfer			
Adjustments to Budget Years			-105

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603125A - Combating Terrorism, Technology Development for**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		41822	8610	3383	0	0	0	0
DF1	SURVIVABILITY & DENIAL	0	4856	3383	0	0	0	0
DF2	DETERRENCE, INDICATION & WARNINGS	33437	1778	0	0	0	0	0
DF3	CONSEQUENCE MANAGEMENT & RECOVERY	1430	1976	0	0	0	0	0
DF4	ATTRIBUTION & RETALIATION	6955	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 engineering technologies against asymmetric threats in support of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Base Camp Protection will demonstrate a survivability planning capability and lightweight low-cost blast/ballistic protective measures. This will increase base camp survivability of personnel and equipment against advanced conventional weapons and terrorist threats, reduce logistics requirements, and enhance the capability of the Future Force in low-intensity conflicts and peacekeeping operations. 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 program element is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

$41842 in Defense Emergency Response Funds were provided to this program element in FY03.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	41842	4916	3436
Current Budget (FY 2005 PB)	41822	8610	3383
Total Adjustments	-20	3694	-53
Congressional program reductions		-74	
Congressional rescissions			
Congressional increases		3800	
Reprogrammings	-20	-32	
SBIR/STTR Transfer			
Adjustments to Budget Years			-53

Significant Change Explanation.
FY04 - Two FY04 Congressional adds totaling $3800 were added to this PE.

FY04 Congressional adds with no R-2A:
($1726) Detecting Contaminants in Drinking Water, Project DF2: The purpose of this one year Congressional add is to research methods of detecting contaminants in drinking water. No additional funding is required to complete this project.

($1919) Information Security System, Project DF3: The purpose of this one year Congressional add is to support the implementation of an information security system to increase the survivability of Army computer systems in the event of a cyber attack. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603125A - Combating Terrorism, Technology Development for**	**DF1**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
DF1	SURVIVABILITY & DENIAL	0	4856	3383	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this project is to mature and demonstrate advanced survivability engineering technologies against asymmetric threats in support of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Technologies demonstrated within this project are transitioned from program element 0602784A (Military Engineering Technology), project T40. Base Camp Protection will demonstrate a survivability planning capability and lightweight low-cost blast/ballistic protective measures. This will increase base camp survivability of personnel and equipment against advanced conventional weapons and terrorist threats, reduce logistics requirements, and enhance the capability of the Future Force in low-intensity conflicts and peacekeeping 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 the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Base Camp Protection/Survivability – In FY04, develop capability for base camp planning and layout, and develop base camp survivability measures for blast and ballistic protection suitable for use by Stryker Brigade Combat Teams. In FY05, will demonstrate initial integration of weapons effects data, survivability assessment procedures, and the Anti-Terrorist (AT) planning software for base camp planning and assessment. Will demonstrate base camp survivability measures for blast and ballistic protection.	0	4715	3383
Small Business Innovative Research/Small Business Technology Transfer Programs	0	141	0
Totals	0	4856	3383

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603238A - Global Surveillance/Air Defense/Precision Strike T**	**177**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
177	JT ALS PS DEMO	29774	12505	10721	12441	12766	13054	13352

A. Mission Description and Budget Item Justification: Joint Precision Strike Demonstration's (JPSD) mission is to integrate and demonstrate innovative futuristic Operational Concepts and Tactics Techniques and Procedures (TTPs) with emerging technologies to significantly improve OSD/Joint Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) capabilities. JPSD horizontally integrates state-of-the-art software applications and tools across the spectrum of C4ISR to optimize sensor to shooter operations and solve critical joint problems. The Integration and Evaluation Center (IEC), the foundation for JPSD's Simulation Based Acquisition process, was used to establish the Joint Virtual Battlespace (JVB) concept. JVB was designed to conduct studies and demonstrations for measuring and evaluating system of systems designs and concepts. JVB advanced software designs and a draft modeling and simulations architecture transition into PE 0603015A, Project S30 (Joint Virtual Battlespace) to support the Modeling Architecture for Technology and Research EXperimentation (MATREX) research. Further work on JVB will be done within the context of MATREX starting in FY04. The results of the ICT advanced technology development effort will transition into PE 0605718, Project S01 (Integration and Evaluation Center (IEC) Sustainment) where it will support MATREX on a reimbursable basis starting in FY04. The Theater Precision Strike Operations (TPSO) Advanced Concept Technology Demonstration (ACTD), by use of state of the art software applications/tools provides the Commander, Combined Forces Command (CFC), Korea with a significantly enhanced Theater-wide capability to plan, coordinate and conduct Counter-Fire, Precision Strike Engagements and Joint Battlespace Command and Control (C2). TPSO has also provided software applications for the worldwide Combatant Commanders and their component commanders to perform Near-Real-Time C2. These enhancements have been provided to CENTCOM, PACOM, SOCOM, EUCOM and JFCOM. The Joint Intelligence, Surveillance and Reconnaissance (JISR) ACTD implements a tactical networked sensor grid using internet web based technologies to horizontally integrate tactical and operational level ISR information from existing stove-piped legacy Service and joint C4ISR systems for CENTCOM (ARCENT and 1st Marine Expeditionary Force (MEF)). JISR also integrates nontraditional tactical sensors (i.e., FIREFINDER radar and unattended ground sensors) into an Intelligence, Sensor and Reconnaissance (ISR) picture which allows the Early Entry Force (EEF) Commander and his higher headquarters to access and geospatially visualize all available ISR information using any workstation equipped with a web browser. This capability will be integrated worldwide. 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 member of the Program Executive Office, Intelligence, Electronic Warfare, and Sensors (PEOIEW&S), Fort Monmouth, NJ. Work is done at JPSD, Ft. Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
TPSO ACTD - FY03: Participated and supported major Combined Forces Command (CFC) exercises and component exercises to add ADOCS upgrades and new capabilities. Provided support training, upgrades and field support to major field exercises (RSO&I; UFL03, Lucky Sentinel, MC03, MEFEX, BFE-J, JEFX). Participated in and supported both Operation Southern Watch in Afghanistan and Operation Iraqi Freedom (OIF). Provided ADOCS applications to support deliberate targeting (ATO/ACO), time sensitive targeting, situational awareness, and other mission threads to over 3000 joint warfighter users at HQ CENTCOM Forward and its components. Upgraded ADOCS worldwide with new capabilities based on critical CFC requirements (CENTCOM, EUCOM, SOCOM, PACOM and JFCOM). Executed transition and sustainment plans to support the TPSO "Leave Behind" systems during the final year of transition. Matured DII - COE Level Six compliant version of ADOCS.	9519	0	0
JISR ACTD - FY03:Refined and Enhanced JISR interfaces to source systems based upon user defined TTP/CONOPS (Lucky Sentinel 03, MEFEX 03, OIF. Planned and executed additional formal assessment by Joint Interoperability Test Center (JITC), Joint Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Battle Center and warfighter assessments by CENTCOM and I MEF. Completed an assessment of military utility, operational effectiveness, suitability, and interoperability during demonstration. FY04: Refine and enhance interoperability reviews of Defense Information Infrastructure/ Common Operating Environment (DII/COE) certification from appropriate certification authorities to include DISA. Transition Memoranda of Agreement will be accomplished with proposed programs executive officer's (PEO's) with responsibilities for programs of record, ASAS-L, CHIMS, GCCS/JC2, and DCGS-A. FY05: Complete sustainment support to respective service and joint C4ISR user warfighters of the JISR product delivered in FY04. Field up to seven additional JISR servers to support technology transition to programs of record; ASAS-L, CHIMS, C2PC, GCCS, DCGS-A, MCS-L and JC2. Deploy an additional four servers in support of OIF II in Iraq and Kuwait, expanding our user base to the coalition partners and the CPA. Continued presence of contractor personnel in Iraq to provide training, and system support to organizations using JISR servers. Continue to maintain and upgrade the current set of JISR servers (seven) in support of operations and transition. Complete the ACTD.	4808	12153	8749

Accomplishments/Planned Program A(continued)	FY 2003	FY 2004	FY 2005
JVB - FY03: Supported FCS C4ISR Experiment at Ft. Knox in Dec 2003 and FCS LSI Capstone Demonstration in March 2003 (key events for FCS Milestone B Decision in FY 2003). Developed software to integrate contractor virtual prototypes and conducted operational analysis of contractor final concepts in support of FCS program decision. Integrated dynamic environment, NBC component simulations and CONOPS/tactics into the JVB framework. Integrated models, services and simulation elements from the Army's Research, Development and Engineering Center community. Transitioned effort lead to AMC RDE Command. In FY04 and beyond, this effort is funded in PE 0603015A, Projects S30 (Joint Virtual Battlespace) and S31 (RDEC Federation).	15447	0	0
IFSAR MAPPING - FY03: IFSAR MAPPING ACTD approved. Implementation Directive and Management Plan developed. FY04: sensor system design and component fabrication. Platform weight, balance and aerodynamics analysis. FY05: Component laboratory test, integration and evaluation.	0	0	1972
Small Business Innovative Research/Small Business Technology Transfer Programs	0	352	0
Totals	29774	12505	10721

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	29788	12660	8833
Current Budget (FY 2005 PB)	29774	12505	10721
Total Adjustments	-14	-155	1888
Congressional program reductions		-108	
Congressional rescissions			
Congressional increases			
Reprogrammings	-14	-47	
SBIR/STTR Transfer			
Adjustments to Budget Years			1888

Significant Change Explanation:

FY05 - Funds increased to support the Tactical IFSAR ACTD.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603270A - EW TECHNOLOGY

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		18566	25360	9382	17473	18504	18705	18891
K12	EW DEMONSTRATIONS (CA)	1905	4347	0	0	0	0	0
K15	ADVANCED COMM ECM DEMO	3080	4794	2906	8511	9370	9391	9368
K16	NON-COMMO ECM TECH DEM	7485	6341	6476	8962	9134	9314	9523
K19	MULTIPLE INTEL REMOTED SENSOR SYSTEM - BLK 1	6096	4939	0	0	0	0	0
K20	SHORTSTOP	0	4939	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates multi-intelligence remote sensor technologies and electronic warfare (EW) survivability 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 US Army sensors from enemy deception and jamming. The advanced communications Electronic Countermeasures (ECM) K15 project provides technology demonstrations in CM, information collection and reporting to transition to Army intelligence and electronic warfare (IEW) systems. This project also supports demonstrations of automatic/automated fusion of intelligence, information, and data from multiple sources to provide unit of action/unit of employment common operating picture (COP). The Non-communication ECM technology demonstration project (K16) 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. Technologies matured as part of this PE will be demonstrated in the integrated situation awareness (SA) and targeting advanced technology demonstration (ATD), and the integrated counter measures platform survivability effort. 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).

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 provided by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	18756	11273	9213
Current Budget (FY 2005 PB)	18566	25360	9382
Total Adjustments	-190	14087	169
Congressional program reductions		-217	
Congressional rescissions			
Congressional increases		14400	
Reprogrammings	-190	-96	
SBIR/STTR Transfer			
Adjustments to Budget Years			169

Change Summary Explanation: Funding - FY 2004: Five FY04 Congressional Adds totaling $14400 were added to this PE.

FY04 Congressional Adds with no R-2As:

($960) AN/VVR-1 Laser Warning Receiver, Project K12: The purpose of this one year Congressional add is to complete the qualification of the AN/VVR-3, procure prototype systems and perform a demonstration on a combat vehicle. No additional funds are required to complete this project.

($4795) Multifunction Intelligence and Remote Sensor System, Project K19: The purpose of this one year Congressional add is to add air delivery capability and automatic detect, track, classify, and locate functions, incorporate power management algorithms, and investigate application of sensor technology to unmanned ground vehicles. No additional funds are required to complete this project.

($4795) Shortstop Electronic Protection System, Project K20: The purpose of this one year Congressional add is to perform threat analysis, architecture analysis, prototype hardware and software development, implementation, and test/evaluation to expand the Shortstop Electronic Protection System technology, capability and performance to include the selective disruption and usage denial of modern communication devices, in specific environments for specific duration. No additional funds are required to complete this project.

($2301) US Army Tactical ELINT for Ground Maneuver Forces, Project K12: The purpose of this one year Congressional add is to investigate

application of specific emitter identification techniques to evolving Army ELINT mission requirements. No additional funds are required to complete this project.

($959) WX Intelligence Sensor System, Project K12: The purpose of this one year Congressional add is to investigate, mature, and rapidly prototype a demonstration system for an unattended, localized weather sensor system that will be network compatible with Remote Sensor Systems (Silent Warrior). No additional funds are required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603270A - EW TECHNOLOGY**	**K15**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
K15	ADVANCED COMM ECM DEMO	3080	4794	2906	8511	9370	9391	9368

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. The goal of the Warfighter Electronic Collection and Mapping program is to provide the warfighter at the unit level with the ability to locate enemy tactical radio RF emitters. Electronic Support for the Future Force (ESFF) will provide lightweight, low cost UAV and Unattended Ground Sensors (UGS) Electronic Support Measures (ESM) to detect and locate modern signals of interest. The Joint Intelligence, Surveillance, and Reconnaissance (JISR) Advanced Concept Technology Demonstration (ACTD) provides the tools that allow the warfighter, at all echelons, a comprehensive near-real time view of ISR information based on both traditional and selected non-traditional sensors to enhance situation awareness. Information Operations for the Future Force 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 PE is performed by the Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Information Operations for the Future Force (IOFF): In FY05, will identify and test techniques to cross cue/correlate geolocations and Internet Protocol (IP) virtual address locations in a lab environment. Will refine precision direction finding capability to determine 3-D coordinates of potential targets.	0	0	336
- JISR ACTD: In FY03, integrated advanced intelligence web applications into existing brigade intelligence systems to enhance situation awareness by ultimately increasing sensor feeds, timeliness, and number of users accessing shared data. Demonstrated initial operational capability and participated in two field exercises. Other work related to this project is performed under project K16.	2390	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Warfighter Electronic Collection and Mapping and Electronic Support for the Future Force: This effort matures and demonstrates technologies that enable tactical signal intercept and jamming. In FY03, integrated warfighter RF collection system co-resident algorithms on Small Unit Operations (SUO) radio platform to enable SUO radios to perform RF collection. In FY04, provide advanced simulation capability of Electronic Support Measure (ESM) sensors and integrate to the Mounted Maneuver Battlespace Lab at Ft. Knox to evaluate tactics and tactical Internet throughput requirements to support networked, unattended radio frequency sensors for Future Combat Systems. In FY05, will perform lab and field test for networked radio frequency (RF) ESM sensor architecture for unmanned ground and air vehicle applications for Future Combat Systems. Will integrate and demonstrate unattended ground and air RF ESM sensors with the network radio links matured by the Networked Sensors for the Future Force (NSFF) Advanced Technology Demonstration program and other future combat system (FCS) efforts. Will integrate software in model of Information Operations systems, test wired and wireless detection and recognition algorithms for correlation of virtual addresses and real locations. Related work is performed under project K16.	690	972	2570
- Single Integrated Ground Picture (SIGP): SIGP is the ground component of the Joint Battle Management Command and Control (JBMC2) capability initiative that provides enhanced Situational Awareness enabling precise and decisive command & control in the Battlespace. In FY04, research what is currently being done to build, coordinate, and ensure joint and coalition data and information interoperability across the battlefield. Baseline current warfighter capabilities to access, fuse, and filter information from multiple sources. Perform operational and systems engineering analysis to identify information interoperability gaps then develop joint standards, architectures, and system requirements for Current and Future Force capabilities based on lessons learned and emerging Joint operational concepts (OPCONs) and concepts of operation (CONOPS).	0	3744	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	78	0
Totals	3080	4794	2906

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603270A - EW TECHNOLOGY**	**K16**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
K16	NON-COMMO ECM TECH DEM	7485	6341	6476	8962	9134	9314	9523

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 ground combat vehicles and the dismounted forces. The vehicle survivability approach will provide detection avoidance through signature management and hit avoidance using warning receivers and 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 fuzed munitions. The ability to neutralize booby trap improvised explosive devices (IEDs) will be matured and demonstrated by embedding the maximum capability in projected FCS/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 demonstrate those 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 Unit of Action commander to support a "see first, understand first, act first, finish decisively" standard. The Warfighter Electronic Collection and Mapping (WECM) program provides the capability at the unit level to locate enemy tactical RF emitters. This will employ non-traditional uses of software-defined radios to perform tactical, short-range detection of threat emission. The Joint Intelligence, Surveillance, and Reconnaissance (JISR) ACTD will provide the tools that allow the warfighter, at all echelons, a comprehensive near-real time view of ISR information based on both traditional and selected non-traditional sensors to enhance situation awareness.

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 the Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ and the Army Research Lab, Adelphi MD.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Sensor Countermeasures for the Future Force: 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 weapons data links, providing a level of survivability to dismounted, light and medium forces not currently available. In FY04, conduct modeling and simulations in support of deception and jamming technique development. Develop and test prototype hardware and software against remote controlled weapons. In FY05, develop Electronic Counter Measure (ECM) techniques, using receivers, antennas and jamming sources in a laboratory environment. Refine ECM techniques and conduct field testing of algorithms and radio frequency receivers against weapon control links to neutralize remote controlled weapons.	0	2981	1960
- Integrated Countermeasures and Integrated Survivability: This effort matures and demonstrates technologies that enhance vehicle system survivability. In FY03, performed antitank guided missile (ATGM), surface-to-air missile and anti-aircraft artillery countermeasure modeling and simulation. In FY04, integrate two color uncooled mid-Infrared (IR) ground vehicle missile-warning sensors with IR jammers for use against ATGMs. In FY05, will conduct live fire demonstrations of missile warning and IR countermeasures on a moving platform. Demonstrate timely and accurate handoff of information to cue active protection system.	2590	1987	2516
- JISR ACTD: This effort matures and demonstrates technologies that enable the networked information operations with joint intelligence, surveillance, reconnaissance, and intercept. In FY03, demonstrated in a field test, RF collection system on surrogate RF radio platform to detect and geolocate enemy's close battle, low power tactical communications. Demonstrated electronic mapping for Brigade and above early entry forces. Demonstrated ability of radios to network and pass threat situation awareness information to Battle Command Brigade and Below and JISR in less than two minutes. Performed final experiment to demonstrate data correlation, cueing, complete mission planning, and analysis tools. Correlated imagery intelligence, human intelligence, and signals intelligence into human centered decision-making formats that could be quickly used at levels from combat vehicle to division commander. Transitioned to PM Prophet and PM ACS.	1074	0	0
- Fusion Based Knowledge for the Future Force (FBKFF): In FY04, develop level 2 and 3 fusion tools to understand enemy intent and prepare Course of Action plan. Integrate the Topographic Engineering Center's Battlespace Terrain Reasoning and Awareness module into the fusion tools. Evaluate concepts for a Physical Damage Assessment (PDA) experiment with automated planning tools. In FY05, will continue development of Knowledge infrastructure. Will build and demonstrate in a pilot experiment a PDA module to assess PDA/Battle Damage Assessment tools.	0	500	2000

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Tactical Wireless Network: In FY04, provide simulated intruder attacks to test Network Assurance mechanism being matured to protect mobile wireless systems and networks. Attempt to exploit weaknesses in mobile wireless protocols and test Wireless Intrusion Detection efforts.	0	720	0
- Warfighter Electronic Collection and Mapping: In FY03, performed field test for networked RF collection capabilities as an embedded function in the SUO radio. Performed lab test for the system architecture's ability to detect, identify, and locate enemy tactical radios with a CEP of 200m or better to support the Objective Force Warfighter. Refined and optimized software algorithms to exploit enemy RF transmissions that represented threats to Future Combat Systems vehicles. Other work related to this project was performed under project K15.	3821	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	153	0
Totals	7485	6341	6476

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603313A - Missile and Rocket Advanced Technology

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	100616	121126	92800	66669	51189	72954	74474
206	MISSILE SIMULATION	15982	9939	3221	3318	3380	3459	3537
263	FUTURE MSL TECH INTEGR(FMTI)	34136	49776	31245	40593	24430	14730	14726
550	COUNTER ACTIVE PROTECTION	7954	2766	0	0	0	0	0
655	HYPERVELOCITY MISSILE TD	38258	44556	52075	16265	13503	20974	22473
704	ADVANCED MISSILE DEMO	1905	6187	6259	6493	0	5464	5440
G03	NATIONAL AEROSPACE INITIATIVE ADVANCED TECHNOLOGY	0	0	0	0	9876	28327	28298
NA6	MISSILE AND ROCKET INITIATIVES (CA)	2381	7902	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element demonstrates advanced missile technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability capabilities for the Future 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 program element includes demonstrations of advanced tactical missiles, real-time hardware-in-the-loop simulations, and multi-role seeker technology efforts. The technologies in this PE enhance the capabilities of locating targets in clutter, lightweight missile launchers, precision guidance, hypervelocity missile flight, and missile communications, command and control. The major efforts in this program element are the Compact Kinetic Energy Missile (CKEM), Low Cost Precision Kill (LCPK), Non-Line-Of-Sight Launcher System (NLOS-LS) Communications, NLOS-LS next generation missiles, and the hypersonic missile technology and engine demonstration. The CKEM technology program will demonstrate a prime candidate to provide overwhelming lethality for the FCS Direct Fire System. The goal of the CKEM effort is to design, fabricate and demonstrate a direct-fire missile that offers a significant increase in cost / kill ratio and enhanced stowed-kills, when compared to current direct-fire weapon systems. The NLOS-LS funding provides for longer range, more robust missiles, in a network of missiles 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 (DTAP). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	99695	111321	94062
Current Budget (FY 2005 PB)	100616	121126	92800
Total Adjustments	921	9805	-1262
Congressional program reductions		-11041	
Congressional rescissions			
Congressional increases		21300	
Reprogrammings	921	-454	
SBIR/STTR Transfer			
Adjustments to Budget Years			-1262

FY04 Congressional Adds with no R2-A:

- ($2685) Close-in Active Protection (CIAPS) prototype, Project 550: The objective of this one year Congressional Add is to demonstrate a complete of Close-In Active Protection System prototype for defense of combat vehicles against rocket propelled grenades and missiles fired without warning from close range; and investigate improvements for weight and size reduction.

- ($959) Army Manufacturing and Maintenance Organization, Project NA6: The objective of this one year Congressional Add is to address technology efforts and requirements impacting the sustainment of Army weapon systems. No additional funding is required to complete this project.

- ($1438) Micro-factories for Precision Parts, Project NA6: The objective of this one year Congressional Add is to develop a "desktop" factory using modular micro CNC machines. No additional funding is required to complete this project.

- ($3356) Warfighter Protection Lab, Project NA6: The objective of this one year Congressional Add is to apply army simulation technology to force protection. No additional funding is required to complete this project.

- ($959) Volumetrically Controlled Manufacturing (VCM), Project NA6: The objective of this one year Congressional Add is to develop a precision synthetic manufacturing process that uses mathematical algorithm to precisely calculate 3D material matrix coefficients, in discrete volumes, and then

replicates those properties within a manufacturing process. No additional funding is required to complete this project.

- ($959) Army AMCODE Integration, Project NA6: The objective of this one year Congressional Add is to develop a collaborative design environment for army missiles. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**206**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
206	MISSILE SIMULATION	15982	9939	3221	3318	3380	3459	3537

A. Mission Description and Budget Item Justification: This project supports three separate, but related tasks. The first task is the design, expansion, and improvement of hardware-in-the-loop (HWIL) simulation capabilities. The HWIL simulation is used to evaluate tactical missiles that are guided by radio frequency (RF), millimeter wave (MMW), electro-optical (EO), and infrared (IR) spectral signals. Future missile systems will use multi-mode combinations of these guidance technologies such as those envisioned for the Common Missile, NLOS-LS, and other systems within the Future Force systems. Evaluation by means of HWIL provides a cost-effective support to missile maturation throughout weapon system life cycles and permits a reduction in the number of flight tests actually performed. The second task is to support the development, implementation, integration, and test of missile simulation capabilities in the Modeling Architecture for Technology and Research Experimentation (MATREX) environment. MATREX is envisioned to support distributed simulations of various current, FCS, and Future Force evaluations, technology trade studies, and experimentations. This effort will facilitate the modeling and simulation capabilities of various Army agencies allowing cooperative simulation efforts such as the MATREX, which is envisioned for FCS and Future Force evaluation. The third task is battlefield distributed simulation, which provides an all-analytical simulation of Future Force weapon systems engaging multiple targets in a simulated battlefield environment, including the effects of natural and battle-caused obscurants and disturbances. 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 2003	FY 2004	FY 2005
Missile Simulation - In FY03, matured tri-mode beam combiner technology for multi-mode guided missiles and sub-munitions; developed IR scene projector capabilities to 1024x1024 elements with frame update rates exceeding 250 Hz, and with "snap" update electronics; implemented an IR in-band target scene projector based on micro-electromechanical systems (MEMS) devices for HWIL simulation. In FY04, develop Laser Detection and Ranging (LADAR) radar scene projector for HWIL simulation; mature end-to-end HWIL simulation techniques with remotely located ground equipment (launchers, Command & Control, Communications, Computers and Intelligence (C4I), fire control sensors and units) connected to real-time HWIL missile components and simulations. In FY05, will design and implement distributed simulation capabilities including classified and unclassified Ethernet and fiber optic wide area and local network equipment to analyze FCS, CKEM, NLOS-LS, the Future Force and weaponization of manned and unmanned air and ground vehicles in conjunction with Battle Labs and other Research, Development, and Engineering Centers. Will investigate parallel processing techniques to provide image processing power to enhance obscuration modeling required by both real and virtual prototype simulators.	2928	2932	3221
Missile Simulation Technology – This Congressional add in FY03 matured high fidelity, man-in-the-loop, simulation support to missile and missile platform development programs. In FY04, this add matures the missile simulation capability to include representations of all fielded missiles systems. It also includes representatives of missiles expected to be in the FCS Unit of Action. No additional funding is required to complete this project.	7335	6720	0
Volumetrically Controlled Manufacturing – This Congressional add matured simulation / modeling capability to optimize component design and manufacturing, using volumetrically controlled manufacturing methods. No additional funding is required to complete this project.	5719	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	287	0
Totals	15982	9939	3221

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**263**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
263	FUTURE MSL TECH INTEGR(FMTI)	34136	49776	31245	40593	24430	14730	14726

A. Mission Description and Budget Item Justification: This project demonstrates advanced tactical missile technologies including seekers, propulsion, airframes, communications, and guidance and controls for FCS and the Future Force. The major efforts in this project are the NetFires Comms and NLOS-LS Technology programs. These technologies include the demonstration and integration of multi-mode seeker concepts, controllable thrust motors (gels, pintle-controlled solids, or air breathing), aided target acquisition (ATA), networked missile radios and missile antennas. Seeker technology will address imaging infrared, 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, will be demonstrated to provide longer ranges and shorter flight times while increasing system robustness in air-to-ground, ground-to-ground, and ground-to-air roles. ATA will be demonstrated permitting true fire-and-forget at targets beyond visual range. 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. The Army's baseline communications networking waveform for the NLOS-LS missiles will be developed and demonstrated by funding the Communications Electronics Research Development Engineering Center (CERDEC) SLICE program. In addition, developing a System Development and Demonstration (SDD) risk mitigation missile radio and antenna that supports current NLOS-LS SDD program. Testing of the NLOS-LS products from both the SLICE and risk mitigation efforts will be funded and accomplished by this program. Secure wide-band data link hardware, allowing target position updates during missile flight, and transmission of imagery to the ground will be demonstrated. These efforts provide risk mitigation in support of the start of System Development and Demonstration (SDD) start for NLOS-LS in FY04 and are supported by the Program Executive Officer Tactical 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). Work is performed at the Aviation & Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
NLOS-LS Communications Simulation: In FY03, designed and coded software to simulate the NLOS-LS missile seekers, flight models, and communications networking and modeled a Unit of Action with NLOS-LS assets into the TRADOC-approved Caspian Sea scenario. Performed a series of man-in-the-loop experiments employing NLOS-LS in the combat scenario in order to explicitly generate the NLOS-LS communications traffic. In FY04, continue to evaluate results of the simulation experiments to refine communications requirements for NLOS-LS. Update the communications simulation with vendor enhancements and re-evaluate NLOS-LS communications performance in a combat environment.	3845	742	0
NLOS-LS Waveform Development: Develop JTRS SCA 2.2 compliant waveform and networking protocols for NLOS-LS: In FY 03, initiated development of the detailed models of the NLOS-LS networking protocols and the software enhancements to the waveform and networking protocols to achieve the NLOS-LS requirements. In FY04, complete software development of the NLOS-LS waveform and networking and conduct rigorous laboratory testing of the software to prepare for outdoor testing.	11688	10223	0
NLOS-LS Missile Radio and Antenna: Develop risk mitigation missile radio & antenna for NLOS-LS: In FY 03, designed a radio for the NLOS-LS missile application. Specific missile requirements such as thermal dissipation, power interface to the missile, GPS interface to the missile, and packaging were solved. Manufacturability also stressed. In FY04, fabricate and assemble the missile radios and antennas, perform rigorous testing in the laboratory in preparation for outdoor testing.	8060	9980	0
NLOS-LS Communications Testing: Plan and conduct a realistic, real world test of the radio hardware, antennas, and waveforms: In FY03, identified the appropriate format for the test and a test site, prepared data gathering software in order to measure performance of the radios and waveforms, and prepared a test plan. In FY04, rent aircraft and ground vehicles, conduct pre-tests to give the vendors a chance to dry-run the comms networking solutions, and perform the culminating test using aircraft as surrogate missiles in a 20-node test of both the Soldier Radio Waveform and the risk mitigation radio and antenna. Test will consist of 10 aircraft-based radios and 10 ground-based radios operating in a variety of terrain and altitudes while in motion and will replicate NLOS-LS in an operational environment.	1912	4330	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
NLOS Technology – Precision Attack Missile (PAM): In FY04, design and develop critical subsystems for PAM: - Enhanced Seeker Uncooled Infrared (UCIR) - Redesign UCIR optics, real-time Autonomous Target Acquisition (ATA) code development, fabricate and assemble two prototype type seekers and perform captive flight tests. - Advanced Propulsion – Demonstrate in static tests a pulse motor without barriers in a PAM size with minimum signature propellant, develop and demonstrate in static tests reduced smoke/ insensitive munition technology in boost-sustain risk mitigation motor, perform nozzle material investigations and static test with PAM type propellants. In FY05, will continue the design, development, fabrication of PAM critical components for Increment 1 and perform laboratory/relevant environment subsystem level testing.	3421	6740	7500
NLOS-Technology – Loiter Attack Missile (LAM): In FY04, design and develop critical subsystems for LAM. Seeker Semi-Active Laser (SAL)/LADAR - Redesign current LAM seeker to incorporate LADAR enhancements, perform trade studies and conceptual design for enhanced LAM seeker; Advanced Propulsion-award multiple contracts for turbofan trade studies and initiate prototype development for bench testing; Lethality/ Warhead- design, develop, and demonstrate advanced warhead technologies. In FY05, will continue the design, development, and fabrication of LAM critical components for Increment 1 and perform laboratory/relevant environment subsystem level testing.	0	4630	7400
NLOS-LS Technology Critical Subsystems: In FY04, design and develop critical subsystems for PAM/LAM: Generate ATA analysis and assessment tools (software/simulation development) for PAM and LAM ATA performance evaluations. Conduct system analysis and simulation development for initial few-on-few capabilities, Common Simulation Framework (CSF) 3-DOF simulation for rapid trade studies, and enhanced visualization demonstrations with 3D battlefield viewer and “heads-up” telemetry display. Address LAM and PAM manufacturing and affordability issues through system research, design and development. Perform trade studies, identifying alternate variants and critical subsystem requirements to achieve NLOS-LS Objective System performance and advanced warhead testing for objective requirements. In FY05, will continue the design, development, fabrication of PAM and LAM critical subsystems for Increment 1 and perform laboratory/relevant environment subsystem level testing. Will focus component experiments for proof of principal of NLOS-LS Objective System concepts.	0	8320	16345
Common Missile (CM) - In FY03, conducted seeker tower testing; prepared seekers and range for Captive Flight Testing; performed Captive Flight Testing of Tri-mode seekers for CM; and conducted final flight-type static testing of controllable propulsion system(s).	2400	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Loiter Attack Munition-Aviation (LAM-A) – This Congressional add in FY03 funded stabilized test vehicle flight tests from a helicopter rail; continued turbofan engine development testing and performed simulations to refine and optimize command and control techniques. In FY04, this add generates force-on-force simulation exercises with warfighters, performs hardware-in-the-loop simulations with flight hardware, completes system vulnerability and turbofan propulsion studies, continues the aircraft cockpit integration design, tests breadboard high-bandwidth data-link hardware; and prepares for control vehicle test flights of a long-range, precision-strike weapon for the aviation forces. No additional funding is required to complete this project.	2810	3375	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1436	0
Totals	34136	49776	31245

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**655**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
655	HYPERVELOCITY MISSILE TD	38258	44556	52075	16265	13503	20974	22473

A. Mission Description and Budget Item Justification: Compact Kinetic Energy Missile (CKEM) ATD will enable the Future Force, including FCS, by providing overwhelming lethality with a small, light, fast hypervelocity compact kinetic energy missile. CKEM will 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 km. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**655**

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Compact Kinetic Energy Missile (CKEM) - In FY03, continued demonstration of critical hypervelocity technologies in operational environments; completed design trade studies and finalized design; fabricated and tested components/subsystems for advanced propulsion, enhanced lethality, miniaturized high-g guidance and control, and fully operational Inertial Measurement Unit (IMU). In FY04 incorporate demonstrated component technologies into an integrated system and continue to perform critical technology demonstrations and subsystem integration testing and evaluation including hardware-in-the-loop (HWIL) to validate performance models. Conduct full-scale lethality sled tests against advanced threat armors to evaluate penetrator design performance. Integrate advanced propulsion designs into competing missile configurations and complete guidance and control test vehicle flight to characterize performance. Perform a Preliminary Design Review (PDR) in mid FY04 to initiate Option 1 Missile Design, Integration and Controlled Flight Testing of the Advanced Technology Demonstration Contract. In FY05, will provide a detailed design and fabrication of a missile system that is traceable to a tactical system. Will provide fabrication, integration and flight-testing of at least two (2) Control Test Vehicle (CTV) missiles. Will conduct testing in a HWIL facility to verify performance for Critical Design Review (CDR). Will start Option II phase of the CKEM ATD to include fabricate and integrate and six guided flight tests.	37114	43293	52075
- CKEM Distributed Prototype Simulation – This one year Congressional add funded the design of high-bandwidth tool sets for use with simulation models to provide low-cost evaluation techniques for CKEM. No additional funding is required to complete this project.	1144	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1263	0
Totals	38258	44556	52075

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**704**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
704	ADVANCED MISSILE DEMO	1905	6187	6259	6493	0	5464	5440

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 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 develop a common fire control system for the Future Combat Systems (FCS) family of vehicles. The resulting Validated Fire Control Software Package, Enhanced Combat Decision Aid Software (ECDAS), will enable a commander or platform 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. 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 2003	FY 2004	FY 2005
- FC-NET - In FY04, design and mature technical fire control components through modeling and simulation. Start integration of the multi-weapon technical fire control architecture into the lethality module of the Crew integration and Automation Test Bed (CAT) Advanced Technology Demonstration (ATD). Demonstrate common technical fire control architecture in a manned ground vehicle and an unmanned armed ground vehicle in a virtual test environment. Continue to mature the Weapon-Target Pairing Algorithms currently identified as one of the 31 critical technologies for FCS. In FY05, develop a technical fire control interface to the tactical fire control infrastructure and finalize the Weapon-Target Pairing Algorithms. Demonstrate and test in a virtual simulation environment a distributed Technical Fire Control Architecture. This program uses technology developed under 0602303A Missile Technology.	0	4933	3384
- AMMPGM - In FY04, complete wind tunnel testing, fabrication and static testing of flight weight motor. In FY05, will complete ballistic flight testing of flight weight motor and will transition technology and designs to Advanced Precision Kill Weapon System (APKWS) Block II SDD. This program uses technology developed under 0602303A Missile Technology.	0	1074	2875
- M-72 LAW – This one year Congressional add demonstrated increased capability light anti-tank weapon (LAW) for Special Operations Forces in urban environments. No additional funding is required to complete this project.	1905	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	180	0
Totals	1905	6187	6259

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	28075	29662	25577	26696	27731	28622	32428
608	COUNTERMINE & BAR DEV	25450	21254	22628	23370	23817	24239	27668
64C	COUNTERMINE DEMONSTRATIONS (CA)	0	5433	0	0	0	0	0
683	ANTI-PERSONNEL LANDMINE (APL) ALTERNATIVES	2625	2975	2949	3326	3914	4383	4760

A. Mission Description and Budget Item Justification: The primary goal of this program element (PE) is to mature and demonstrate the sensor technologies required to detect mines, minefields, and obstacles to enable assured mobility for the high operational tempo (OPTEMPO) Future Force, and, where feasible, exploits opportunities to enhance Current Force capabilities. It also will provide the US Army with the capability for in-stride detection and breaching, close-in detection, area clearance, and neutralization of landmines. This PE 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 improvised explosive devices (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 landmine detection at very low false alarm rates. Efforts within this PE assess airborne mine detectors for contingency applications and mature lightweight plug-and-play detectors for use in mission specific applications. This PE explores alternative systems for anti-personnel landmines and innovative concepts for minefield clearance. Will conduct Advanced Concept Technology Demonstrations, Advanced Warfighting Experiments, and modeling and simulation activities to assess the effectiveness of system concepts. Efforts within this PE are closely coordinated with the U.S. Marine Corps. The program adheres to Tri-Service/Project Reliance Agreements on conventional air/surface weapons and ground 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). The PE contains no duplication with any effort within the military departments. Work in this PE is performed by the Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	28595	24552	25476
Current Budget (FY 2005 PB)	28075	29662	25577
Total Adjustments	-520	5110	101
Congressional program reductions		-279	
Congressional rescissions			
Congressional increases		5500	
Reprogrammings	-520	-111	
SBIR/STTR Transfer			
Adjustments to Budget Years			101

Change Summary Explanation: Funding - FY 2004 - Two Congressional adds totaling $5500 were added to this PE.

($1343) EDIT Advanced Landmine Detection, Project 64C. The purpose of this one year Congressional add is to demonstrate a handheld time-domain electro-magnetic sensor and imaging detector based on a Resonant Microstrip Patch Antenna technology. No additional funding is required to complete this project.

($3932) Advanced Demining Technology, Project 64C. The purpose of this one year Congressional add is to mature an integrated remote controlled mine detection and neutralization system used for demining operations. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**	**608**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
608	COUNTERMINE & BAR DEV	25450	21254	22628	23370	23817	24239	27668

A. Mission Description and Budget Item Justification: This project matures countermine technologies for integration into future Army systems. 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. The landmines being addressed include conventional and command detonated, including improvised explosive devices (IEDs), metallic and low/non-metallic construction. 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 at very low false alarm rates. 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 in temporally and spatially varying vegetation, soil, weather, and diurnal conditions. This project has the potential to provide advanced countermine capabilities to the mounted and dismounted soldier by adapting commercial or emerging technologies for standoff mine detection and neutralization. Detection technologies include, but are not limited to, wide band radar, acoustic, laser, explosive detection sensors, infrared and visual imagery, radio frequency, signal processing, electronic and physical mine marking. Neutralization technologies include chemical reactants, electromagnetic energy, and kinetic energy. The intent is to provide increased operational tempo and survivability for US Forces prior to their entry into harm's way. This project also evaluates area clearance systems under the Joint Area Clearance (JAC) Advanced Concept Technology Demonstration (ACTD) as a means to determine the best system for rear area and supply route clearance operations. These efforts support ACTDs, Army Warfighting Experiment, modeling and simulation assessments and defines potential system effectiveness. 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 Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Lightweight Airborne Multispectral Mine Detection System (LAMD) Program: In FY03, matured the mine detection aided target recognition (ATR) leveraged from the Marine Corps' Multi-Spectral Tactical UAV Program (Cobra Minefield Detection Program), hardware, workstations, and communication protocols to support the Airborne Standoff Minefield Detection System (ASTAMIDS) acquisition program managed by Program Manager Close Combat Systems (PM-CCS). Provided an active sensor as a plug and play candidate for ASTAMIDS upgrades for scatterable surface minefield detection and false alarm mitigation. Transitioned LAMD technology (WESCAM Advanced EOIR with Countermine Filter Wheel, RX detection algorithm, Triple Window Filter detection algorithm) to PM CCS in support of a successful ASTAMIDS Milestone B decision.	5328	0	0
Autonomous Mine Detection Sensors Program: In FY03, selected and evaluated sensor suite concept to be used against small anti-personnel landmines from a man portable robotic platform. In FY04, mature and demonstrate potential robotic standoff and forward looking dismounted technologies for anti-personnel mines. In FY05, will continue maturation and demonstration efforts; mature those technologies that have the greatest potential to meet requirements; demonstrate system prototypes for performance and application in relevant environments; build prototypes based on previous demonstrations; integrate technologies on Training and Doctrine Command (TRADOC) identified robotic platforms; and evaluate security of robotic control networks.	3005	5440	5070
FCS Standoff Mine Detection System: In FY03, demonstrated the potential for revolutionary improvements of operational tempo (OPTEMPO) in mined areas with the use of very lightweight forward looking airborne sensors on small unmanned aerial vehicles (UAVs) that detect anti-tank mines on roads and provide, through downlink, data to Future Force vehicles. In FY04, transition the two-color 6.2 airborne sensor; integrate the sensor on a stabilized vertical takeoff and landing (VTOL) platform and demonstrate performance. This effort also will advance aided target recognition (AiTR) efforts and integrate them on organic aerial vehicles (OAV) for demonstration. In FY05, will establish baseline performance of bolt-on forward looking ground vehicle sensor and fusion AiTRs. Improve fusion AiTRs; and link airborne sensors with ground vehicle suite to demonstrate performance of the combined mine detection approach.	990	5690	5610

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Mine Detection False Alarm Reduction for Improved OPTEMPO: In FY03, evaluated scanning technologies and mine detection confirmation technologies to include wide band frequency radar and quadrupole resonance sensors for false alarm reduction performance on small overpass unmanned ground vehicles. Conducted testing of the Wichmann ground penetrating radar (GPR) 1.2 meter wide slanted antenna against anti-tank mines. Conducted ground pressure distribution testing of wide profile low pressure tires and rims for overpass capability and integrated low profile Advanced Wideband GPR on experimental unmanned ground vehicle (XUGV). Using the Wichmann radar, completed first round of blind testing at temperate and arid test sites, demonstrated 100x improvement in false alarm rate with high probabilities of detection. In FY04, mature and evaluate these sensor mine detection technologies, ATRs, and signal processing techniques associated with each technology to improve robustness. Integrate the most promising combination scanning/confirmation capabilities on a surrogate recon vehicle to demonstrate overpass capability and false alarm reduction performance.	7708	9110	0
The Joint Area Clearance (JAC) ACTD: In FY03, conducted operational demonstrations and a military assessment of candidate clearance systems. In FY04, transition technologies found to have military utility to Program Manager Close Combat Systems and Marine Corps Systems Command.	2393	510	0
Mine Neutralization for Assured Mobility. In FY05, mature and demonstrate concepts for minefield neutralization such as small shaped charges or directed small arms fire to cover a wide variety of mine types including both anti-tank and anti-personnel mines, and reduce the logistics burden for neutralization hardware for the Army.	0	0	3060
Airborne IED/Mine Detection. In FY05, design, mature and demonstrate sensors appropriate for aerial detection of buried and surface mines and improvised explosive devices (IEDs) from helicopters and unmanned aerial vehicle (UAV) platforms with an emphasis on infrared and TV change detection. Mature algorithms to automate the Change Detection Work Station (CDWS) to improve throughput rates.	0	0	4908
Countermine On The Move. In FY05 will complete the maturation of a faster wideband ground penetrating radar integrated with a nuclear quadrupole resonance confirmation sensor for higher rates of advance. Perform operational assured mobility simulations of countermine systems comprising interactive components such as unmanned aerial vehicles, manned aircraft, and forward looking sensors.	0	0	3980
Electromagnetic-wave Detection and Imaging Transceiver Landmine Detection: This one-year Congressional add demonstrated the combat utility of a handheld detector integrated with the newly matured Micro-electromechanical Systems (MEMS) accelerometer for self contained sensor-head tracking. No additional funding was required to complete this project.	1722	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Landmine Detection Using Terahertz Radiation Technology: This one-year Congressional add demonstrated a high power (peak and average) compact and portable, particle accelerator based, THz radiation source that produces THz imagery. No additional funding was required to complete this project.	957	0	0
Advanced Demining Technology: This one-year Congressional add demonstrated a remotely operated mine detection and mine clearing system. No additional funding was required to complete this project.	3347	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	504	0
Totals	25450	21254	22628

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**	**683**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
683	ANTI-PERSONNEL LANDMINE (APL) ALTERNATIVES	2625	2975	2949	3326	3914	4383	4760

A. Mission Description and Budget Item Justification: This project is part of the Antipersonnel Landmine Alternatives (APLA) effort and provides technology demonstrations of alternative systems that minimize the risk of injury or loss to non-combatants from exposure to anti-personnel landmines (APLs). This includes alternatives to anti-personnel sub-munitions used in mixed anti-tank (AT) landmine systems. The alternatives will include distributed anti-personnel surveillance systems (autonomous seismic, acoustic, and day/night imaging sensor systems), command and control systems (networked, wireless, sensor communications, and information management tools) to be used with man-in-the-loop overwatch fires. Will evaluate and mature alternatives in parallel in order to provide similar capabilities that are currently provided by APLs and APL sub-munitions in mixed Anti-Tank systems. Will use distributed simulation to evaluate new concepts and modify doctrine. Will construct and evaluate model 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 Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Anti-Personnel Landmine Alternatives. In FY03, matured component technologies, and addressed interoperability issues and the transition to Program Managers. In FY04, mature technologies, establish detection and identification distances against dismounted troops, and initiate a study for the concept on networked personnel detection nodes. In FY05, will complete maturation of secure inter-field and intra-field radios for weapons control, explore alternative miniature low cost communications devices, complete the concept study, and demonstrate a networked personnel detection node in a relevant environment.	2625	2889	2949
Small Business Innovative Research/Small Business Technology Transfer Programs	0	86	0
Totals	2625	2975	2949

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603607A - JOINT SERVICE SMALL ARMS PROGRAM**	**627**

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
627 JT SVC SA PROG (JSSAP)	16396	9575	5968	6844	7160	7303	7470

A. Mission Description and Budget Item Justification: This Program Element matures and demonstrates advanced technologies that integrate into individual and crew-served weapons to provide greater lethality, utility and range at a significantly reduced weight for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Efforts include: the Objective Crew-Served Weapon (OCSW) Advanced Technology Demonstration (ATD); and Objective Individual Combat Weapon (OICW) System Enhancement; and the Lightweight Machine Gun and Ammunition (LMGA). OCSW demonstrated the next generation crew-served weapon with improved combat effectiveness by being able to hit protected personnel targets in defilade (obscured or non-visible), and over 60% reduced weight when compared to the MK19 grenade machine gun and M2 machine gun it will replace. The OICW system enhancement efforts will mature, demonstrate and transition lethality-enhancing and cost/weight-reducing technologies into the OCSW and OICW. The LMGA, complementing both the highly lethal OICW and OCSW will offer significantly reduced weight over the currently fielded M249 Squad Automatic Weapon and its associated ammunition. This weapon will lighten the soldier's load, provide improved battlefield mobility and reduced logistics burden to maximize operational utility and survivability, while maintaining current levels of performance. All Joint Service Small Arms Program (JSSAP) efforts follow the Joint Service Small Arms Master Plan (JSSAMP) and Service Mission Need Statements and 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). The program element contains no duplication with any effort within the Military Departments. Work is performed by the US Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Work in this PE is derived and fully integrated with the 6.2 efforts found 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 Soldier, Project Manager Soldier Weapons, Product Manager (PM) Crew Served Weapons, PM Individual Weapons, USMC Director, Ground Weapons; and US Special Operations Command (SOCOM).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
OCSW: In FY03, demonstrated accuracy and functionality of air-bursting high explosive munition; fabricated test quantities of munitions; conducted environmental testing of weapon; extended limits of man-rated firing; conducted final system integration test; conducted system acceptance test. Completed ATD. Provided technical support to OCSW Milestone B decision review.	3148	0	0
OCSW .50 Caliber Variant: In FY03, efforts focused on developing and test firing a .50 cal variant of the weapon resulting in a significant cost saving for reliability testing and a new weapon variant for potential field use to replace the existing M2 machine gun.	3500	0	0

Accomplishments/Planned Program B(continued)	FY 2003	FY 2004	FY 2005
OICW System Enhancement: In FY03, performed Microelectrical Mechanical Systems (MEMS) based Safe & Arm (S&A) and fuze integration and initiated fuze/warhead performance and safety tests. In FY 04, continue OICW 20mm system integration, conduct test firing of MEMS S&A in test barrel and demonstrate in the XM29; will quantify production costs.	2400	4236	0
LMGA: In FY04, award contracts to design a lightweight, reliable machine gun and ammunition. In FY05, will conduct initial integration tests with OFW Lead Technology Integrator and down select to final weapon design; build and test initial weapon and ammunition components.	0	1732	5968
OCSW: This one year Congressional add reduced risk in the System Development and Demonstration Phase by further maturing the OCSW airburst fuze; demonstrated a fully integrated airburst round; further increased the reliability of the system and support the conduct of OCSW Milestone B.	3341	0	0
Anti-material Sniper Rifle (AMSR): This one year Congressional add evaluated weapon technologies in the areas of light weight materials, recoil mitigation and energy recovery and demonstrated these in a 25mm Anti-Material Sniper Rifle technology based on the XM107 .50 caliber Sniper Rifle, which is compatible with the XM307, Objective Crew Served Weapon Ammunition. The FY04 Congressional add addresses the building and safety certification of additional prototype weapons; the design, development, fabrication and testing of 25mm OCSW, and AMSR-compatible light armor piercing ammunition; and overall system demonstration of the XM109 AMSR in conjunction with several User components	4007	3352	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	255	0
Totals	16396	9575	5968

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603607A - JOINT SERVICE SMALL ARMS PROGRAM**	**627**

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	12998	6193	5979
Current Budget (FY 2005 PB)	16396	9575	5968
Total Adjustments	3398	3382	-11
Congressional program reductions		-82	
Congressional rescissions			
Congressional increases		3500	
Reprogrammings	3398	-36	
SBIR/STTR Transfer			
Adjustments to Budget Years			-11

Significant Change Explanation.
FY03 - Funds increased to support OCSW acceleration.
FY04 - One FY04 Congressional add totaling $3500 was added to the PE.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603654A - Line-Of-Sight Technology Demonstration**	**460**

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
460 LOSAT TECHNOLOGY DEMO	29931	8739	0	0	0	0	0

A. Mission Description and Budget Item Justification: Line-of-Sight Anti-Tank (LOSAT) and the Kinetic Energy Missile (KEM) technology provides light forces needed lethality and the foundation for the Future Force Kinetic Energy Missile integration This program focuses on the integration of the LOSAT weapon system into a light, early deployable configuration in order to help remedy the urgent need for the early entry force lethality shortfall against heavy armor in support of the Army Transformation. The LOSAT weapon system consists of a kinetic energy (KE) missile launcher mounted on a heavy High Mobility Multi-purpose Wheeled Vehicle (HMMWV) chassis. LOSAT offers a highly mobile, near-term, advanced capability for overwhelming armor destruction with a high rate of fire, increased range, and increased force survivability. LOSAT, deployed in the early entry force, will provide the decisive edge to win swiftly with minimum casualties and provides an assault support weapon capability. LOSAT is strategically and tactically deployable, giving Commanders and decision makers greater flexibility. Once in theater, LOSAT is extremely mobile and can be dropped or sling loaded under CH-47 and UH-60L aircraft. The performance of this hypervelocity kinetic energy missile (velocity of a mile per second) is not affected by the proliferation of emerging threat active protective systems and enhanced reactive armors, which are both rapidly becoming available on the global marketplace. LOSAT was initiated as a DoD-approved Advanced Concept Technology Demonstration (ACTD) program in FY 1998 to position the technology for future acquisition decisions; demonstrate subsystem capabilities in flight tests and dirty battlefield environments; evaluate the utility of the LOSAT technology for the early entry forces; demonstrate an integrated HMMWV-based LOSAT system in-flight tests and advanced war fighting experiments; and evaluate affordability issues. The ACTD program is a cost-effective means to assess the operational value of LOSAT to the early entry force through deployment with the XVIII Airborne Corps while longer-term applied research efforts continue for a small Compact Kinetic Energy Missile and an objective Future Combat 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 is performed at the Program Executive Office for Tactical Missiles, Redstone Arsenal, AL. In December 1999, the Army and OSD funded the LOSAT accelerated advanced development and procurement as part of the Army Transformation by adding additional design activities, reducing risk, completing system qualification testing, and adding additional Operational tests to support transition to limited production of the LOSAT Weapon System, with entry into Low Rate Initial Production (LRIP) starting in FY 2004.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
In FY03 supported system ground and flight qualification tests, safety certification, and man-rating assessment.	5130	0	0
In FY03-04, fabrication, assembly, qualification and test support for 12 prototype Fire Units.	12606	1694	0
In FY03-04, fabrication, assembly, qualification testing,and flight testing of 37 prototype missiles.	10315	6791	0
In FY03, completed and certified Fire Unit and Missile software design, code, unit level test, and system level test.	880	0	0

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603654A - Line-Of-Sight Technology Demonstration**	**460**

Accomplishments/Planned Program B(continued)	FY 2003	FY 2004	FY 2005
In FY03, supported Early Soldier involvement training and execute force on force Dismounted Battlespace Battlefield Lab Demonstration.	1000	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	254	0
Totals	29931	8739	0

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	26955	8847	0
Current Budget (FY 2005 PB)	29931	8739	0
Total Adjustments	2976	-108	0
Congressional program reductions		-75	
Congressional rescissions			
Congressional increases			
Reprogrammings	2976	-33	
SBIR/STTR Transfer			
Adjustments to Budget Years			

Significant Change Explanation.
FY03 - Funds increased to support the LOSAT Technical Demonstration.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603710A - NIGHT VISION ADVANCED TECHNOLOGY

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	77129	84066	50071	60779	60493	49593	47009
590	OVERWATCH ACTD	0	1844	5797	1350	482	0	0
C65	DC65	2737	9181	5966	6251	4467	3332	3406
C67	DC67	5616	0	0	0	0	0	0
K70	NIGHT VISION ADV TECH	44636	27326	19977	24279	27112	31165	31130
K73	NIGHT VISION SENSOR DEMONSTRATIONS (CA)	0	37586	0	0	0	0	0
K86	NIGHT VISION, ABN SYS	24140	8129	18331	28899	28432	15096	12473

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, exploits opportunities to enhance Current Force capabilities. The Networked Sensors for the Future Force program will provide a system of networked, low-cost, distributed unmanned sensors for close-in battlefield situational awareness, a cost effective targeting system (CETS) for autonomous target acquisition, and sensors for organic unmanned aerial vehicles for beyond-line-of-sight targeting in areas shadowed by terrain features. The Disposable Sensors program will demonstrate new lightweight low-cost unattended ground sensors that will provide increased situational awareness and force protection capabilities for the Future Combat Systems (FCS) and Objective Force Warrior (OFW). This program also demonstrates mission equipment packages for Class I and Class II unmanned air vehicles that enable small, lightweight, interchangeable payloads of varying sizes to support target detection, identification, and location for the Unit of Action. The Hyperspectral Airborne Multi-Mission Exploitation and Reconnaissance (HAMMER) effort demonstrates sensors and algorithms designed to detect mines and targets in camouflage, concealment and deception. The head tracked sensor suites program will demonstrate situational awareness for FCS infantry carriers operating in close-in complex terrain. The low power infrared (IR) sensors program demonstrated a lightweight, affordable day/night imaging capability. The Overwatch ACTD effort focuses on assessing the military utility and maturing concepts of operation to address counter ambush operations. This PE adheres to Tri-Service Reliance agreements on sensors and electronic devices, with oversight, and coordination provided by the Joint Directors of Laboratories. 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). The PE contains no duplication with any effort within the military departments. Work in this PE is performed by the 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 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	73609	47088	54635
Current Budget (FY 2005 PB)	77129	84066	50071
Total Adjustments	3520	36978	-4564
Congressional program reductions		-755	
Congressional rescissions			
Congressional increases		38050	
Reprogrammings	3520	-317	
SBIR/STTR Transfer			
Adjustments to Budget Years			-4564

Significant Change Explanation.
FY04 - Eight FY04 Congressional Adds totaling $38050 were added to the PE.
FY05 - Funds realigned ($4564k) to higher priority requirements.

FY04 Congressional Adds with no R-2A:
($4700) Advanced Passive Millimeter Wave Imager, Project K73. The purpose of this one year Congressional add is to demonstrate an all weather penetrating alternative to shorter wavelength infrared (IR) thermal imaging cameras. No additional funding is required to complete this project.

($8056) Buster Backpack Unmanned Aerial Vehicle, Project K73. The purpose of this one year Congressional add is to mature a low maintenance, fixed wing, fully autonomous aerial platform capable of carrying sensor payloads. No additional funding is required to complete this effort.

($1630) Camera Assisted Monitoring System (CAMS), Project K73. The purpose of this one year Congressional add is to design, develop, fabricate, inegrate, experiment, and demonstrate robust suites of mobile and fixed security capabilities, processes, and procedures. No additional funding is required to complete this effort.

($2398) Digital Night Vision Fusion, Project K73. The purpose of this one year Congressional add is to refine the design and conduct tests and evaluations of a digitally fused system comprised of a halo-free, 16mm image intensified (I2) complementary metal oxide semiconductor (CMOS) camera and a long wave infrared (LWIR) uncooled microbolometer sensor. No additional funding is required to complete this project.

($1438) Personal Miniature Thermal Vision (PMTV) System, Project K73. The purpose of this one year Congressional add is to mature a VOx 320 x 240 25 micron pixel miniature uncooled weapon sight and a prototype 640 x 480 uncooled camera. No additional funding is required to complete this effort.

($3357) Wire Detection, Wind Sensor and Obstacle Avoidance, Project K73. The purpose of this one year Congressional add is to mature a proof-of-concept hazard detection and warning system, using active millimeter wave technology, for low flying Army helicopter applications. No additional funding is required to complete this project.

($12227) Sensor Technology for Force Protection, Project K73. The purpose of this one year Congressional add is to use multiple sensor modalities (electro-optical, radar, communications, etc.) integrated in a tactical package for force protection/counter terrorism. No additional funding is required to complete this project.

($2685) Warfighter/Firefighter Position, Location and Tracking, Project K73. The purpose of this one year Congressional add is to continue development of a system capable of guiding Fire and Rescue Personnel to within one meter (Search Sweep Radius) of their objective within and around a fire scene building, and to investigate the miniaturization of the electronics and extending the range for use as a military system to track individual Soldiers along with maneuver elements. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**590**

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
590 OVERWATCH ACTD	0	1844	5797	1350	482	0	0

A. Mission Description and Budget Item Justification: This project matures the technology and capability to provide real-time detection, location, and classification of small arms, mortars, and rocket propelled grenades (RPGs) in complex terrain and demonstrates the capability within an Advanced Concept Technology Demonstration (ACTD) by providing the information to the warfighter for action. This ACTD focuses on assessing the military utility and developing concepts of operation addressing mobile force protection for unit of action forces involved in operations across the spectrum of conflict, from close combat to peacekeeping operations by locating enemy activity and real-time reporting of counter targeting information. The ACTD will mature and integrate a sensor/processor suite containing mid-wave infrared sensor, long-wave infrared imaging sensor, laser ranger/designator on a HMMWV with the appropriate C4I interfaces to disseminate information. Final product for the ACTD is a technology demonstrator to determine operational utility and deliver system performance specifications in support of the Future Combat Systems and Future Force requirements. Work in this ACTD is performed by the Army Space and Missile Defense Command and the US Army CERDEC Night Vision and Electronic Sensors Directorate. Other agencies participating include the Office of the Secretary of Defense and the USMC.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- In FY04, mature Overwatch ACTD threat signature database to support real time classification algorithms for small caliber weapons; mature infrared sensor data read-out performance and integrate sensor/processor/laser rangefinder/network interfaces for initial full scale functionality test on a HMMWV. In FY05, will complete real time operational software, sensor shooter interfaces and communications hardware integration and will demonstrate and evaluate the sensor/processor on a HMMWV. Will also continue hardware/software maturization and conduct initial full scale functionality tests, including capability to respond to threats from a full 360 degree region of concern.	0	1790	5797
Small Business Innovative Research/Small Business Technology Transfer Programs	0	54	0
Totals	0	1844	5797

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K70**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
K70	NIGHT VISION ADV TECH	44636	27326	19977	24279	27112	31165	31130

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. Where feasible, this project also exploits opportunities to enhance Current Force capabilities. This project will demonstrate ground-based aided target detection/recognition and long range laser target identification utilizing short wave infrared components integrated into a surrogate target acquisition sensor suite including gimbaled-scanned, second generation forward looking infrared (FLIR), day TV and laser range finder. The Multi-function Staring Sensor Suite (MFS3) effort demonstrated a compact, affordable sensor suite for long-range non-cooperative target identification applicable to ground vehicles, amphibious assault vehicles and surface ships. The Networked Sensors for the Future Force (NSfFF) Advanced Technology Demonstration (ATD) will demonstrate beyond-line-of-sight day/night targeting and situational awareness by demonstrating sensors and software that complement higher echelon surveillance for the Future Force. The NSfFF effort will also demonstrate next-generation, distributed, unattended ground sensor systems (UGS) incorporating low-power infrared imaging and robust networking/communication technologies; a cost effective targeting sensor (CETS) for unmanned targeting, a new generation of low cost distributed unmanned networked sensor systems organic to the reconnaissance, surveillance and target acquisition (RSTA) team; and remote monitoring of an area of interest out to ~10km. The Third Generation Infrared Technology effort will demonstrate the combat overmatch benefits of third generation infrared technology; 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 horizontal technology integration (HTI) efforts to use standard components across multiple applications for cost savings. The Target Acquisition Sensor Suite (TASS) effort will demonstrate ground-based aided target detection/recognition utilizing active short wave infrared components for long range identification. The Disposable Sensors effort will mature and demonstrate a new class of lightweight, very low-cost, disposable UGS systems that can be remotely delivered or hand emplaced and utilize various sensor technologies (acoustic, seismic, magnetic, infrared, imaging, environmental, and electronic/radio frequency) and algorithms to improve target detection, target identification, multi-target tracking, and information management. The Head Tracked Sensor Suite effort will demonstrate a day/night 360 degree x 90 degree dome of situational awareness coverage, enabling connectivity with the dismounted infantry during closed hatch operations. The horizontal technology integration (HTI) forward looking infrared (FLIR) effort will mature the prototype 3rd Generation HTI FLIR system components as a form/fit/function of the Future Combat Systems Increment I, and long range line of sight combat vehicle sensor suites. 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 Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Network Sensors for the Future Force. In FY03, evaluated sensor cross-cueing through emerging command and control (C2) tools. Analyzed operational feedback and integrated into Program Manager-FCS system architecture. Collected field data to assess the technical readiness level for a small-UAV targeting sensor including Defense Advanced Research Project Agency (DARPA) Airborne Video Surveillance software. Demonstrated UGS/CETS/SUAV/FSCS cross cueing. Designed/fabricated and deployed mobile RSTA hub for command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) on-the-move. In FY04, complete hardware fabrication and integrate novel low-cost targeting sensor systems on the unmanned ground vehicle (the Cost Effective Targeting System (CETS)). Also in FY04, fabricate and install an advanced sensor package on a small unmanned aerial vehicle, and demonstrate a robust network of more than 50 unattended ground sensor nodes that is capable of sustaining partial damage or incapacitation by an enemy and reacting independently to ensure continuing flow of RSTA information to command and control points (i.e. is "self-healing"). In FY05, will complete integration of sensor management and acoustic/seismic planning tools into surrogate Future Combat System RSTA demonstrator platform, investigate dismounted reconnaissance team C2 configuration, conduct ATD demonstration, and finalize specifications for system transition.	8510	16006	9070
Head Tracked Sensor Suite (HTSS). In FY03, demonstrated capability of critical components used in the head tracked system for achieving closed hatch situational awareness (SA) and connectivity for coordinated fights. Conducted concept exploration phase demonstration to improve target handoff from dismounted soldier to mounted forces. In FY04, integrate laser coding, intrusion detection, situational awareness network interface, and high performance FLIR into the HTSS. Integrate HTSS onto a combat vehicle and demonstrate HTSS image fusion, coded laser pointing and SA network integration. In FY05, will conduct limited user test and perform analysis of results to verify operability and utility.	1991	4760	3160
Low Power Uncooled Infrared Sensor(LPUIR). In FY03, conducted integration and demonstration of large format uncooled thermal imaging cameras and weapon sights. Demonstrated live fire testing of LPUIR weapon sights on M2 (.50 cal) and M4 (5.56) weapons.	3856	0	0
Multi-Function Staring Sensor Suite (MFS3). In FY03, demonstrated 9X increase in search rate, 10X increase in azimuth field of regard and 2.8 X increase in identification range. Completed integration of MFS3 hardware into testbed platform.	1979	0	0
Joint Intelligence, Surveillance, and Reconnaissance (JISR) Program. In FY03, provided Sensor Interface and Management Support (SIAMS) simulation support to JISR demonstration and evaluation in warfighter exercises.	400	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Disposable Sensors. In FY04, establish disposable sensor testbed to explore novel unattended ground sensor system concepts and algorithms for detection, classification, and location of targets/events using techniques that can be ultra low cost. In FY05, will demonstrate novel system concepts and measure/predict performance parameters. Will conduct design and proof-of-principle hardware development for promising disposable sensor system concepts.	0	2390	3580
Target Acquisition Sensor Suite (TASS) Technology Maturity Demonstrator. In FY04, complete system modeling and design, sub-system interface definition, and forward looking infrared-aided target recognition (FLIR-AiTR) interface definition for FCS Reconnaissance, Surveillance, Target Acquisition (RSTA). In FY05, will complete system hardware integration and conduct imagery data collection at various test sites in order to exercise, optimize and test target recognition algorithms.	0	2590	2277
3rd Generation Infrared Technology. In FY04, begin modification to the original ground based Multifunction Staring Sensor Suite (MFS3) for insertion of a dual band manufacturing technology (Man Tech) dewar assembly and test MFS3 against low signature targets. In FY05, will integrate UAV detection and tracking and add the sensor to shooter linkage into network systems.	0	850	1890
Sensor Technology for Force Protection. This one-year Congressional add demonstrated an advanced mobile force protection system. No additional funding was required to complete this project.	10542	0	0
AN/TAS-4 Upgrade. This one-year Congressional add developed a new staring focal plane array for the AN/TAS-4. No additional funding was required to complete this project.	4055	0	0
Focal Plane Array (FPA) for Targeting and Fire Control. This one-year Congressional add demonstrated a multi-color, multi-functional, and multi-spectral FPA. No additional funding was required to complete this project.	2385	0	0
Warfighter/Firefighter Position, Location, and Tracking Project: This one-year Congressional add demonstrated a system to locate friendly units in military operations in urban terrain (MOUT) and complex urban terrain. No additional funding was required to complete this project.	2004	0	0
Personal Miniature Thermal Vision System. This one-year Congressional add matured and demonstrated a miniature 320x240 uncooled IR camera. No additional funding was required to complete this project.	954	0	0
Helmet Mounted Infrared Sensor System. This one-year Congressional add matured a system to provide Department of Defense firefighters with lightweight, low power multipurpose uncooled thermal imaging capabilities. No additional funding was required to complete this project.	954	0	0
Camera Assisted Monitoring System (CAMS). In FY03, this one year congressional add demonstrated a mobile sensor system that includes on-board sensors, unattended ground sensors, visible, and thermal imaging devices. No additonal funding was required to complete this project.	4000	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Digital Fusion. This one-year Congressional add matured a digitally-fused, halo-free 16mm image intensified (I2) complementary metal oxide semiconductor (CMOS) camera and a long wave infrared (LWIR) uncooled microbolometer. No additional funding was required to complete this project.	3006	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	730	0
Totals	44636	27326	19977

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K86**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
K86	NIGHT VISION, ABN SYS	24140	8129	18331	28899	28432	15096	12473

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) beyond today's tactical line-of-sight. This capability is critical to the survivability of the Future Forces' light maneuver forces. The technology efforts focus on improved targeting and night pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (ATR) capabilities for current and future helicopters (attack, scout, cargo, and utility). The Networked Sensors for the Future Force Advanced Technology Demonstration (ATD) project will mature multi mission (RSTA, Countermine) day/night targeting sensors and software for small unmanned aerial vehicles (UAV) for the Future Force. Technologies to be addressed include automated flight control and ultra-light payloads for UAVs. The mission equipment package for the Class II UAV will demonstrate small, lightweight, interchangeable payloads (electro-optical/infrared, laser radar) to support target detection, identification, and location of difficult targets for the Unit of Action. The mission equipment package for Class I UAVs will demonstrate very small, very lightweight, interchangeable payloads (electro-optic, thermal, acoustic, chemical) to support intelligence, surveillance, and reconnaissance requirements for the Unit of Action. The advanced night vision goggles (ANVG) ATD demonstrated a lightweight, low cost, very wide field of view, panoramic night pilotage capability and a fusion goggle capability for vehicle commanders increasing their target acquisition capability. The Hyperspectral Airborne Multi-Mission Exploitation and Reconnaissance (HAMMER) effort will conduct sensor and algorithm development to provide countermine and camouflage, concealment and deception (CC&D) detection and targeting. The Third Generation Infrared Technology effort will improve survivability and lethality by providing identification at detection ranges and will support horizontal technology integration (HTI) efforts to use standard components across different applications for cost savings. 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 Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Advanced Night Vision Goggle (ANVG). In FY03, demonstrated an integrated heads up display concept and optically fused infrared/image intensification for ground applications. Conducted field-of-view (FOV), weight, resolution, eye-relief and exit-pupil tradeoffs. Conducted lab, air and ground tests and evaluations, identified necessary refinements. Delivered prototype ANVGs for pilotage (2.3X FOV of current Aviators Night Vision Imaging System (ANVIS)).	2437	0	0
Hyperspectral Airborne Multi-Mission Exploitation and Reconnaissance (HAMMER) Program. In FY03, performed phenomenology analysis with long wave infrared (LWIR) data. Identified areas for improvement in algorithms used for minefield detection. Developed and improved algorithms to achieve better detection performance against camouflage, concealment and deception targets. In FY04, finalize design and build sensor. In FY05, will continue development and evaluation of countermine and target exploitation algorithms and implement in real time code.	819	950	1510
Network Sensors for the Future Force ATD. In FY03, integrated and demonstrated day/night targeting sensors on small UAVs and geo-registered imaging software. In FY04, integrate sensor prototypes, networked communication and sensor data management to form a network of distributed sensors. In FY05, will test the network system in an operational environment, conduct refinements based on test results, and demonstrate an optimized system.	5625	2250	5590
Mission Equipment Packages (MEP) for Class II Unmanned Aerial Vehicle (UAV). In FY04, establish sensor concepts and designs maximizing organic air vehicle utility. In FY05, will begin maturation of selected payload designs including ladar, TV and FLIR, and explore foliage penetration.	0	3307	8891
Third Generation Infrared Technology. In FY04, evaluate and quantify the applicability of advanced technologies based on visible, laser augmented short wave infrared (IR), mid wave (MW) IR and two-color Gen III thermal imaging for improved long range identification in airborne applications. In FY05, will conduct trade-offs and initiate detailed design work for most promising approaches based on the analyses conducted.	0	1420	2340
Passive Millimeter Wave Imager. This one year Congressional add demonstrated a passive see-through fog imaging capability to support a United States Special Operations Command (USSOCOM) aviation requirement. No additional funding was required to complete this project.	5722	0	0
Lightweight Man-portable Unmanned Aerial Vehicle. This one-year Congressional add matured a small UAV and miniaturized sensors, and conducted performance and reliability test and evaluations. No additional funding was required to complete this project.	9537	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	202	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Totals	24140	8129	18331

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	12694	20462	14666	12906	13826	14780	16225
002	ENVIRONMENTAL COMPLIANCE TECHNOLOGY	1725	1399	657	1346	1952	1999	2045
025	POLLUTION PREVENTION TECHNOLOGY	792	2333	2788	3252	3401	3483	3574
03E	ENVIRONMENTAL RESTORATION TECHNOLOGY	5890	11840	11221	8308	8473	9298	10606
03F	ENVIRONMENTAL QUALITY TECH DEMONSTRATIONS (CA)	0	2420	0	0	0	0	0
EM3	PROTON EXCHANGE MEMBRANE FUEL CELL DEMO	4287	2470	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to mature and demonstrate technologies that will 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 program element 0602720A (Environmental Quality Technology). This program includes technology demonstrations for: (1) restoration of sites contaminated with toxic and/or hazardous materials (such as unexploded ordnance [UXO]) resulting from Army operations; (2) pollution prevention to minimize the Army's use and generation of toxic chemicals and hazardous wastes; (3) compliance with environmental laws by control, treatment, and disposal of hazardous waste products; and (4) conservation of natural and cultural resources while providing a realistic environment for mission activities. This program demonstrates technological feasibility, assesses technology operability and producibility, and transitions technology from the laboratory to field use. Technologies developed by this program element will 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 will 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). Work in this program element is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi, and the U.S. Army Research, Development and Engineering Command that is headquartered at Fort Belvoir, Virginia.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	12846	15776	14897
Current Budget (FY 2005 PB)	12694	20462	14666
Total Adjustments	-152	4686	-231
Congressional program reductions		-188	
Congressional rescissions			
Congressional increases		4950	
Reprogrammings	-152	-76	
SBIR/STTR Transfer			
Adjustments to Budget Years			-231

Significant Change Explanation.
FY04 - Two FY04 Congressional adds totaling $4950 were added to this PE.

Projects with no R-2As:
- ($2398) PEM Demonstration Program, Project EM3: The objective of this one year Congressional add is to purchase, test and assess residential-sized PEM fuel cell systems for military applications. No additional funding is required to complete this project.
- ($2349) Environmental Compliance Technology (Defense Acquisition of Developmental Technology, Project 03F: The objective of this one year Congressional add is to develop, test and assess new military products by linking small businesses and military stakeholders. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**002**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
002	ENVIRONMENTAL COMPLIANCE TECHNOLOGY	1725	1399	657	1346	1952	1999	2045

A. Mission Description and Budget Item Justification: This project will mature and demonstrate technologies transitioned from program element 0602720A (Environmental Quality Technology), projects 048 and 896 that will assist Army installations in achieving environmental compliance. These technologies will 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. Technology demonstrated will also reduce the cost of training noise compliance issues for the Army, avoid reductions in availability of training facilities, and sustain the viability of testing and training ranges. Efforts under this project will 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. 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 Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
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. In FY03, demonstrated lead removal technologies that result in non-hazardous waste that leaches less than the U.S. Environmental Protection Agency criterion of 5 ppm lead. Demonstrated rotating media biofilter technology for control of hazardous air pollutants emissions from surface coating and cleaning operations. In FY04, mature and demonstrate zero emission control system for control of HAP emissions from chromium plating operations. In FY05, will mature and demonstrate complete emission control system for demil furnaces.	1725	1359	657
Small Business Innovative Research/Small Business Technology Transfer Programs	0	40	0
Totals	1725	1399	657

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**025**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
025	POLLUTION PREVENTION TECHNOLOGY	792	2333	2788	3252	3401	3483	3574

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 and processes to comply with existing and new national laws and local regulations, (2) demonstration of advanced technologies for the reuse and recycling of solid waste resulting from barracks and motor pool modernization programs required to meet the operational needs of the Future Force, and (3) demonstration of advanced technologies to eliminate or significantly reduce the environmental impacts that threaten the sustainment of rocket and missile propellant production and maintenance facilities, and training ranges. These propellant technologies are transitioned from program element 0602720A, project 895, and will ensure that advanced energetic materials required for FCS high performance munitions are developed that 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). Work in this project is performed by the Army Research Laboratory located at Aberdeen, Maryland, the U.S. Army Engineer Research and Development Center headquartered at Vicksburg, Mississippi, and the Aviation and Missile Research, Development and Engineering Center located at Huntsville, Alabama.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Sustainable Painting Operations – In FY03, reformulated, evaluated, qualified and implemented hazardous air pollutant (HAP) free rubber-to-metal bonding materials and procedures. In FY04, demonstrate HAP free general and high performance munitions coating materials. In FY05, will demonstrate HAP free solvents for depainting. Solid Waste Diversion - In FY04, mature demolition debris reduction technologies that enable materials' reuse and recycling. In FY05, will demonstrate advanced technologies for the reuse and recycling of solid waste resulting from barracks and motor pool modernization programs. Ordnance Manufacture, Maintenance, Use, and Surveillance - In FY05, will demonstrate benign propellant alternatives that eliminate or significantly reduce the environmental impacts associated with the manufacture, maintenance, use and surveillance of rocket and missile propellants.	792	2265	2788
Small Business Innovative Research/Small Business Technology Transfer Programs	0	68	0
Totals	792	2333	2788

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**03E**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
03E	ENVIRONMENTAL RESTORATION TECHNOLOGY	5890	11840	11221	8308	8473	9298	10606

A. Mission Description and Budget Item Justification: This project will mature and demonstrate technologies transitioned from program element 0602720A (Environmental Quality Technology), projects F25 and 835 that improve the Army's ability to achieve cost-effective environmental restoration of contaminated sites at its installations, active and inactive ranges, its rework and production facilities, and the battlefield. Technologies demonstrated within this project focus on reducing the cost of remediation of Army sites contaminated by hazardous/toxic material. Efforts under this project will enable the Army to prevent pollution of the air, soil, and groundwater at installations, ranges, facilities, and battlefield operations, and to comply with the myriad of Federal, state, and host country regulations dealing with contaminated soil and groundwater. This program includes demonstrations of proof of technological feasibility and assessments of operability and productivity, and includes technology transition from the laboratory to demonstration/validation funded under program element 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). Work in this project is performed by the U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Unexploded Ordnance (UXO) – In FY03, developed and initiated a demonstration plan for a series of UXO detection/discrimination multi-sensing and processing data acquisition/data analysis methods, each tailored to a specific set of site environmental conditions. In FY04, demonstrate an integrated suite of UXO detection multi-sensing and processing modes optimized for site-specific environmental characteristics. Fabricate an optimized multi-sensor and data fusion analysis UXO detection/discrimination system. Transition UXO detection/discrimination sensors and multi-sensing processes to the Army Environmental Center for demonstration/validation.	2003	919	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Hazard/Risk Assessment Tools for Military Unique Compounds – In FY03, validated comprehensive screening, toxicity, and bioaccumulation models and integrated into the Army Risk Assessment Modeling System (ARAMS). In FY04, complete version 2.0 of ARAMS containing higher order assessment methods (i.e., Geographic Information System based spatially explicit wildlife exposure model and contaminant fate and transport models). Demonstrate and validate a rigorous ARAMS that seamlessly links models of exposure/effects with toxicological data for multiple species. In FY05, will complete ARAMS version 2.1 with tutorials and case studies of cost effectiveness capable of assessing contaminant transport through multiple media types such as different soil types and predicting contaminant exposure and toxicity levels in humans and other organisms of concern.	3887	5403	3815
In Situ Remediation Technologies for Contaminated Groundwater and Soils – In FY04, demonstrate technologies for in situ physical and biological cleanup (in place without pumping or excavation) of explosive materials in groundwater and demonstrate commercial off-the-shelf technologies for monitoring and analyzing military unique compounds on site. In FY05, will evaluate at pilot scale levels advanced electro-kinetic treatment technologies for lead removal from soils; in situ reactive barriers and/or reactive barriers coupled with biodegradation for treating explosive materials in groundwater; and base hydrolysis for explosives contamination.	0	2644	3030
Characterization, Evaluation and Remediation of Distributed Source Contamination on Army Ranges – In FY04, demonstrate aggressive chemical metal treatment alternatives for small arms training ranges. Demonstrate recycling metal contaminated extracts for soils treatment systems. In FY05, will develop predictive model for distributed source contamination impacts on inactive and live fire training ranges. Will adapt and demonstrate hazardous wastes site restoration processes and techniques for application to distributed contamination sources on inactive and live fire ranges.	0	1610	3030
Long Term Monitoring Applications - In FY04, begin advanced development of on-site sensors and quantitative chemical analysis of military relevant contaminants for in situ, near real-time monitoring of environmental cleanup actions. In FY05, will continue development of cost-effective, long term monitoring systems that will greatly reduce the frequency of manual sampling and off-site laboratory analysis.	0	919	1346
Small Business Innovative Research/Small Business Technology Transfer Programs	0	345	0
Totals	5890	11840	11221

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603734A - Military Engineering Advanced Technology**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		13643	13106	3865	5358	6006	6149	6290
T08	COMBAT ENG SYSTEMS	2735	3396	3865	5358	6006	6149	6290
T13	STATIONARY POWER & ENERGY TECH DEMONSTRATIONS (CA)	10908	9710	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to mature and demonstrate advanced military engineering technologies that support the Future Force, and where feasible, exploits opportunities to enhance Current Force capabilities. Technologies demonstrated within this program element are transitioned from program element 0602784A (Military Engineering Technology). Joint Rapid Airfield Construction (JRAC) technologies will support the expedient upgrading of existing airfields and rapid construction of new contingency airfields. Current construction technologies take too long. JRAC's terrain based site selection algorithms, computer assisted construction equipment, and fast curing soil stabilization chemical technologies support Army force projection goals. The time required to double the throughput of a minimal airfield will be reduced from four to two days. 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 U.S. Army Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	13696	3441	3926
Current Budget (FY 2005 PB)	13643	13106	3865
Total Adjustments	-53	9665	-61
Congressional program reductions		-116	
Congressional rescissions			
Congressional increases		9830	
Reprogrammings	-53	-49	
SBIR/STTR Transfer			
Adjustments to Budget Years			-61

Significant Change Explanation.
FY04 - Four FY04 Congressional adds totaling $9830 were added to this PE.

FY04 Congressional Adds with no R2-As:
($9427) Stationary Power and Energy Technology Demonstrations, Project T13:

($1679) Canola Oil Fuel Center, Project T13: The purpose of this one year Congressional add is to test and assess fuel systems for military and civil stationary power applications. No additional funding is required to complete this project.

($2685) Solid Oxide Fuel Cell Development, Project T13: The purpose of this one year Congressional add is to test and assess fuel systems for military and civil stationary power applications. No additional funding is required to complete this project.

($3433) Fuel Cell Hybrid Generating System with Ramgen Jet Technology, Project T13: The purpose of this one year Congressional add is to test and assess fuel systems for military and civil stationary power applications. No additional funding is required to complete this project.

($1630) Fuel Cell Integration with Fuel-Flexible Infrastructure, Project T13: The purpose of this one year Congressional add is to test and assess fuel systems for military and civil stationary power applications. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603734A - Military Engineering Advanced Technology**	**T08**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T08	COMBAT ENG SYSTEMS	2735	3396	3865	5358	6006	6149	6290

A. Mission Description and Budget Item Justification: The objective of this project is to mature and demonstrate advanced military engineering technologies that support the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Technologies demonstrated within this project are transitioned from program element 0602784A (Military Engineering Technology), projects T40 and T42. Joint Rapid Airfield Construction (JRAC) technologies will support the expedient upgrading of existing airfields and rapid construction of new contingency airfields. Current construction technologies take too long. JRAC's terrain based site selection algorithms, computer assisted construction equipment, and fast curing soil stabilization chemical technologies support Army force projection goals. The time required to double the throughput of a minimal airfield will be reduced from four to two days. 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 Engineer Research and Development Center that is headquartered at Vicksburg, Mississippi.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Joint Rapid Airfield Construction – In FY03, selected promising new construction technologies to enhance airfield construction productivity and determined stabilizer technologies suitable for rapid stabilization of unsurfaced airfields. In FY04, demonstrate advanced airfield construction technologies that increase productivity and reduce pavement repair time and soil stabilization technologies for C-130 operations. In FY05, integrate advanced performance models and terrain data in airfield site selection.	2735	3297	3865
Small Business Innovative Research/Small Business Technology Transfer Programs	0	99	0
Totals	2735	3396	3865

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Tech**

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	26928	24731	31951	52647	53762	36778	30212
101	TACTICAL AUTOMATION	16035	15015	14803	19881	21325	21515	21509
1AA	TACTICAL COMPUTER SCIENCE DEMONSTRATIONS (CA)	1430	2766	0	0	0	0	0
1AB	SENSOR DEMONSTRATIONS (CA)	0	1976	0	0	0	0	0
243	SENSORS & SIGNALS PROC	9463	4974	17148	32766	32437	15263	8703

A. Mission Description and Budget Item Justification: This Program Element (PE) supports information dominance for the Army's Future Force. To gain and maintain battlefield dominance, the Future Force needs to understand, decide and act more rapidly than its adversaries. This PE will allow forces to more effectively collect, transfer and display digital information around the battlefield. It provides architectures and products to correct command and control (C2) deficiencies affecting rapid mobile, dispersed operations. It demonstrates technologies necessary for integrated battlefield situational awareness (SA), force synchronization, data correlation, tactical surveillance, and combat identification. Additionally, the technologies support split-based, on-the move (OTM) C2 operations, and multi-sensor payload for an A-160 class unmanned platform. The PE also addresses radar and signal processing. Technology solutions from this PE will be demonstrated in the Agile Commander Advanced Technology Demonstration (ATD).

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 related to and fully coordinated with PE 0602783A (Computer and Software Technology), PE 0602782A (Command, Control and Communications Technology), and PE 0602120A (Sensors and Electronic Survivability). Work in this PE is performed by the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	22153	20255	31565
Current Budget (FY 2005 PB)	26928	24731	31951
Total Adjustments	4775	4476	386
Congressional program reductions		-232	
Congressional rescissions			
Congressional increases		4800	
Reprogrammings	4775	-92	
SBIR/STTR Transfer			
Adjustments to Budget Years			386

Significant Change Explanation.
FY03 - Funds increased to support the LCMR Program.
FY04 - Two FY04 Congressional adds totaling $4800 were added to this PE.

FY04 Congressional Adds with no R-2As:
($2685) MVMNT Program for Simulation Based Operations, Project 1AA: The purpose of this one year Congressional add is to mature and demonstrate technologies enabling simulation based operation. No additional funds are required to complete this project.
($1919) Palletized Radar for Black Hawk Helicopters, Project 1AB: The purpose of this one year congressional add is to mature and demonstrate one palletized Synthetic Aperture Radar/Ground Moving Target Indicator radar and integrate on an UH-60. No additional funds are required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Tech**	**101**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
101	TACTICAL AUTOMATION	16035	15015	14803	19881	21325	21515	21509

A. Mission Description and Budget Item Justification: This project provides improved command and control architectures and technologies for Future 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 (S&T) solutions addressing: (1) digital transfer and display of horizontal battlefield situational awareness (SA) and a common view of the battlefield; (2) synchronization of combined and joint force operations; and (3) 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. The Agile Commander ATD will demonstrate digital hardware and software technologies that provide agile, rapidly deployable, split-based C2 operation. The Networked Sensors for the Future Force ATD will demonstrate flexible C2 technologies to enable the commander of a Unit Cell to manage multiple battlefield sensors, including those on unmanned air and ground platforms, in a timely, effective manner. Joint developer/warfighter demonstrations will be conducted in coordination with the Unit of Action, dismounted, battle command and combat service support battle labs. Products transition to the Program Executive Offices for integration.

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Distributed Command and Control (C2) On-the-Move: In FY03, demonstrated semi-automated Course of Action Analysis (COAA) and wargaming capabilities and web-based intelligent agents for execution monitoring. Matured initial mobile adaptive computing software, integrated and demonstrated with scaleable communications capabilities, to ensure C2 under varying operating conditions, both dispersed and while on-the-move. Participated in C4ISR On-The-Move testbed demonstrations; and matured and transitioned course of action (COA) and decision support software to PM Maneuver Control System (MCS) and automated data input software to PM-FBCB2. In FY04, demonstrate capability to monitor the execution of 100 events, task sensors, receive a fused sensor data picture, and enable networked sensors and fires. Develop and deliver decision support software to serve as the common component integrating multiple battlelabs in a series of collaborative experiments. Demonstrate adaptive command and control applications working within a quality-of-service communications network. In FY05, will mature a distributed collaboration software environment for use in complex and urban terrain and mature a set of web-based decision support and modeling and simulation tools for FCS and Army Future Force commanders to collaboratively plan coalition activities in highly mobile operations. Will design and build a cohesive, intelligent agent-based C2 and ISR module and demonstrate near real-time surveillance and reconnaissance information in support of Commander's Priority Intelligence Requirements.	13233	11403	4655
- Tactical Intelligence, Surveillance and Reconnaissance: Provide a real-time, integrated Red and Blue forces picture with the capability to drill down to the underlying sensor data, define battlespace visualization requirements, and adapt COA tools to integrate C2, intelligence and resource allocation data to reduce workload of mission planners. In FY03, demonstrated an integrated common C2 and intelligence database, battlespace visualization products, and associated COA tools.	2802	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Networked Unmanned Ground and Air Systems: Mature and demonstrate a networked battle management and unmanned system capability at the Unit of Action (UA) and lower echelons to allow soldiers to execute battle command with effective use of multiple air and ground unmanned systems. In FY04, evaluate maturity and applicability of existing technology in unmanned systems and establish a notional overall system architecture to enable the simultaneous Command and Control (C2) of multiple air and ground robotic systems. Integrate and demonstrate initial C2 tools for sensor mission planning for forward scouts that provide C2 for tactical networked sensors through the management of unmanned platform assets. In FY05, will conduct comparative tests of integration approaches from TARDEC, AMRDEC, ARL, and DARPA to determine critical functions needed to control unmanned assets at the UA. Will enhance and mature the C2 tools for the forward scout; mature modeling and simulation capability; and demonstrate C2 for networked sensors, including management of robotic sensor systems.	0	3392	4500
- Battle Information and Knowledge Exchange: Mature and demonstrate technologies to support the interfacing and information exchange management between unit of action/unit of employment (UA/UE) C2 software applications and Army, Joint, Coalition and National information systems. In FY04, analyze conceptual UE operational architectures being developed by TRADOC, with emphasis on connectivity and information exchange requirements between FCS systems and Joint, Interagency, and Multi-National information systems. In FY05, will test the architecture using candidate interface and information exchange technologies and distributed computing technologies for information management.	0	78	5648
Small Business Innovative Research/Small Business Technology Transfer Programs	0	142	0
Totals	16035	15015	14803

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Tech**	**243**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
243	SENSORS & SIGNALS PROC	9463	4974	17148	32766	32437	15263	8703

A. Mission Description and Budget Item Justification: The Army needs a single multi-role sensor with sufficient mobility to support early entry forces or contingency theaters. A full complement of battlefield sensors cannot currently be expediently deployed. 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 FCS 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 Foliage Penetration Radar Program will provide the Warfighter an all weather airborne capability to detect and locate tactical targets employing camouflage and foliage as deceptive tactics. The goal of the Eye in the Sky (EIS) program is to demonstrate a multi-function, integrated sensor payload, including 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 weather on manned and tactical unmanned aerial vehicles (UAVs), such as the A-160. Synergistic operation of sensors with on-board sensor management, correlation of data for an integrated operational picture will be matured with significant leveraging of signal processing achievements from industry, DARPA and other services.

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

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Multi-Mission Radar (MMR) and Foliage Penetrating Radar (FOPEN): In FY03, completed system design, critical design review and test and demonstration plans. Matured software and hardware components for subsystem to include signal processor and software algorithms. In FY04, perform integration for software and algorithm for target classification, mission sorting, and target queuing management. Perform hardware, software, and engineering test. In FY05, will perform Radar system test with dedicated targets. Will build and demonstrate efficient/lightweight transmitters and power supplies.	3391	4864	7579
– Eye-in-the-Sky: In FY05, will conduct Operational Concept Study for integration of multi-sensor payload for Class IV UAV; will begin Mission Management Module design and maturation for cross-sensor control and data correlation; will initiate the development of a simulation effort to identify means of autonomous sensor management to capitalize on sensor synergies and identify COTS/GOTS sensors for the multi-sensor payload.	0	0	5700
- Suite of Sense Through the Wall Systems for the Future Force (STTW): In FY05 will integrate prototype STTW systems with emerging FCS and Objective Force Warrior (OFW) network communications architecture to demonstrate transmission of STTW data on a real time basis. Will evaluate data transmission, dissemination and software tools. Will provide STTW performance model for incorporation into Battle Lab and OFW operational modeling and simulation. Will investigate technologies for personnel detection, concealed explosive detection and concealed weapons detection. Will establish techniques for detection of stationary personnel through light construction materials.	0	0	3869
- Automated Passive Propagation Sensor/Analyzer: This one year Congressional add demonstrated an automated weather data collection and measurement module that integrated into existing sensor systems. This information will be fed to existing intelligence gathering systems. No additional funding is required to complete this project.	952	0	0
- Lightweight Counter Mortar Radar: In FY03, developed and built two (2) prototype, man portable counter mortar radar systems capable of locating enemy mortar (81mm, 120mm) firing positions from 1-7 km for SOCOM. System improvements resulted in location accuracy within 100m and continuous 360° coverage. Prototype units used in live fire tests at Yuma Proving Grounds in Arizona and for CONOPs development.	5120	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	110	0
Totals	9463	4974	17148