UNCLASSIFIED

Supporting Data FY 1999 Budget Estimate
Submitted to Congress - February 1998

DESCRIPTIVE SUMMARIES OF THE

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

19980319 099

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)

"READINESS THROUGH MODERNIZATION"

DTIC QUALITY INSPECTED 3

VOLUME I

UNCLASSIFIED

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY FY 1999 FEBRUARY 1998

VOLUME I
Budget Activities 1, 2 and 3

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

DTIC QUALITY INSPECTED 3

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1999 RDT&E, ARMY
PROGRAM ELEMENT DESCRIPTIVE SUMMARIES

INTRODUCTION AND EXPLANATION OF CONTENTS

1. General. This section has been prepared for the purpose of providing information concerning the Army Research, Development, Test and Evaluation program. The Descriptive Summaries are comprised of R-2 (Budget Item Justification Sheet) and R-3 (RDT&E Program Element/Project Cost Breakdown) Exhibits which provide narrative information on all RDT&E program elements and projects for the FY 1997, 1998 and 1999 time period.

2. Relationship of the FY 1999 Budget Submission to the FY 1998 Budget submitted to Congress. This paragraph provides a list of program elements restructured, transitioned, or established to provide specific program identification.

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

OLD PE/PROJECT	NEW PROJECT TITLE	NEW PE/PROJECT
0601102A/S13, S14	Tele-Medicine/Soldier Status	0601102A/S19
0602105A, 0602120A,0602211A, 0602270A, 0602303A, 0602601A, 0602622A, 0602624A, 0602709A, 0602784A, 0602786A, 0603004A	Army After Next (AAN) Applied Research	0602308A/636
0602787A/870, 874, 878, 879	Tele-Medicine/Advanced Technology	0602787A/869
0602720A/829	National Defense Center for Environmental Excellence	0708045A/E31
0605601A/D699, 0605604A/D734, 0605706A/M542	Army Evaluation Center	0605716A/D302
0605802A/798	Armament Group Support	0605801A/M76
0203758A/D398	Force XXI Battle Command Brigade and Below (FBCB2)	0203759A/D120
0203802A/D701	Hydra 70 Engineering and Manufacturing Development	0604802A/D705

B. FY 1999 Developmental Transitions.

FROM PE/PROJECT	PROJECT TITLE	TO PE/PROJECT
0603313A/387	Multi-Purpose Individual Munition	0604802A/284

C. Establishment of New FY 1999 Program Elements/Projects. There are no major system new starts. Minor new initiatives for FY 1999, in addition to Congressionally directed initiatives for FY 1998, are shown below with asterisks. The remaining programs listed are outyear initiatives or restructures beyond FY 1999 or were previously funded from other Defense appropriations.

TITLE	PE/PROJECT
Passive Millimeter Wave Camera*	0602120A/A142
Dual Use Application Program (DUAP)	0602805A/A105
Commercial Technology to Reduce Costs*	0602720A/A908
Agriculturally Based Bioremediation*	0602720A/AF26
Computer Based Land Management*	0602720A/A917
Shortstop*	0602270A/A936
Best Centers*	0602720A/821
Pollution Prevention	0602720A/895
Themophotovoltaic Generator*	0602705AAJ04
Air Defense Alerting Device on Bradley Stinger*	0602601A/AH72
Simulation Laboratory*	0602601A/H74
Joint Robotic Development*	0602601A/AH58
Plastic Cased Ammo*	0602624A/AJ03
Climate Change Fuel Cell Technology*	0602784A/AT46
Hardened Materials*	0602105A/AHM1
Center for Geosciences and Atmospheric Research (CGAR)*	0602784A/AT48
Orthopedic Implant Research	0602787A/D919
Prostate Cancer Research*	0602787A/D920
Ovarian Cancer Research*	0602787A/D921
Joint Tactical Radio System	0604280A/D152
Outrider Unmanned Aerial Vehicle*	0603003A/464
Trajectory Correctable Munition*	0603004A/A233
ASTAMIDS*	0603606A/A674

C. Establishment of New FY 1999 Program Elements/Projects. (continued)

TITLE	PE/PROJECT
Stinger Universal Launcher*	0603003A/D448
Palletized Landing System Commercial Engine*	0603005A/A507
Metal Matrix Composites*	0603005A/A506
Volume Angiocat*	0603002A/D934
WRMAC Catheterization Lab*	0603002A/D931
Cooperative Teleradiology*	0603002A/D930
Artificial Lung Technology*	0603002A/D929
Advanced Trauma Care*	0603002A/D924
Prostate Diagnostic Image*	0603002A/D923
Emergency Telemedicine	0603002A/D922
Hypervelocity Missile TD	0603313A/A655
Commercial Operating and Support Savings Initiative (COSSI)	0604824A/D112
Auto Test Equipment Development	0604746/DL65
Combat Service Support Equipment – Engineering Development	0604804/DL43
Net Assessment Directorate	0605803A/M735
Munitions Survivability & Logistics	0605805A/D297
Tactical Unmanned Aerial Vehicle	0605204A/D114
Reliability, Maintainability and Sustainability (RMS)	0708045A/DE27

D. FY 1999 programs for which funding was shown in the FY 1998 President's Budget Submit (February 1997), but which are no longer funded.

PE/PROJECT	TITLE	BRIEF EXPLANATION
0602624A/H36	Fuze Technology	Program terminated
0603774A/598	LTASS	Funds transferred to system line.

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

0203735A/DC64	0602786A/AC60	0603322A
0203806A	0603003A/DB38/D391	0603710A/DC63/DC65
0203808A	0603005A/DC62/DC66	0603851A
0301359A	0603009A	0603854A/DC68
0602601A/AC83/DC84	0603013A	0604649A/DG15
0602104A	0603017A	0604328A/DC71
0602122A	0603018A	
0602712A/AC61	0603020A	

Department of the Army
FY 1999 RDT&E Program

Exhibit R-1

Summary

Date: Feb 1998

Thousands of Dollars

Summary Recap of Budget Activities	FY 1997	FY 1998	FY 1999
Basic Research	174,763	180,643	200,760
Applied Research	541,944	654,051	511,285
Advanced Technology Development	653,525	657,518	483,595
Demonstration and Validation	539,607	562,811	466,009
Engineering and Manufacturing Development	1,145,529	1,162,405	1,269,124
RDT&E Management Support	1,144,658	1,129,057	1,076,593
Operational Systems Development	715,889	678,794	773,179
Total Research Development Test & Eval Army	4,915,915	5,025,279	4,780,545

THIS PAGE INTENTIONALLY LEFT BLANK

Department of the Army
FY 1999 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 1998

Line No	Program Element Number	Item	Act	FY 1997	FY 1998	FY 1999
				Thousands of Dollars		
1	0601101A	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	1	14,108	13,678	14,902
2	0601102A	DEFENSE RESEARCH SCIENCES	1	117,041	121,827	137,399
3	0601104A	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	1	43,614	45,138	48,459
	Basic Research			174,763	180,643	200,760
4	0602104A	TRACTOR ROSE	2	2,987	0	6,000
5	0602105A	MATERIALS TECHNOLOGY	2	14,339	12,415	10,137
6	0602120A	SENSORS AND ELECTRONIC SURVIVABILITY	2	19,140	25,855	18,738
7	0602122A	TRACTOR HIP	2	7,796	7,018	11,685
8	0602211A	AVIATION TECHNOLOGY	2	20,637	22,211	29,746
9	0602270A	EW TECHNOLOGY	2	14,845	18,925	16,249
10	0602303A	MISSILE TECHNOLOGY	2	28,677	24,238	25,180
11	0602308A	MODELING & SIMULATION TECHNOLOGY	2	20,107	20,339	27,981
12	0602601A	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	2	34,272	60,162	40,107
13	0602618A	BALLISTICS TECHNOLOGY	2	39,248	40,042	31,115
14	0602622A	CHEMICAL, SMOKE AND EQUIP DEFEATING TECHNOLOG	2	2,193	3,577	5,116
15	0602623A	JOINT SERVICE SMALL ARMS PROGRAM	2	4,388	9,000	5,229
16	0602624A	WEAPONS AND MUNITIONS TECHNOLOGY	2	20,993	29,905	29,489
17	0602705A	ELECTRONICS AND ELECTRONIC DEVICES	2	23,756	24,464	22,329
18	0602709A	NIGHT VISION TECHNOLOGY	2	16,935	16,712	19,157
19	0602712A	COUNTERMINE SYSTEMS DEVELOPMENT	2	7,052	10,272	10,715
20	0602716A	HUMAN FACTORS ENGINEERING TECHNOLOGY	2	15,781	16,723	13,369
21	0602720A	ENVIRONMENTAL QUALITY TECHNOLOGY	2	50,019	56,131	13,842
22	0602782A	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	2	13,893	16,197	19,746
23	0602783A	COMPUTER AND SOFTWARE TECHNOLOGY	2	6,419	658	2,185
24	0602784A	MILITARY ENGINEERING TECHNOLOGY	2	37,505	50,802	37,488
25	0602785A	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	2	9,196	8,736	8,602
26	602786A	WARFIGHTER TECHNOLOGY	2	23,513	18,088	18,661
27	0602787A	MEDICAL TECHNOLOGY	2	106,131	160,376	67,255
28	0602789A	ARMY ARTIFICIAL INTELLIGENCE TECHNOLOGY	2	2,122	1,205	1,164
29	0602805A	DUAL USE APPLICATIONS PROGRAM	2	0	0	20,000
	Applied Research		2	541,944	654,051	511,285

Department of the Army
FY 1999 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 1998

Line No	Program Element Number	Item	Act	FY 1997	FY 1998	FY 1999
				Thousands of Dollars		
30	0603001A	WARFIGHTER ADVANCED TECHNOLOGY	3	23,211	34,361	32,969
31	0603002A	MEDICAL ADVANCED TECHNOLOGY	3	195,884	176,737	11,012
32	0603003A	AVIATION ADVANCED TECHNOLOGY	3	54,901	89,467	30,048
33	0603004A	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	3	27,661	25,444	24,555
34	0603005A	COMBAT VEHICLE AND AUTOMATIVE ADVANCED TECH	3	28,160	40,796	54,435
35	0603006A	COMMAND, CONTROL, COMM ADVANCED TECHNOLOGY	3	29,627	25,708	20,109
36	0603007A	MANPOWER, PERSONNEL AND TRAINING ADV TECH	3	4,289	2,910	3,021
37	0603009A	TRACTOR HIKE	3	16,123	13,441	9,873
38	0603013A	TRACTOR DIRT	3	2,679	0	57
39	0603017A	TRACTOR RED	3	8,221	5,399	4,590
40	0603020A	TRACTOR ROSE	3	4,845	10,859	2,016
41	0603105A	MILITARY HIV RESEARCH	3	17,080	2,629	5,710
42	0603238A	AIR DEFENSE/PRECISION STRIKE TECHNOLOGY	3	19,291	12,773	9,973
43	0603270A	EW TECHNOLOGY	3	6,480	7,929	11,508
44	0603313A	MISSILE AND ROCKET ADVANCED TECHNOLOGY	3	93,739	90,468	86,096
45	0603322A	TRACTOR GEM	3	6,123	5,991	4,408
46	0603606A	LANDMINE WARFARE AND BARRIER ADV TECHNOLOGY	3	26,899	31,581	21,944
47	0603607A	JOINT SERVICE SMALL ARMS PROGRAM	3	8,825	9,015	5,173
48	0603654A	LINE-OF-SIGHT TECHNOLOGY DEMO	3	9,533	4,845	20,099
49	0603710A	NIGHT VISION ADVANCED TECHNOLOGY	3	28,584	18,705	23,960
50	0603734A	MILITARY ENGINEERING ADVANCED TECHNOLOGY	3	19,678	19,574	13,564
51	0603772A	ADV TACTICAL COMPUTER SCIENCE & SENSOR TECH	3	21,692	18,886	18,456
52	0603780A	SERDP/ENVIRONMENT SECURITY TECHNOLOGY PROGRAM	3	0	0	54,419
53	0604280A	JOINT TACTICAL RADIO SYSTEM	3	0	10,000	15,600
		Advanced Technology Development		653,525	657,518	483,595
54	0603018A	TRACTOR TREAD	4	2,267	0	0
55	0603308A	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION	4	68,205	73,304	12,240
56	0603619A	LANDMINE WARFARE AND BARRIER - ADV DEV	4	27,164	24,299	6,778
57	0603627A	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-AD	4	5,573	0	0
58	0603639A	ARMAMENT ENHANCEMENT INITIATIVE	4	56,687	37,127	26,526
59	0603640A	ARTILLERY PROPELLANT DEVELOPMENT	4	8,103	8,258	0
60	0603645A	ARMORED SYSTEMS MODERNIZATION-ADVANCED DEVEL	4	1,612	1,945	0

Appropriation: 2040 A Research Development Test & Eval Army — Date: Feb 1998

Line No	Program Element Number	Item	Act	Thousands of Dollars FY 1997	FY 1998	FY 1999
61	0603649A	ENGINEER MOB EQUIP ADVANCED DEV	4	498	0	0
62	0603653A	ADVANCED TANK ARMAMENT SYSTEM	4	11,144	8,704	8,928
63	0603713A	ARMY DATA DISTRIBUTION SYTEM	4	25,699	20,526	17,281
64	0603745A	TACTICAL ELECTRONIC SUPPORT SYSTEMS - ADV DEV	4	3,837	0	0
65	0603747A	SOLDIER SUPPORT AND SURVIVABILITY	4	6,487	7,324	7,581
66	0603766A	TAC EXPLOIT OF NAT CAP (TENCAP)-DEM/VAL TIARA	4	24,714	19,566	0
67	0603774A	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	4	2,254	2,848	2,681
68	0603790A	NATO RESEARCH AND DEVELOPMENT (H)	4	9,495	8,866	11,161
69	0603801A	AVIATION - ADV DEV	4	10,648	13,696	7,487
70	0603804A	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	4	7,100	6,574	17,478
71	0603805A	CBT SERVICE SUPPORT CONTROL SYS EVAL & ANALYS	4	15,479	7,280	14,353
72	0603807A	MEDICAL SYSTEMS - ADV DEV	4	9,730	6,555	11,414
73	0603851A	TRACTOR EARL	4	2,922	1,851	966
74	0603854A	ARTILLERY SYSTEMS DEMONSTRATION/VALIDATION	4	232,288	314,017	313,166
75	0603856A	SCAMP BLOCK II (SPACE)	4	7,701	71	7,969
		Demonstration and Validation		539,607	562,811	466,009
76	0604201A	AIRCRAFT AVIONICS	5	17,706	31,660	7,878
77	0604220A	ARMED, DEPLOYABLE OH-58D	5	1,100	0	0
78	0604223A	COMANCHE	5	325,299	272,187	367,823
79	0604270A	EW DEVELOPMENT	5	69,067	84,180	85,989
80	0604321A	ALL SOURCE ANALYSIS SYSTEM	5	37,463	26,094	28,081
81	0604325A	FOLLOW-ON TO TOW	5	5,934	13,449	48,106
82	0604328A	TRACTOR EARL	5	1,484	11	1,788
83	0604604A	MEDIUM TACTICAL VEHICLES	5	5,719	3,614	0
84	0604609A	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ED	5	0	0	706
85	0604611A	JAVELIN (AWWS-M)	5	5,855	7,771	5,277
86	0604619A	LANDMINE WARFARE	5	25,355	19,189	23,189
87	0604622A	FAMILY OF HEAVY TACTICAL VEHICLES	5	4,906	4,845	0
88	0604633A	AIR TRAFFIC CONTROL	5	7,086	4,533	1,737
89	0604640A	ADVANCED COMMAND AND CONTROL VEHICLE	5	7,545	10,532	0
90	0604641A	TACTICAL UNMANNED GROUND VEHICLE	5	2,728	2,604	2,468
91	0604642A	LIGHT TACTICLE WHEELED VEHICLE	5	3,409	0	0

Department of the Army
FY 1999 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 1998

Line No	Program Element Number	Item	Act	FY 1997	FY 1998	FY 1999
				Thousands of Dollars		
92	0604645A	ARMORED SYSTEMS MODERNIZATION (ASM)-ENG DEV	5	6,408	0	4,500
93	0604649A	ENGINEER MOBILITY EQUIPMENT DEVELOPMENT	5	44,225	50,585	63,069
94	0604710A	NIGHT VISION SYSTEMS - ENG DEV	5	33,970	35,052	21,311
95	0604713A	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	5	73,404	60,053	62,218
96	0604715A	NON-SYSTEM TRAINING DEVICES - ENG DEV	5	46,142	82,965	64,035
97	0604716A	TERRAIN INFORMATION - ENG DEV	5	6,969	2,825	2,999
98	0604726A	INTEGRATED METEOROLOGICAL SUPPORT SYSTEM	5	0	1,887	1,790
99	0604739A	JTT/CIBS-M (TIARA)	5	4,588	4,360	4,447
100	0604741A	AIR DEFENSE C2I - ENG DEV	5	19,577	21,181	6,476
101	0604746A	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	5	8,868	8,220	7,030
102	0604760A	DISTRIBUTIVE INTERACTIVE SIMULATIONS ENG DEV	5	17,618	20,249	2,766
103	0604766A	TAC EXPLOIT NAT CAP (TENCAP)-EMD (TIARA)	5	14,839	17,807	44,674
104	0604768A	BRILLIANT ANTI-ARMOR SUBMUNITION(BAT)	5	161,583	229,389	134,858
105	0604770A	JOINT SURVEILLANCE/TARGET ATTACK RADAR SYSTEM	5	9,406	6,726	5,503
106	0604778A	POSITIONING SYS DEVEL (SPACE)	5	417	407	379
107	0604780A	COMBINED ARMS TACTICAL TRAINER (CATT)	5	29,420	12,880	7,533
108	0604801A	AVIATION - ENG DEV	5	4,331	4,951	6,599
109	0604802A	WEAPONS AND MUNITIONS - ENG DEV	5	21,567	14,611	37,725
110	0604804A	LOGISTICS & ENGINEER EQUIPMENT - ENG DEV	5	19,061	27,174	26,002
111	0604805A	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ED	5	13,315	10,710	16,404
112	0604807A	MEDICAL MATERIEL/MED BIO DEFENSE EQUIPMENT ED	5	4,570	4,345	5,338
113	0604808A	LANDMINE WARFARE/BARRIER - ENG DEV	5	9,342	13,818	46,905
114	0604814A	SENSE AND DESTROY ARMOR - ENG DEV	5	9,677	10,847	20,813
115	0604816A	LONGBOW	5	10,762	0	0
116	0604817A	COMBAT IDENTIFICATION	5	16,889	19,026	13,471
117	0604818A	ARMY TACTICAL COMM & CONT HARDWARE & SOFTWARE	5	35,495	19,184	32,929
118	0604820A	RADAR DEVELOPMENT	5	0	0	2,786
119	0604823A	FIREFINDER	5	2,430	2,484	19,822
120	0604824A	COSSI	5	0	0	33,600
121	0604854A	ARTILLERY SYSTEMS - ENGINEERING DEVELOPMENT	5	0	0	100
		Engineering and Manufacturing Development		1,145,529	1,162,405	1,269,124

Appropriation: 2040 A Research Development Test & Eval Army — Date: Feb 1998

Line No	Program Element Number	Item	Act	Thousands of Dollars FY 1997	FY 1998	FY 1999
122	0604256A	THREAT SIMULATOR DEVELOPMENT	6	11,146	16,480	11,935
123	0604258A	TARGET SYSTEMS DEVELOPMENT	6	9,661	11,328	13,127
124	0604759A	MAJOR TEST & EVALUATION INVESTMENT	6	39,698	39,200	40,284
125	0605103A	RAND ARROYO CENTER	6	20,550	16,534	16,718
126	0605301A	ARMY KWAJALEIN ATOLL	6	140,078	120,918	142,710
127	0605326A	CONCEPTS EXPERIMENTATION	6	0	0	17,441
128	0605502A	SMALL BUS INV RSCH/SMALL BUS TECH PILOT PROG	6	99,082	0	0
129	0605601A	ARMY TEST RANGES AND FACILITIES	6	128,036	118,327	119,553
130	0605602A	ARMY TECHNOLOGY & SUSTAINING INSTRUMENTATION	6	20,761	32,160	33,439
131	0605604A	SURVIVABILITY/LETHALITY ANALYSIS	6	29,362	31,308	30,498
132	0605605A	DOD HIGH ENERGY LASER SYS TEST FAC (HELSTF)	6	29,227	28,965	15,022
133	0605606A	AIRCRAFT CERTIFICATION	6	2,415	2,828	2,924
134	0605702A	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	6	6,278	6,235	6,691
135	0605706A	MATERIEL SYSTEMS ANALYSIS	6	14,006	27,755	9,711
136	0605709A	EXPLOITATION OF FOREIGN ITEMS	6	6,962	7,523	4,031
137	0605712A	SUPPORT OF OPERATIONAL TESTING	6	44,900	76,807	66,320
138	0605716A	ARMY EVALUATION CENTER	6	0	0	25,526
139	0605801A	PROGRAMWIDE ACTIVITIES	6	58,310	79,626	64,588
140	0605802A	INTERNATIONAL COOPERATIVE RESEARCH AND DEV	6	1,494	0	0
141	0605803A	TECHNICAL INFORMATION ACTIVITIES	6	16,465	14,673	16,251
142	0605805A	MUNITIONS STANDARDZION EFFECTIVENESS & SAFETY	6	3,083	11,064	8,497
143	0605853A	ENVIRONMENTAL CONSERVATION	6	1,874	1,723	3,195
144	0605854A	POLLUTION PREVENTION	6	13,413	5,187	8,694
145	0605856A	ENVIRONMENTAL COMPLIANCE-RDT&E	6	52,716	56,576	44,116
146	0605876A	MINOR CONSTUCTION (RPM) - RDTE	6	4,148	4,258	4,205
147	0605878A	MAINTENANCE AND REPAIR (RPM) - RDTE	6	66,869	83,751	49,233
148	0605879A	REAL PROPERTY SERVICES (RPS)	6	88,190	86,199	87,172
149	0605896A	BASE OPERATIONS-RDT&E	6	217,667	224,593	230,029
150	0605898A	MANAGEMENT HEADQUARTERS (RSCH & DEVELOPMENT)	6	18,035	25,039	4,683
151	0909999A	CLOSED ACCOUNT ADJUSTMENT	6	232	0	0
		RDT&E Management Support		1,144,658	1,129,057	1,076,593

Department of the Army
FY 1999 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 1998

Line No	Program Element Number	Item	Act	FY 1997	FY 1998	FY 1999
				Thousands of Dollars		
152	0102419A	AEROSTAT JOINT PROGRAM	7	25,680	33,011	103,937
153	0203726A	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	7	37,507	37,455	35,111
154	0203735A	COMBAT VEHICLE IMPROVEMENT PROGRAMS	7	203,653	161,497	94,756
155	0203740A	MANEUVER CONTROL SYSTEM	7	27,166	24,510	28,923
156	0203744A	AIRCRAFT MODIFICATIONS/PRODUCT IMPROV PROGRAM	7	21,836	21,567	26,681
157	0203752A	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	7	3,734	2,849	2,948
158	0203758A	DIGITIZATION	7	98,124	94,103	45,007
159	0203759A	FORCE XXI BATTLE CMD, BRIGADE & BELOW	7	0	0	52,469
160	0203761A	FORCE XXI WARFIGHTING RAPID ACQUISITION PGM	7	16,640	43,126	99,528
161	0203801A	MISSILE/AIR DEFENSE PRODUCT IMPRV PROGRAM	7	60,882	30,443	11,252
162	0203802A	OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS	7	13,570	1,216	1,248
163	0203806A	TRACTOR RUT	7	3,030	2,046	0
164	0203808A	TRACTOR CARD	7	6,588	6,373	3,993
165	0208010A	JOINT TACTICAL COMMUNICATIONS PROG (TRI-TAC)	7	17,747	21,105	35,941
166	0208053A	JOINT TACTICAL GRD STATION (TIARA)	7	2,022	5,001	12,229
167	0301359A	SPECIAL ARMY PROGRAM	7	10,929	7,315	6,537
168	0303140A	COMMUNICATIONS SECURITY (COMSEC) EQUIPMENT	7	3,048	11,771	7,433
169	0303142A	SATCOM GROUND ENVIRO (SPACE)	7	37,665	48,939	53,897
170	0303150A	ARMY GLOBAL C2 SYS	7	18,877	14,581	17,543
171	0305114A	TRAFFIC CNTL/APPROACH/LANDING SYS (JPALS)	7	0	728	0
172	0305128A	SECURITY AND INTELLIGENCE ACTIVITIES	7	464	484	950
173	0305204A	TACTICAL UNMANNED AERIAL VEHICLE	7	0	0	75,636
174	0603778A	MLRS PRODUCT IMPROVEMENT PROGRAM	7	61,721	36,171	20,244
175	0708045A	MANUFACTURING TECHNOLOGY	7	45,006	64,278	30,511
176	1001018A	NATO JSTARS - TIARA	7	0	10,225	6,405
		Operational Systems Development		715,889	678,794	773,179
Total		Research Development Test & Eval Army		4,915,915	5,025,279	4,780,545

TABLE OF CONTENTS

	PE	PROGRAM ELEMENT TITLE	PAGE
#1 - BASIC RESEARCH			
1	0601101A	In-House Laboratory Independent Research	1
2	0601102A	Defense Research Sciences	11
3	0601104A	University and Industry Research Centers	75
#2 - APPLIED RESEARCH			
4	0602105A	Materials Technology	97
5	0602120A	Sensors and Electronic Survivability	101
6	0602211A	Aviation Technology	111
7	0602270A	Electronic Warfare (EW) Technology	121
8	0602303A	Missile Technology	129
9	0602308A	Modeling and Simulation Technology	135
10	0602601A	Combat Vehicle and Automotive Technology	143
11	0602618A	Ballistics Technology	163
12	0602622A	Chemical, Smoke and Equipment Defeating Technology	173
13	0602623A	Joint Service Small Arms Program	175
14	0602624A	Weapons and Munitions Technology	177
15	0602705A	Electronics and Electronic Devices	187
16	0602709A	Night Vision Technology	195
17	0602712A	Countermine Applied Research	199
18	0602716A	Human Factors Engineering Technology	203
19	0602720A	Environmental Quality Technology	209
20	0602782A	Command, Control, Communications Technology	237
21	0602783A	Information and Communication Technology	243
22	0602784A	Military Engineering Technology	249
23	0602785A	Manpower/Personnel/Training Technology	267
24	0602786A	Warfighter Technology	273
25	0602787A	Medical Technology	285
26	0602789A	Army Artificial Intelligence Technology	313

TABLE OF CONTENTS

	PE	PROGRAM ELEMENT TITLE	PAGE
#2 - APPLIED RESEARCH - Continued			
27	0602805A	Dual Use Applications Program	315
#3 - ADVANCED TECHNOLOGY DEVELOPMENT			
28	0603001A	Warfighter Advanced Technology	317
29	0603002A	Medical Advanced Technology	331
30	0603003A	Aviation Advanced Technology	357
31	0603004A	Weapons and Munitions Advanced Technology	371
32	0603005A	Combat Vehicle and Automotive Advanced Technology	379
33	0603006A	Command, Control and Communications Advanced Technology	393
34	0603007A	Manpower, Personnel and Training Advanced Technology	407
35	0603105A	Military Human Immunodeficiency Virus (HIV) Research	411
36	0603238A	Air Defense/Precision Strike Technology	413
37	0603270A	Electronic Warfare (EW) Technology	419
38	0603313A	Missile and Rocket Advanced Technology	425
39	0603606A	Landmine Warfare and Barrier Advanced Technology	449
40	0603607A	Joint Service Small Arms Program	455
41	0603654A	Line-of-Sight Technology Demonstration	459
42	0603710A	Night Vision Advanced Technology	461
43	0603734A	Military Engineering Advanced Technology	469
44	0603772A	Advanced Tactical Computer Science and Sensor Technology	477
45	0603780A	Strategic Environmental Research and Development Program/Environmental Security Technology	485
46	0604280A	Joint Tactical Radio System	489
#4 - DEMONSTRATION AND VALIDATION			
47	0603308A	Army Missile Defense Systems Integration	491
48	0603619A	Landmine Warfare and Barrier - Advanced Development	501
49	0603627A	Smoke, Obscurant and Target Defeating System - Advanced Development	511

TABLE OF CONTENTS

	PE	PROGRAM ELEMENT TITLE	PAGE
#4 - DEMONSTRATION AND VALIDATION - Continued			
50	0603639A	Armament Enhancement Initiative	515
51	0603640A	Artillery Propellant Development	523
52	0603645A	Armored Systems Modernization - Advanced Development	527
53	0603649A	Engineering Modification Equipment - Advanced Development	535
54	0603653A	Advanced Tank Armament System	539
55	0603713A	Army Data Distribution System	545
56	0603745A	Tactical Electronic Support Systems - Advanced Development (TIARA)	557
57	0603747A	Soldier Support and Survivability	561
58	0603766A	Tactical Exploitation of National Capabilities (TENCAP) - Demonstration/Validation (TIARA)	577
59	0603774A	Night Vision Systems - Advanced Development	581
60	0603790A	NATO Research & Development	585
61	0603801A	Aviation - Advanced Development	595
62	0603804A	Logistics and Engineering Equipment - Advanced Development	609
63	0603805A	Combat Service Support Control Systems Evaluation and Analysis	637
64	0603807A	Medical Systems - Advanced Development	647
65	0603854A	Artillery Systems Advanced Development	661
66	0603856A	SCAMP BLKII (SPACE)	667
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT			
67	0604201A	Aircraft Avionics	671
68	0604220A	Armed, Deployable OH-58D	677
69	0604223A	Comanche	680
70	0604270A	Electronic Warfare (EW) Development	690
71	0604321A	All Source Analysis System (TIARA)	716
72	0604325A	Follow-On To TOW	728
73	0604604A	Medium Tactical Vehicles	732
74	0604609A	Smoke, Obscurant and Target Defeating System - Engineering Development	736
75	0604611A	Javelin	740

TABLE OF CONTENTS

	PE	PROGRAM ELEMENT TITLE	PAGE
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT - Continued			
76	0604619A	Landmine Warfare	744
77	0604622A	Family of Heavy Tactical Vehicles	748
78	0604633A	Air Traffic Control	754
79	0604640A	Advanced Command and Control Vehicle	758
80	0604641A	Tactical Unmanned Ground Vehicle	762
81	0604642A	Light Tactical Wheeled Vehicle	766
82	0604645A	Armored Systems Modernization (ASM) - Engineering Development	774
83	0604649A	Engineer Mobility Equipment Development	780
84	0604710A	Night Vision Systems - Engineering Development	792
85	0604713A	Combat Feeding, Clothing, and Equipment	808
86	0604715A	Non-System Training Devices - Engineering Development	834
87	0604716A	Terrain Information - Engineering Development (TIARA)	846
88	0604726A	Integrated Meteorological System (IMETS) (TIARA)	852
89	0604739A	JTT/CIBS-M (TIARA)	856
90	0604741A	Air Defense Command, Control, Intelligence - Engineering Development	860
91	0604746A	Automatic Test Equipment Development	864
92	0604760A	Distributive Interactive Simulations - Engineering Development	872
93	0604766A	Tactical Exploitation of National Capabilities (TENCAP) - Engineering & Manufacturing Development (TIARA)	886
94	0604768A	Brilliant Anti-Armor (BAT) Submunition	890
95	0604770A	Joint Surveillance/Target Attack Radar System	910
96	0604778A	Positioning Systems Development (SPACE)	916
97	0604780A	Combined Arms Tactical Trainer (CATT)	920
98	0604801A	Aviation - Engineering Development	924
99	0604802A	Weapons and Munitions - Engineering Development	930
100	0604804A	Logistics & Engineer Equipment - Engineering Development	960
101	0604805A	Command, Control, Communications Systems - Engineering Development	1002
102	0604807A	Medical Materiel - Engineering Development	1020

TABLE OF CONTENTS

	PE	PROGRAM ELEMENT TITLE	PAGE
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT - Continued			
103	0604808A	Landmine Warfare/Barrier - Engineering Development	1034
104	0604814A	Sense and Destroy Armor Munition - Engineering Development	1042
105	0604816A	Longbow	1050
106	0604817A	Combat Identification - Engineering & Manufacturing Development	1060
107	0604818A	Army Tactical Command and Control Hardware & Software	1074
108	0604820A	Radar Development	1084
109	0604823A	Firefinder	1088
110	0604824A	Commercial Operating & Support Savings Initiative (COSSI)	1094
111	0604854A	Artillery Systems - Engineering Development	1096
#6 - MANAGEMENT AND SUPPORT			
112	0604256A	Threat Simulator Development	1100
113	0604258A	Target Systems Development	1102
114	0604759A	Major Test and Evaluation Investment	1108
115	0605103A	Rand Arroyo Center	1116
116	0605301A	Army Kwajalein Atoll	1120
117	0605326A	Concept Experimentation Program	1124
118	0605601A	Army Test Ranges and Facilities	1126
119	0605602A	Army Test Technology and Sustaining Instrumentation	1142
120	0605604A	Survivability/Lethality Analysis	1150
121	0605605A	DOD High Energy Laser System Test Facility (HELSTF)	1168
122	0605606A	Aircraft Certification	1170
123	0605702A	Meteorological Support to Research, Development, Testing & Evaluation Activities	1172
124	0605706A	Materiel Systems Analysis	1176
125	0605709A	Exploitation of Foreign Items	1186
126	0605712A	Support of Operational Testing	1190
127	0605716A	Army Evaluation Center	1206
128	0605801A	Programwide Activities	1208

TABLE OF CONTENTS

	PE	PROGRAM ELEMENT TITLE	PAGE
#6 - MANAGEMENT AND SUPPORT - Continued			
129	0605802A	International Cooperative Research and Development	1214
130	0605803A	Technical Information Activities	1216
131	0605805A	Munitions Standardization Effectiveness and Safety	1232
132	0605853A	Environmental Conservation	1244
133	0605854A	Pollution Prevention	1250
134	0605856A	Environmental Compliance - Research, Development, Testing & Evaluation	1258
135	0605876A	Minor Construction - Research, Development, Testing & Evaluation	1266
136	0605878A	Maintenance and Repair - Research, Development, Testing & Evaluation	1274
137	0605879A	Real Property Services (RPS)	1282
138	0605896A	Base Operations - Research, Development, Testing & Evaluation	1288
139	0605898A	Management Headquarters (Research and Development)	1296
#7 - OPERATIONAL SYSTEM DEVELOPMENT			
140	0102419A	Aerostat Joint Program	1300
141	0203726A	Advanced Field Artillery Tactical Data System	1306
142	0203735A	Combat Vehicle Improvement Programs	1316
143	0203740A	Maneuver Control System	1342
144	0203744A	Aircraft Modifications/Product Improvement Program	1350
145	0203752A	Aircraft Engine Component Improvement Program	1362
146	0203758A	Digitization	1368
147	0203759A	Force XXI Battle Command, Brigade and Below(FBCB2)	1374
148	0203761A	Force XXI Warfighter Rapid Acquisition Program (WRAP)	1378
149	0203801A	Missile/Air Defense Product Improvement Program	1392
150	0203802A	Other Missile Product Improvement Programs	1404
151	0208010A	Joint Tactical Communications Program (TRI-TAC)	1420
152	0208053A	Joint Tactical Ground Station (TIARA)	1424
153	0303140A	Communications Security (COMSEC) Equipment	1428
154	0303142A	Satellite Command (SATCOM) Ground Environment	1438

TABLE OF CONTENTS

	PE	PROGRAM ELEMENT TITLE	PAGE
#7 - OPERATIONAL SYSTEM DEVELOPMENT - Continued			
155	0303150A	Army Global Command and Control System (AGCCS)	1466
156	0305114A	Joint Precision Approach Landing System (JPALS)	1472
157	0305128A	Security and Intelligence Activities	1474
158	0305204A	Tactical Unmanned Aerial Vehicles	1478
159	0603778A	Multiple Launch Rocket System Product Improvement Program	1480
160	0708045A	Army Industrial Preparedness Manufacturing Technology	1498
161	1001018A	NATO Joint STARS	1510

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Advanced Command and Control Vehicle	0604640A	758
Advanced Field Artillery Tactical Data System	0203726A	1306
Advanced Tactical Computer Science and Sensor Technology	0603772A	477
Advanced Tank Armament System	0603653A	539
Aerostat Joint Program	0102419A	1300
Air Defense Command, Control, Intelligence - Engineering Development	0604741A	860
Air Defense/Precision Strike Technology	0603238A	413
Air Traffic Control	0604633A	754
Aircraft Avionics	0604201A	671
Aircraft Certification	0605606A	1170
Aircraft Engine Component Improvement Program	0203752A	1362
Aircraft Modifications/Product Improvement Program	0203744A	1350
All Source Analysis System (TIARA)	0604321A	716
Armament Enhancement Initiative	0603639A	515
Armed, Deployable OH-58D	0604220A	677
Armored Systems Modernization - Advanced Development	0603645A	527
Armored Systems Modernization (ASM) - Engineering Development	0604645A	774
Army Artificial Intelligence Technology	0602789A	313
Army Data Distribution System	0603713A	545
Army Evaluation Center	0605716A	1206
Army Global Command and Control System (AGCCS)	0303150A	1466
Army Industrial Preparedness Manufacturing Technology	0708045A	1498
Army Kwajalein Atoll	0605301A	1120
Army Missile Defense Systems Integration	0603308A	491
Army Tactical Command and Control Hardware & Software	0604818A	1074

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Army Test Ranges and Facilities	0605601A	1126
Army Test Technology and Sustaining Instrumentation	0605602A	1142
Artillery Propellant Development	0603640A	523
Artillery Systems - Engineering Development	0604854A	1096
Artillery Systems Advanced Development	0603854A	661
Automatic Test Equipment Development	0604746A	864
Aviation - Advanced Development	0603801A	595
Aviation - Engineering Development	0604801A	924
Aviation Advanced Technology	0603003A	357
Aviation Technology	0602211A	111
Ballistics Technology	0602618A	163
Base Operations - Research, Development, Testing & Evaluation	0605896A	1288
Brilliant Anti-Armor (BAT) Submunition	0604768A	890
Chemical, Smoke and Equipment Defeating Technology	0602622A	173
Comanche	0604223A	680
Combat Feeding, Clothing, and Equipment	0604713A	808
Combat Identification - Engineering & Manufacturing Development	0604817A	1060
Combat Service Support Control Systems Evaluation and Analysis	0603805A	637
Combat Vehicle and Automotive Advanced Technology	0603005A	379
Combat Vehicle and Automotive Technology	0602601A	143
Combat Vehicle Improvement Programs	0203735A	1316
Combined Arms Tactical Trainer (CATT)	0604780A	920
Command, Control and Communications Advanced Technology	0603006A	393
Command, Control, Communications Systems - Engineering Development	0604805A	1002
Command, Control, Communications Technology	0602782A	237

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Commercial Operating & Support Savings Initiative (COSSI)	0604824A	1094
Communications Security (COMSEC) Equipment	0303140A	1428
Concept Experimentation Program	0605326A	1124
Countermine Applied Research	0602712A	199
Defense Research Sciences	0601102A	11
Digitization	0203758A	1368
Distributive Interactive Simulations - Engineering Development	0604760A	872
DOD High Energy Laser System Test Facility (HELSTF)	0605605A	1168
Dual Use Applications Program	0602805A	315
Electronic Warfare (EW) Technology	0603270A	419
Electronic Warfare (EW) Technology	0602270A	121
Electronic Warfare (EW) Development	0604270A	690
Electronics and Electronic Devices	0602705A	187
Engineer Mobility Equipment Development	0604649A	780
Engineering Modification Equipment - Advanced Development	0603649A	535
Environmental Compliance - Research, Development, Testing & Evaluation	0605856A	1258
Environmental Conservation	0605853A	1244
Environmental Quality Technology	0602720A	209
Exploitation of Foreign Items	0605709A	1186
Family of Heavy Tactical Vehicles	0604622A	748
Firefinder	0604823A	1088
Follow-On To TOW	0604325A	728
Force XXI Battle Command, Brigade and Below(FBCB2)	0203759A	1374
Force XXI Warfighter Rapid Acquisition Program (WRAP)	0203761A	1378
Human Factors Engineering Technology	0602716A	203

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
In-House Laboratory Independent Research	0601101A	1
Information and Communication Technology	0602783A	243
Integrated Meteorological System (IMETS) (TIARA)	0604726A	852
International Cooperative Research and Development	0605802A	1214
Javelin	0604611A	740
Joint Precision Approach Landing System (JPALS)	0305114A	1472
Joint Service Small Arms Program	0603607A	455
Joint Service Small Arms Program	0602623A	175
Joint Surveillance/Target Attack Radar System	0604770A	910
Joint Tactical Communications Program (TRI-TAC)	0208010A	1420
Joint Tactical Ground Station (TIARA)	0208053A	1424
Joint Tactical Radio System	0604280A	489
JTT/CIBS-M (TIARA)	0604739A	856
Landmine Warfare	0604619A	744
Landmine Warfare and Barrier - Advanced Development	0603619A	501
Landmine Warfare and Barrier Advanced Technology	0603606A	449
Landmine Warfare/Barrier - Engineering Development	0604808A	1034
Light Tactical Wheeled Vehicle	0604642A	766
Line-of-Sight Technology Demonstration	0603654A	459
Logistics & Engineer Equipment - Engineering Development	0604804A	960
Logistics and Engineering Equipment - Advanced Development	0603804A	609
Longbow	0604816A	1050
Maintenance and Repair - Research, Development, Testing & Evaluation	0605878A	1274
Major Test and Evaluation Investment	0604759A	1108
Management Headquarters (Research and Development)	0605898A	1296

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Maneuver Control System	0203740A	1342
Manpower, Personnel and Training Advanced Technology	0603007A	407
Manpower/Personnel/Training Technology	0602785A	267
Materials Technology	0602105A	97
Materiel Systems Analysis	0605706A	1176
Medical Advanced Technology	0603002A	331
Medical Materiel - Engineering Development	0604807A	1020
Medical Systems - Advanced Development	0603807A	647
Medical Technology	0602787A	285
Medium Tactical Vehicles	0604604A	732
Meteorological Support to Research, Development, Testing & Evaluation Activities	0605702A	1172
Military Engineering Advanced Technology	0603734A	469
Military Engineering Technology	0602784A	249
Military Human Immunodeficiency Virus (HIV) Research	0603105A	411
Minor Construction - Research, Development, Testing & Evaluation	0605876A	1266
Missile and Rocket Advanced Technology	0603313A	425
Missile Technology	0602303A	129
Missile/Air Defense Product Improvement Program	0203801A	1392
Modeling and Simulation Technology	0602308A	135
Multiple Launch Rocket System Product Improvement Program	0603778A	1480
Munitions Standardization Effectiveness and Safety	0605805A	1232
NATO Joint STARS	1001018A	1510
NATO Research & Development	0603790A	585
Night Vision Advanced Technology	0603710A	461
Night Vision Systems - Advanced Development	0603774A	581

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Night Vision Systems - Engineering Development	0604710A	792
Night Vision Technology	0602709A	195
Non-System Training Devices - Engineering Development	0604715A	834
Other Missile Product Improvement Programs	0203802A	1404
Pollution Prevention	0605854A	1250
Positioning Systems Development (SPACE)	0604778A	916
Programwide Activities	0605801A	1208
Radar Development	0604820A	1084
Rand Arroyo Center	0605103A	1116
Real Property Services (RPS)	0605879A	1282
Satellite Command (SATCOM) Ground Environment	0303142A	1438
SCAMP BLKII (SPACE)	0603856A	667
Security and Intelligence Activities	0305128A	1474
Sense and Destroy Armor Munition - Engineering Development	0604814A	1042
Sensors and Electronic Survivability	0602120A	101
Smoke, Obscurant and Target Defeating System - Advanced Development	0603627A	511
Smoke, Obscurant and Target Defeating System - Engineering Development	0604609A	736
Soldier Support and Survivability	0603747A	561
Strategic Environmental Research and Development Program/Environmental Security Technology	0603780A	485
Support of Operational Testing	0605712A	1190
Survivability/Lethality Analysis	0605604A	1150
Tactical Electronic Support Systems - Advanced Development (TIARA)	0603745A	557
Tactical Exploitation of National Capabilities (TENCAP) - Demonstration/Validation (TIARA)	0603766A	577
Tactical Exploitation of National Capabilities (TENCAP) - Engineering & Manufacturing Development (TIARA)	0604766A	886
Tactical Unmanned Aerial Vehicles	0305204A	1478

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Tactical Unmanned Ground Vehicle	0604641A	762
Target Systems Development	0604258A	1102
Technical Information Activities	0605803A	1216
Terrain Information - Engineering Development (TIARA)	0604716A	846
Threat Simulator Development	0604256A	1100
University and Industry Research Centers	0601104A	75
Warfighter Advanced Technology	0603001A	317
Warfighter Technology	0602786A	273
Weapons and Munitions - Engineering Development	0604802A	930
Weapons and Munitions Advanced Technology	0603004A	371
Weapons and Munitions Technology	0602624A	177

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

	COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	14108	13678	14902	15726	16124	16515	16961	Continuing	Continuing
A91A	In-House Laboratory Independent Research - Army Materiel Command	9524	9404	9702	10238	10497	10751	11042	Continuing	Continuing
A91C	In-House Laboratory Independent Research - Medical Research and Materiel Command	3727	3571	4225	4458	4572	4683	4808	Continuing	Continuing
A91D	In-House Laboratory Independent Research - Corps of Engineers	733	703	975	1030	1055	1081	1111	Continuing	Continuing
A91E	In-House Lab Independent Research - Army Res Inst of Behavioral and Social Sciences	124	0	0	0	0	0	0	0	249

Mission Description and Budget Item Justification: In-House Laboratory Independent Research (ILIR) 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 senior researchers as well as the most promising, developing scientists. The ILIR funding allocation is based on the quality of past performance. Each year, ILIR project reports are submitted from competing Army research organizations to the Office of the Assistant Secretary of Army (Research, Development, and Acquisition). These ILIR reports are subjected to a strenuous technical peer review by a review committee composed of leading scientists and engineers from the National Academy of Sciences, the Army Science Board, and Army Secretariat. ILIR funding allocation for the subsequent year is based on the score assessed by the ILIR review committee. A portion of the ILIR funding is incentive; programs that rate highest will receive an incentive award. This incentive began at ten percent of the total ILIR funding for FY98 and will grow to be 25% of the total ILIR funds. The incentive funds stimulate quality research and reward those quality research efforts. Successful ILIR projects are typically transitioned to start-up projects under 6.1 or 6.2 mission funding within the organization. Since its establishment by DoD Directive number 3201.4, dated October 8, 1993, the Army's ILIR program has supported and will continue to promote the 1987 Defense Science Board Study on Technology Base Management's recommendation to attract and retain top flight science and engineering PhDs. The projects in this PE explore fundamental concepts in science and technology and therefore are correctly placed in Budget Activity 1.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: A91A

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A91A In-House Laboratory Independent Research - Army Materiel Command	9524	9404	9702	10238	10497	10751	11042	Continuing	Continuing

A. Mission Description and Justification: This project provides funding for ILIR research which is allocated among the seven Research, Development and Engineering Centers (RDECs) in the Army Materiel Command (AMC).

FY 1997 Accomplishments:

- 9524 - Missile RDEC -Conducted research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities.
  - Armaments RDEC -Evaluated unique phenomena in weapons and munitions related research, focusing on gun/cannon barrel erosion prevention and energetic materials for various weaponry applications.
  - Tank-Automotive RDEC -Developed an improved understanding of advanced diesel engine technology through nonlinear models of compliant structures, heat transfer mechanisms for cold start engine phenomena, and non-invasive thermal imaging of engine combustion phenomena.
  - Natick RDEC -Identified innovative technologies in the areas of molecular biology, biopolymers and modeling of personnel equipment characteristics.
  - Edgewood RDEC -Investigated innovative approaches to pathogen detection including development of DNA super libraries and genome sequencing of pathogens; begin development of respirator encumbrance model for the individual soldier.
  - Aviation RDEC -Demonstrated a new rapid, non-intrusive velocity measurement technique, Doppler Global Velocimetry, for measuring rotorcraft 3D flow fields.
  - Communications-Electronics RDEC -Developed antenna and sensor technologies and computer models; improved intelligence data fusion techniques; upgraded sensor simulation/performance models.

Total 9524

FY 1998 Planned Program:

- 9285 - Missile RDEC - Conduct research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities; demonstrate and transition components and concepts.
  - Armaments RDEC -Investigate processes for real-time material characterization, advanced energetic materials development, and controlled biodegradation of battlefield explosives.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research
	PROJECT A91A

FY 1998 Planned Program: (continued)

- Tank-Automotive RDEC -Use fractals to analyze visual signatures; optimize laser-induced breakdown directed energy protection devices; implement singular perturbed non-linear track model on a supercomputer; investigate non-linear controllers for active suspension systems.
- Natick RDEC -Use innovative modeling tools for characterizing materials/fabrics/food constituents for application to military clothing and ration systems with the goal of improving soldier protection and performance.
- Edgewood RDEC -Complete investigation of innovative approaches to biodetection via DNA super libraries and genome sequencing of biological agents; transition investigation to core program. Complete development of respirator encumbrance model and transition to exploratory development.
- Aviation RDEC -Develop and demonstrate techniques for active control of rotor blades for high-lift and/or for reduced vibration.
- Communications-Electronics RDEC -Transition intelligence data fusion techniques to core technology base; improve battlefield visualization software tools; develop antenna and sensor technologies and virtual prototyping models; upgrade sensor simulation performance models; explore advanced battery technology.

119 - Small Business Innovation Program/Small Business Technology Transfer Program

Total 9404

FY 1999 Planned Program:

• 9702 - Missile RDEC - Conduct research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities; demonstrate and transition components and concepts.
- Armaments RDEC -Evaluate micro-electro mechanical systems (MEMS) technology for low-cost projectile guidance and control; continue investigations into real-time material characterizations and advanced energetic materials.
- Tank-Automotive RDEC -Correlate ignition delays with combustion temperature and pressure profiles; automate multibody dynamic systems modeling using algebraic constraints; calculate 3-D stress distributions in thick composite materials.
- Natick RDEC -Validate models of materials/fabric/food constituents against known parameters, transfer results to core basic research and applied research programs in ration and clothing research.
- Edgewood RDEC -Initiate project to prove concept for a specific virus detector. Begin construction of data reduction/analysis algorithms needed for the development of a satellite/high altitude chemical imaging sensor.
- Aviation RDEC -Investigate application of "smart materials" and/or micro-electro mechanical systems (MEMS) for alleviation of dynamic stall to improve rotor aerodynamics.
- Communications-Electronics RDEC -Upgrade battlefield visualization tools; transition antenna technologies; improve power sources technology, advance sensor technology base.

Total 9702

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic Research	0601101A In-House Laboratory Independent Research	A91A

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9686	10354	10877
Appropriated Value	9686	9704	
Adjustments to Appropriated Value	-162	-300	
FY 1999 President's Budget	9524	9404	9702

Change Summary Explanation: FY1998 Funding - Congressional adjustment (-650); undistributed Congressional reductions (-300)

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: A91C

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	3727	3571	4225	4458	4572	4683	4808	Continuing	Continuing

A. Mission Description and Justification: Represents funds to conduct ILIR research allocated among the six laboratories of the Medical Research and Materiel Command, including the Aeromedical Research Laboratory, the Institute of Surgical Research, the Institute of Environmental Medicine, the Medical Institute of Chemical Defense, the Medical Institute of Infectious Diseases and Walter Reed Army Institute of Research.

FY 1997 Accomplishments:

•	3727	- Continued research for medical countermeasures against naturally occurring infectious diseases which can have significant impacts on military operations to protect the force from infection and sustain operations. - Continued research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness. - Continued research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.
Total	3727	

FY 1998 Planned Program:

•	3482	- Continue research for medical countermeasures against naturally occurring infectious diseases which can have significant impacts on military operations to protect the force from infection and sustain operations. - Continue research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness. - Continue research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.
	89	- Small Business Innovation Program/Small Business Technology Transfer Program
Total	3571	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91C

FY 1999 Planned Program:

•	4225	- Continue research for medical countermeasures against naturally occurring infectious diseases which can have significant impacts on military operations to protect the force from infection and sustain operations. - Continue research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness. - Continue research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.
Total	4225	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	3828	3968	4126
Appropriated Value	3828	3684	
Adjustments to Appropriated Value	-101	-113	
FY1999 President's Budget	3727	3571	4225

Change Summary Explanation: FY1998 Funding - Congressional adjustment (-284); undistributed Congressional reductions (-113).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: A91D

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A91D In-House Laboratory Independent Research - Corps of Engineers	733	703	975	1030	1055	1081	1111	Continuing	Continuing

A. **Mission Description and Justification:** Represents funds to conduct ILIR research allocated among the four laboratories within the Army Corps of Engineers, including the Topographic Engineering Center, the Waterways Experimental Station, the Construction Engineering Research Laboratories and the Cold Regions Research and Engineering Laboratory.

FY 1997 Accomplishments:

- 733 - Conducted research in the terrain representation process and terrain data generation by sponsoring related topics in these areas at the Topographic Engineering Center.
  - Determined in vitro molecular and cellular toxicity of common/fielded explosives to establish biomarkers of exposure at the Waterways Experimental Station.
  - Developed simplified, parameter-insensitive, sensorless machine control techniques at the Construction Engineering Research Laboratories.
  - Explored physics based correlation's between mechanical and electrical properties of sea ice as a basis for translation of satellite sensor data to physical behavior and examined means to characterize the diffusion of various chemical species through frozen soils and permafrost at the Cold Region Research and Engineering Laboratory.

Total 733

FY 1998 Planned Program:

- 685 - Devise automated classification and feature extraction algorithms for Georegistered Interferometric Synthetic Aperture Radar and Hyperspectral Imagery.
  - Develop a simulation model and laboratory performance test for evaluation of fundamental machines.
  - Develop interference pattern approach for subsurface object detection in snow/frozen ground.
  - Determine hydrodynamic interaction of sediment mitigation and in-situ object transport in harbors, rivers and areas in proximity to Logistics Over the Shore operations.

18 - Small Business Innovation Program/Small Business Technology Transfer Program

Total 703

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91D

FY 1999 Planned Program:

•	975	- Exploit image statistics from multi-scale transforms for extraction of topographic information from imagery. - Demonstrate the feasibility of shaft sensorless control systems capable of determining the vibration characteristics of rotating machine technology. - Develop hyperspectral approach for snow cover property assessment. - Develop transport mechanisms (including chemical interactions) of contaminants through porous media at micropore scale.
Total	975	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	752	791	825
Appropriated Value	752	725	
Adjustments to Appropriated Value	-19	-22	
FY1999 President's Budget	733	703	975

Change Summary Explanation:
FY1998 Funding: Congressional adjustment (-66); undistributed Congressional reductions (-22).
FY1999 Funding: Increase due to incentive funds for FY98 funding.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: A91E

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A91E In-House Lab Independent Research - Army Res Inst of Behavioral and Social Sciences	124	0	0	0	0	0	0	0	249

A. Mission Description and Justification: Represents funds allocated to the Army Research Institute for Behavioral and Social Sciences to conduct ILIR research.

FY 1997 Accomplishments:

- 124 - Conducted research on the transfer of training from virtual to real environments.

Total 124

FY 1998 Planned Program: Due to program restructuring, ARI will not receive ILIR funding beyond FY1997.

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	127	0	0
Appropriated Value	127		
Adjustments to Appropriated Value	-3		
FY1999 President's Budget	124	0	0

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	117041	121827	137399	144863	148336	151764	155942	Continuing	Continuing
AF20 Advanced Propulsion Research	2279	2282	2384	2516	2580	2643	2714	Continuing	Continuing
AF22 Research in Vehicular Mobility	428	457	539	569	582	597	613	Continuing	Continuing
AH42 Materials and Mechanics	1734	1817	1898	2003	2054	2104	2161	Continuing	Continuing
AH43 Research in Ballistics	5376	5505	3633	3833	3931	4025	4134	Continuing	Continuing
AH44 Advanced Sensors Research	3240	3907	5070	5350	5485	5619	5770	Continuing	Continuing
AH45 Air Mobility	1761	1900	2164	2285	2342	2398	2464	Continuing	Continuing
AH47 Applied Physics Research	2744	2914	3046	3213	3295	3375	3466	Continuing	Continuing
AH48 Battlespace Information & Communications Res	6558	6931	6489	6848	7020	7191	7385	Continuing	Continuing
AH52 Equipment for the Soldier	809	886	999	1054	1081	1107	1137	Continuing	Continuing
BH57 Scientific Problems with Military Applications	45550	50148	58084	61191	62573	63946	65785	Continuing	Continuing
AH66 Advanced Structures Research	1281	1327	1391	1468	1505	1541	1583	Continuing	Continuing
BH67 Environmental Research - Army Material Cmd	3445	4758	3718	3923	4022	4120	4231	Continuing	Continuing
AH68 Processes in Pollution Abatement Technology	334	361	424	448	460	470	483	Continuing	Continuing
BS04 Military Pollutants and Health Hazards	570	609	657	680	683	686	687	Continuing	Continuing
BS13 Science Base/Medical Research infectious Disease	8036	8632	10456	11033	11313	11588	11901	Continuing	Continuing
BS14 Science Base/Combat Casualty Care Research	3650	3832	4212	4444	4556	4667	4792	Continuing	Continuing

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS15 Science Base/Army Operational Medicine Research	5396	5162	6516	6876	7051	7222	7417	Continuing	Continuing
BS16 Science Base/Combat Dentistry Research	447	0	0	0	0	0	0	0	447
BS17 Molecular Biology/Military HIV Research	762	423	457	483	495	507	520	Continuing	Continuing
BS18 Marine Derived Biocatalysts	619	0	0	0	0	0	0	0	619
BS19 Telemedicine Research	0	0	534	552	556	558	558	Continuing	Continuing
AT22 Soil and Rock Mechanics	1685	1822	2070	2184	2239	2294	2356	Continuing	Continuing
AT23 Basic Research/Military Construction	1460	1540	1797	1896	1945	1991	2045	Continuing	Continuing
AT24 Snow, Ice and Frozen Soil	1075	1137	1328	1403	1437	1472	1512	Continuing	Continuing
BT25 Environmental Research - Corps of Engineers	4205	3004	4750	5012	5139	5264	5406	Continuing	Continuing
A305 Automatic Target Recognition Research	1122	1122	1174	1240	1270	1301	1336	Continuing	Continuing
A31B Infrared Optics Research	2228	2202	2302	2429	2491	2551	2620	Continuing	Continuing
B52C Mapping and Remote Sensing	2138	2248	2623	2768	2838	2907	2985	Continuing	Continuing
B53A Battlefield Environment and Signature	3523	3470	3629	3829	3925	4020	4129	Continuing	Continuing
B74A Human Engineering	2239	2474	2590	2732	2801	2869	2947	Continuing	Continuing
B74F Personnel Performance and Training	2347	957	2465	2601	2667	2731	2805	Continuing	Continuing

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences

Mission Description and Budget Item Justification: This program element is focused on sustaining the Army's technological superiority for effectiveness in land warfighting capability and the Army Vision for Force XXI. The program focuses in-house laboratory research on Army unique expertise and capabilities, capitalizing on the scientific talent and specialized facilities to expeditiously transition the resulting knowledge and technology into the appropriate developmental activities. The extramural program leverages the research efforts of other government agencies, academia, and industry for those areas where the Army does not have the technical lead. This translates to a coherent, well-integrated program which is executed by the following six primary contributors: 1) the Army Research Laboratory (ARL); 2) the seven Army Materiel Command Research, Development and Engineering Centers (RDECs); 3) the four Army Corps of Engineer laboratories; 4) the six Army Medical Research and Materiel Command laboratories; 5) the Army Research Institute; and 6) the Army Research Office (ARO). The Army's research program promotes quality through activities such as in-depth reviews of the entire basic research program at all levels and the development of strategic research objectives. The Army broadened its research base by expanding basic research investment in Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs) to 5% of its individual investigator program. This core research program is complemented by the inter-disciplinary research performed under the University Research Initiative (URI) program. The basic research program is coordinated with the other Services via the Joint Directors of Laboratories panels, Project Reliance, and other interservice working groups. The work in this program element is consistent with rigorous peer review, the Army Science and Technology Master Plan (ASTMP), Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies, and the Army Modernization Plan. The projects in this PE include basic research efforts directed toward providing fundamental knowledge for the solution of military problems and therefore are correctly placed in Budget Activity 1. The resultant science base provides the source for follow-on applied research (6.2) and, eventually, advanced technology development (6.3) programs.

Work in this program element is related to and fully coordinated with efforts in PE 0601104A (University/Industry Research Centers), PE 0602120A (Electronic Survivability and Fuzing Technology), PE 0602618A (Ballistics Technology), PE 0602623A (Joint Service Small Arms Program), PE 0602624A (Weapons and Munitions Technology), PE 0602720A (Environmental Quality Technology) (DA Proj 835 only), PE 0602784A (Military Engineering Technology), PE 0602786A (Logistics Technology), PE 0602787A (Medical Technology), PE 0603105A (Medical Human Immunodeficiency Virus (HIV) Research), PE 0603002A (Medical Advanced Technology), PE 0603807A (Medical Systems-Advanced Development), PE 0604807A (Medical Materiel/Medical Defense Equipment-Engineering Development), PE 0605801A (Program wide Activities, Project MMO2), PE 0605898A (Management Headquarters R & D, Project MMO3), and PE 0601103D (University Research Initiatives); the Navy, Air Force, and other Department of Defense agencies; National Aeronautics and Space Administration; National Science Foundation; Department of the Interior; Department of Energy; National Bureau of Standards; other government agencies; and government agencies of Allied nations sponsor related research in areas of this program.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AF20

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AF20 Advanced Propulsion Research	2279	2282	2384	2516	2580	2643	2714	Continuing	Continuing

A. Mission Description and Justification: This project is a joint Army/NASA effort and it is the only DoD basic research project focused on turboshaft engine-specific technology and mechanical power transmission technology. 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. Analysis, code development, experiments and evaluations are conducted to improve engine and drive train components and investigate advanced materials. Component level investigations include compressors, combustors, turbines, injectors, pistons, cylinder liners, piston rings, gears, seals, bearings, shafts, and controls. The goal of the activity is increased performance of small airbreathing engines and power trains, that will support improvements in system mobility, reliability and survivability, and ultimately serve to reduce the logistics cost burden. Logistic issues are key concerns in the Army After Next Planning.

FY 1997 Accomplishments:

- 2279 Completed a study of variable stator endwall leakage and its effect on compressor performance. The study insights are essential for the optimal design of variable geometry airfoils.
  -Completed a carbon deposits/radiation model for an advanced combustor code and released information to industry.
  -Developed a combination of fiber coating, composite external surface coating, and matrix infiltration techniques using ceramic matrix composite (CMC) materials to enable very high temperature operation for long durations; preliminary testing indicates potential for 3000F application.
  -Developed and validated a 2-D finite element design code for predicting crack propagation paths in thin rimmed (light weight, high strength) spiral bevel gears. The code enables the design of quieter rotorcraft gears of greater durability and with less weight.
  -Completed the analysis of powder lubricated slider bearings. This element of the powder lubrication design toolbox will support future code validations and help to exploit the "hydrodynamic-like" behavior of powders in solving high temperature lubrication problems.
  -Completed a linear stability analysis of finite journal bearings (addressing critical end effects) and validated this analysis through experimentation. This effort, coupled with other elements of a larger, integrated journal bearing analysis thrust, will enable accurate predictions of journal bearing performance during dynamic loading.

Total 2279

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences
	PROJECT: AF20

FY 1998 Planned Program:

•	2282	-Complete 3-D particle image velocimetry mapping of compressor/diffuser flow field to provide fundamental information essential for advanced high performance centrifugal compressor design .-Complete Version 1.0 (unstructured grid version) of the National Combustor Code and release to US industry for the design of next generation of gas turbine combustors. -Obtain fundamental heat transfer data for developing/validating wall function models for 3-D Navier Stokes internal/external cooling flow and heat transfer calculations. The new insights into the coupling of internal cooling and film cooling heat transfer will enable high performance turbine designs with less reliance on parasitic cooling flow. -Complete installation of a high-speed helical gearing loss-of-lube rig. This rig will enable improvements to rotorcraft transmission safety while reducing lubrication system weight. -Complete characterization of oxidation resistant coatings for advanced CMCs. These coating are mandatory for successful implementation of CMCs in high temperature gas turbines. -Develop preliminary life prediction models for advanced CMC material that will address the issues concerning their introduction into manned gas turbine engines. -Develop and validate a diesel piston thermal barrier coating (TBC) low cycle fatigue/ high cycle fatigue facility and methodology to duplicate engine failure conditions and evaluate new coatings. The facility will screen candidate TBCs for use on test specimens (pistons) that will be tested by the Army Tank and Automotive Command.
Total	2282	

FY 1999 Planned Program:

•	2384	-Demonstrate quick execution (overnight turn around) for Version 2.0 of the National Combustor Code, providing an increased incentive for industry to use the code. -Characterize the coupling between internal convection and external film cooling for turbine blades . The resulting models will provide insight into the internal cooling and film cooling heat transfer process, and ultimately improve efficiency by reducing the need for parasitic cooling flow. -Complete 3-D gear crack propagation code to improve transmission safety. -Conduct preliminary screening of candidate materials for very high temperature (above 3000F) applications in gas turbines having very high specific power. -Define advanced coating system for low heat rejection diesel application (multiple layer processing, structural analyses, and characterization) permitting higher efficiency diesel design.
Total	2384	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences	PROJECT AF20

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2284	2414	2512
Appropriated Value	2284	2355	
Adjustments to Appropriated Value	-5	-73	
FY 1999 President's Budget	2279	2282	2384

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AF22

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AF22 Research in Vehicular Mobility	428	457	539	569	582	597	613	Continuing	Continuing

A. Mission Description and Justification: This project conducts research in support of advanced military engine technology with emphasis on advanced propulsion, sophisticated vehicle dynamics and simulation, and advanced track and suspension concepts. Advanced propulsion research will dramatically improve power density, performance and thermal efficiency for advanced adiabatic diesel engines, transient heat transfer, high temperature materials and thermodynamics. This project also supports state-of-the-art simulation technologies to achieve a more fundamental understanding of advanced high-output military engines. The subject research is directed at unique, state-of-the-art phenomena in specific areas such as: 1) non-linear ground vehicle control algorithms, using off-road terrain characteristics; and 2) instantaneous diesel engine low friction/cold start optimizations, using advanced analytical and experimental procedures. The subject efforts offer an opportunity to produce quantum Army ground vehicle performance enhancements through the use of optimized parameterization procedures.

FY 1997 Accomplishments:

•	428	-Validated symbolic numerical algorithms within real-time vehicle dynamic scenarios. -Enhanced numerical computational efficiencies of simulative models describing vehicle/human interfaces. -Demonstrated control algorithms for autonomous neural networks in support of vehicle accident avoidance. -Optimized and validated fundamental simulative models for unique ground vehicle powertrain component combinations.
Total	428	

FY 1998 Planned Program:

•	449	- Formulate state-of-the-art non-linear vehicle dynamics insights. - Establish vehicle/human control algorithms for military systems performance enhancements. - Validate fundamental powertrain component models for unique ground vehicles.
•	8	- Small Business Innovation Research/Small Business Technology Transfer Programs
Total	457	

FY 1999 Planned Program:

•	539	- Validate state-of-the-art vehicle dynamics phenomena. - Optimize vehicle/human control models for off-road scenarios. - Optimize fundamental powertrain characteristic phenomena using advanced simulation procedures.
Total	539	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AF22

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	438	542	567
Appropriated Value	438	472	
Adjustments to Appropriated Value	-10	-15	
FY 1999 President's Budget	428	457	539

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH42

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH42 Materials and Mechanics	1734	1817	1898	2003	2054	2104	2161	Continuing	Continuing

A. Mission Description and Justification: This project funds the Army's basic research program in materials science. The goal is to establish the science base allowing the creation and production of advanced materials which will provide higher performance, lower cost, improved reliability, and environmental compatibility for Army unique applications. Emphasis is on understanding the fundamental aspects of chemistry and microstructure that influence the performance and failure mechanisms of materials. This research is conducted at the Army Research Laboratory, Aberdeen Proving Ground, MD and Langley, VA.

FY 1997 Accomplishments:

- 1734 - Determined the relationship between microstructure and mechanisms of flow and failure in materials subjected to high strain rates typical of ballistic impact.
  - Determined relationship of the structure and properties of metal, ceramic, polymer, composite and hybrid materials surfaces and interphases to improve performance and long-term durability.
  - Synthesized and evaluated novel, chemical agent resistant polyurethane.
  - Included dynamics in the viscous thick beam model for improved finite element structural analysis; evaluated the influence of lay up and component geometry on strength and failure of thick curved composite laminates.

Total 1734

FY 1998 Planned Program:

- 1817 - Establish processing parameters for microstructural design of ceramic materials tailored to improve lightweight armor performance.
  - Develop flow and fracture theory for large, high rate deformation of solids under coupled electromagnetic and mechanical forces to improve armor and armament design capabilities.
  - Advance composite materials processing and interface science for improved bonding capabilities and lower cost composite manufacture.
  - Design polymer systems which possess the ability to form novel structural architecture for use as protective clothing, membranes and coatings.
  - Develop improved failure criteria for thick curved composite laminates using methodologies developed in cooperation with Brunel University (UK).

Total 1817

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH42

FY 1999 Planned Program:

•	1898	- Optimize the microstructure of transparent ceramic materials for transparent armor applications. - Create and exploit experiments to simulate the behavior of materials under ballistic impact to improve armor and armament design capabilities. - Determine predictive capability to determine the low-cycle fatigue characteristics of polymer matrix composite materials to allow improved affordability for Army applications. - Model and physically characterize surface sensitive properties of materials using energetic directed ion-laser beam techniques to improve the reliability and service life of Army systems, including surface engineered materials. - Leverage the Brunel University work to improve helicopter hub shear damper models; investigate the computational difficulties associated with simulating the manufacture of composite structures made with elastomers to develop improved design tools for composite structures.
Total	1898	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1738	1921	2000
Appropriated Value	1738	1874	
Adjustments to Appropriated Value	-4	-57	
FY 1999 President's Budget	1734	1817	1898

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH43

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH43 Research in Ballistics	5376	5505	3633	3833	3931	4025	4134	Continuing	Continuing

A. Mission Description and Justification: This project funds the Army's basic research program in ballistics. The goal is to improve the understanding of the chemistry and physics principles controlling the propulsion and flight of gun launched projectiles and the flight of missiles and to understand the interaction of these weapons with armored targets. This research results in the science base which allows the development of more energetic propellants, more accurate and lethal projectiles and missiles, and advanced armors for increased survivability of Army combat systems. This research is conducted at the Army Research Laboratory, Aberdeen Proving Ground, MD in support of ballistic technology applied research in project 0602618/AH80.

FY 1997 Accomplishments:

•	5376	- Developed submodels of the surface and subsurface physics and chemistry of nitramine composite propellants which control burn rate and energy release. - Developed a simple analytical model for ceramic armor elements to predict their armor effectiveness. - Developed computational fluid dynamic methodology and assessed the launch forces for tube launched rockets to improve rocket accuracy.
Total	5376	

FY 1998 Planned Program:

•	5431	- Model the physics of advanced solid propellant charge combustion to develop tools that will enable the design of new propulsion concepts, improve charge reliability, ease optimization, and simplify charge malfunction diagnosis. - Apply computational fluid dynamic calculational technologies to both high and low speed Army systems, e.g., munitions, missiles, and parachutes, to develop tools to reduce design costs. - Measure and model the response of advanced armor materials to ballistic loads to provide methods for building more effective lightweight armor systems.
•	74	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	5505	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH43

FY 1999 Planned Program:

•	3633	- Develop computational capabilities to predict propellant burn rates from ingredients in order to revolutionize the development of advanced high-performance solid propellants. - Couple computational fluid dynamic and rigid body computational techniques to allow prediction of trajectories for advanced guided projectiles, rockets, and missiles. - Measure and model the coupled effect of mechanical, electrical and magnetic fields on armor and projectile materials for ballistic applications.
Total	3633	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5466	5827	6059
Appropriated Value	5466	5680	
Adjustments to Appropriated Value	-90	-175	
FY 1999 President's Budget	5376	5505	3633

Change Summary Explanation: Funding: FY99 funds reprogrammed (-2426) for higher priority requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH44

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH44 Advanced Sensors Research	3240	3907	5070	5350	5485	5619	5770	Continuing	Continuing

A. Mission Description and Justification: This project exploits new opportunities in the basic sciences underpinning the technology areas of digital and image processing modules and algorithms, optical control of radar sensors, nonlinear optical materials and devices, remote sensing, and intelligent system distributive interactive simulations. Research involves fundamental science and engineering principles that support survivable sensor systems. 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 developed to enhance performance of imagers and optical processors. For laser protection, nonlinear optical effects are being explored which will allow broad band protection. These nonlinear effects can also be used for optical image processing or holographic displays and storage. For remote sensing applications, research in materials is conducted that will allow direct lasing in the ultraviolet (UV) wavelength region.

FY 1997 Accomplishments:

- 1469 -Conducted research focused on new data/image compression techniques to offset the growing demands for additional bandwidth in the distributed interactive simulation (DIS) environment.
  -Investigated techniques that automatically established seamless connections between physical models in constructive, virtual, and live simulation.
- 1771 -Demonstrated compact Raman spectrometer
  -Developed a robust wavelet-based detection technique for acoustic shock waves
  -Transitioned wideband high resolution signal processing algorithms to test bed from real-time implementation
  -Designed one dimensional diffractive optical lenses with subwavelength feature for application to infrared photodetectors

Total 3240

FY 1998 Planned Program:

- 1215 - Implement and analyze potential solutions designed in previous fiscal year, producing a partially "fuzzified" system prototype.
  - Include algorithms for structured data text and adapting object technology to standards-based electronic data interchange (edi) in multimedia exchange model.
  - Develop a high level architecture (mathematical algorithm) protocol to distribute structural status of physical buildings between simulations operating within the command and control network, thereby allowing accurate prototyping and analysis of new weapons system performance.
  - Develop infrastructure to support a high level architecture in a synthetic, DIS environment, providing a robust research tool capable of supporting research in digital and image processing moduls, in a context of limited bandwidth.
- 1650 - Develop multispectral imager for visible and midwave infrared radiation .

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH44

FY 1998 Planned Program: (continued)

- Optimize wideband processing techniques for multiple target detection and tracking
- Integrate active and passive optic elements for free space and guided wave communications and sensor processing.

• 987 -Evaluate the effectiveness of sidelobe apodization techniques (an image-artifact reduction scheme) for ultra-wideband radar imaging of underground targets.

• 55 - Small Business Innovative Research/Small Business Technology Transfer Programs.

Total 3907

FY 1999 Planned Program:

• 2537 - Continue the application of fuzzy logic techniques on a much larger scale by extending the partial solution(s) developed previously to a complete solution, producing a fully functional system prototype.
- Insert multimedia application-to-application knowledge exchange technology into an operational data exchange system and validate multimedia exchange model.
- Incorporate high fidelity physical vulnerability models into the synthetic environment for STOW 2000.
- Develop a real time model of physical building structural collapse due to blast effects, thereby shortening weapon system developmental cycles, and reducing both cost and developmental time requirements.
- Initiate the taxonomy for integration of collaborative planning models within the decision making process in order to identify both the critical decisions that emerge within the combat decision making cycle, and the cognitive performance metrics necessary to measure and improve the effectiveness of display structures and decision making tools.

• 2533 -Develop multispectral imager for visible and midwave infrared radiation and a spectrometer for mid- and longwave infrared radiation.
-Investigate time-frequency nonstationary signal processing.
-Develop ultra-wideband image formation techniques for vehicle-mounted, forward-imaging radars.
- Integrate and demonstrate digital optical processing for correction of aberration and focus independent of depth of field.
- Demonstrate advanced sensor processing and communication using integrated optical components.
- Develop techniques to exploit the unique response from metal and dielectric.

Total 5070

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3284	4902	5047
Appropriated Value	3284	4032	
Adjustments to Appropriated Value	-44	-125	
FY 1999 President's Budget	3240	3907	5070

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-995).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH45

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH45 Air Mobility	1761	1900	2164	2285	2342	2398	2464	Continuing	Continuing

A. Mission Description and Justification: Basic research in aerodynamics and avionics as applied to rotary wing aircraft. Analysis, code development, and test and evaluation are conducted on rotor unique aerodynamics, dynamics, performance, and aircraft performance and acoustics.

FY 1997 Accomplishments:

•	1761	-Integrated pressure disk methodology in OVERFLOW to model the effects of a rotor disk on a complex rotorcraft fuselage. -Expanded multi-element airfoil results to maximize envelope expansion.
Total	1761	

FY 1998 Planned Program:

•	1852	- Complete scale model hover testing with a pneumatically actuated, trailing edge flap for high lift. - Develop and validate the HELIX-II gear design tool, which includes accelerated vorticity embedding method to prevent numerical dissipation problems. - Develop advanced aeroelastic concepts for damperless rotor systems to control ground/air resonance. - Develop a grid-adaptive, unstructured overset scheme for the OVERFLOW code to improve the resolution of the rotor wake system. - Integrate a panel methodology into an integrated aeromechanics analysis to model aerodynamic influence of fuselage and wing/empennage.
•	48	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	1900	

FY 1999 Planned Program:

•	2164	- Develop structure/actuator concepts for application to multi-controller active, on-blade systems for low vibration rotorcraft. - Design and fabricate a scale model equipped with oscillatory blowing to control flow separation. - Fabricate and test an isolated, instrumented baseline rotor for increased payload, reduced noise and vibration.
Total	2164	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE
	February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic Research	0601102A Defense Research Sciences	AH45

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1809	2191	2280
Appropriated Value	1809	1961	
Adjustments to Appropriated Value	-48	-61	
FY 1999 President's Budget	1761	1900	2164

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-291).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH47

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH47 Applied Physics Research	2744	2914	3046	3213	3295	3375	3466	Continuing	Continuing

A. Mission Description and Justification: The objective of this project is to investigate the physics of various phenomena occurring in semiconductor structures, including thin heterostructure systems where quantum confinement effects are important. The basic knowledge learned will be applied to develop novel optoelectronic devices and test their performance. Active and passive optoelectronic components and subsystems will be developed that are of importance for Army systems. These include applications for Army optical control of microwaves, tactical wireless communications, and optical signal processing. From a logistical point of view it is important that the Army capitalize on advancements in semiconductor optoelectronics because of the potential for vastly reduced system size, weight, and cost as well as for the drastic improvements in system performance that optoelectronics can provide.

FY 1997 Accomplishments:

•	2744	-Performed research on GaSb/AlSb/InAs structures for novel broken-gap intersubband and interband emitter/detector structures. -Analyzed Global Positioning System (GPS) and laser ranging data from GPS satellites to determine GPS accuracy (with NASA and University of Maryland). -Performed research on integrated photonic laser/shifter/receiver that extended the capabilities of battlefield digitization. -Demonstrated tunable waveguide modulator/detector at 800 nm. -Designed, fabricated, and tested polarization independent modulator for Army communication systems. -Developed 815 nanometer reflection modulator for laser radar (LADAR) program.
Total	2744	

FY 1998 Planned Program:

•	2911	-Investigate novel semiconductor structures and their basic properties for applications in next generation devices -Investigate microcavity effects for producing more efficient vertical cavity surface emitting lasers (VCSELs) and light emitting diodes (LEDs). -Investigate relativistically correct model for GPS within the framework of general relativity. -Design and test anisotropically strained quantum well terahertz (THz) radiation detector for sensing and radar ranging. -Fabricate and test GaSb/AlSb/InAs based broken-gap interband and intersubband emitter/detector devices.
•	3	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	2914	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH47

FY 1999 Planned Program:

•	3046	- Demonstrate magnetic resonance microscopy concepts developed in collaboration with Johns Hopkins Applied Physics Lab under the Microelectronics Research Cooperative program (MRCP). - Investigate quantum-wire based optoelectronic device structures. - Investigate techniques for fabricating ultra small tunneling structures for high speed switching applications. - Investigate VCSEL structures that exploit microcavity effects to enhance device performance. - Investigate improvements to GPS positioning algorithms for smart munitions. - Investigate VCSEL arrays with reduced polarization switching noise for signal processing applications.
Total	3046	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2751	3083	3207
Appropriated Value	2751	3007	
Adjustments to Appropriated Value	-7	-93	
FY 1999 President's Budget	2744	2914	3046

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH48

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH48 Battlespace Information & Communications Res	6558	6931	6489	6848	7020	7191	7385	Continuing	Continuing

A. Mission Description and Justification: This project addresses fundamental research in technologies that will enable the development of intelligent and survivable command, control, communication, and intelligence systems. As the combat force structure becomes smaller and operates in more dispersed formations, information systems must be developed that are more robust, intelligent, interoperable, and survivable if the Army After Next is to retain both information and maneuver dominance. This research will address the areas of information warfare survivability and intelligent systems for C4I. The information warfare program will develop capabilities that will enable the Army to overcome the inherent vulnerabilities associated with using standardized protocols and commercial technologies while addressing survivability in a unique hostile military environment that includes highly mobile nodes and infrastructure, bandwidth-constrained communications at lower echelons, diverse networks with dynamic topologies, high level multi-path interference and fading, jamming and multi-access interference, and information warfare threats. The intelligent systems program will focus on developing C41 software agents: including human-agent, and agent-databases interactions; formal intelligent agents reasoning and learning techniques; secure cooperation mechanisms for multiple agents; machine interpretation of human discourse and text; and parallel processing techniques for real-time and scaleable intelligent systems supporting natural language, visualization, reasoning, and learning. The project also supports the Army High Performance Computer Resource Center at the University of Minnesota in FY97 and FY98; the Center is supported in PE 0601104A, Project BH53 beginning in FY99.

FY 1997 Accomplishments:

- 4745 - Investigated techniques that provide secure and survivable technologies, networks, and architectures. Initiated development of robust, adaptive, and fault tolerant networking protocols. Investigated secure techniques for mobile host protocols.
  - Investigated the application of software intelligent agents to C4I applications..
- 1813 - Developed the first version of a parallelized coupled fluid-structure interaction solver for modeling the structural dynamics of parachute canopies.
  - Established working techniques for simulation of parachute inflation fluid-structure interactions and applied these to an axisymmetric inflation.
  - Developed a numerical model of the firing cycle of the regenerative liquid propellant gun.
  - Developed a finite element two-phase flow solver for simulate sloshing in bulk liquid transport vehicles.
  - Developed with ARO and AHPCRC funding, serial METIS, an unstructured graph partitioning system. METIS is now being widely used by the DoD Computational High Performance Computing Software Initiative Projects in computational structural mechanics (CSM), computational fluid dynamics (CFD) and environmental sciences (ES) as well as at the AHPCRC.
  - A preliminary, alpha version of Parallel METIS, which can run on scalable computing systems, was made available for testing.

Total 6558

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences
	PROJECT: AH48

FY 1998 Planned Program:

•	5177	- Continue refinement of selected techniques that improve security and survivability technologies, networks, and architectures. - Develop and simulate secure mobility management techniques for mobile host protocols that support dynamic tactical network reconfiguration. - Develop and simulate software intelligent agents for information system vulnerability assessment and other C4I applications. - Develop the infrastructure for survivability and C4I software agents including human-agent, agent-agent, and agent-database interactions.
•	1587	- Continue development of adaptive gridding, mesh moving, and multi-body modeling techniques. Apply these techniques to model paratrooper exit from large transport aircraft. Develop advanced 3-D computational techniques capable of modeling (1) the deployment and flight of large ram air parachutes, (2) fluid flow about round parachutes, and (3) two-phase fluid mixing of sloshing fluids and their effect on vehicle stability. Improved simulation capability (both in scale of calculations performed, and time to completion). New algorithms and new computational resources should result in a five-fold improvement in time to completion. Work will transition to NRDEC. - Develop an efficient fully parallelized version of the F3D code capable of solving steady state flow problems on 50 million point grids in a practical time. Also, demonstrate a twenty-fold speed up on benchmark runs. - Release a production version of parallel METIS. - Continue development of modeling techniques for multi-phase fluid flow in porous media including biodegradation of contaminants. - Conduct research into new methodologies required for advanced mesh-free computational applications in structural mechanics.
•	167	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	6931	

FY 1999 Planned Program:

•	6489	- Demonstrate and validate secure mobility management techniques for mobile host protocols that support dynamic tactical network configurations. - Demonstrate and validate software intelligent agents that can detect information operations on combat networks. - Develop autonomous agents that, while working in concert with other tools, support the command process by reducing a commander's workload through timely identification, transmission and notification of vital data. - Develop hierarchical digital modulation algorithms for classification and identification of signals on battlefield. - Develop spatial diversity combining algorithms for tactical communications. - Develop algorithms for performing channel and source coding for tactical communications, error correcting codes, such as, Reed-Solomon, or capable to operate in high-bit error environments. - Develop efficient algorithms for Internet protocols for highly mobile networks.
Total	6489	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE
	February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic Research	0601102A Defense Research Sciences	AH48

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	6729	6199	7925
Appropriated Value	6729	7179	
Adjustments to Appropriated Value	-171	-248	
FY 1999 President's Budget	6558	6931	6489

Change Summary Explanation: Funding: FY 1999 funds reprogrammed (-1436) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH52

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH52 Equipment for the Soldier	809	886	999	1054	1081	1107	1137	Continuing	Continuing

A. Mission Description and Justification: Basic research focused on three core technology areas critical to the Soldier System: biotechnology, polymer science/textile technology and food technology. Research is targeted toward enhancing the mission performance, survivability, and sustainability of the soldier by advancing the state of the art in defense against battlefield threats and hazards such as ballistics, chemical agents, lasers, environmental extremes, and shortfalls in the availability of nutritious, satisfying rations essential to the health and well-being of soldiers.

FY 1997 Accomplishments:

•	809	- Explored protective barriers based on "active" membrane systems leading to new protections for the soldier from percutaneous toxins. - Completed molecular modeling of polymer interphases leading to the development of polymeric films and fibers with improved mechanical properties for ballistic and chemical agent protection. - Designed at the molecular level advanced ceramics for small arms protection. - "Electrospun" microfine fiber mats for evaluation of properties for protective clothing. - Fabricated electroconducting polymer and photoresponsive protein composites with various potential applications including individual laser eye protection. - Investigated various plasticizers/moisture binders to ameliorate textural changes during storage of intermediate moisture foods leading to new ration items that lend variety and texture to Meal-Ready-to-Eat (MRE). - Incorporated self-assembly techniques into newly developed ballistic silk fibers for further refinement of properties and characteristics for ballistic protection.
Total	809	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences
PROJECT: AH52	

FY 1998 Planned Program:

•	864	- Mathematically model the energy dissipating effects of textile systems to predict the behavior of newly designed textiles. - Characterize polymeric "interphases" for optimization of ballistic and chemical agent protective properties. - Incorporate energy converting proteins into electroactive polymer matrices for enhanced signal transduction in optical devices. - Leverage the Multidisciplinary University Research Initiative (MURI) for "functionally tailored fibers and fabrics", with the new electrospinning technology to produce new chemical protective clothing. - Formulate and process meat proteins to optimize microwaving as a new sterilization technique for military rations. - Enhance and measure individual soldier mobility and related physical performance through biomechanics, anthropometry and nutrition.
•	22	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	886	

FY 1999 Planned Program:

•	999	- Screen new materials using "electrospinlacing" technology for the production of "seamless" chemical protective clothing. - Validate mathematical models of textile damage effects from abrasion, strain, and ballistic impacts. - Extend the molecular modeling of interphases to address diffusion in polymers to extend chemical protection capability. - Incorporate production variables into the assessment of physical and chemical factors affecting non-linear optical behavior of candidate laser protective material. - Apply sophisticated analytical methodologies to formulated meat proteins to determine the effects of microwave sterilization of military rations. - Modify protein systems in electroactive polymer matrices using chemical means to optimize signal transduction in optical devices. - Quantify soldier physical performance emphasizing biomechanical and anthropometric parameters of the soldier's load.
Total	999	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	831	1014	1056
Appropriated Value	831	914	
Adjustments to Appropriated Value	-22	-28	
FY 1999 President's Budget	809	886	999

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-128).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BH57

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH57 Scientific Problems with Military Applications	45550	50148	58084	61191	62573	63946	65785	Continuing	Continuing

A. Mission Description and Justification: This extramural research project seeks to capture and exploit new scientific opportunities and technology breakthroughs, primarily at universities, to improve the Army's future operational capabilities. The Army Research Office maintains a strong peer-reviewed scientific research program through which technological improvements to warfighting capability can be assessed and implemented. Included are research efforts of scientific study and experimentation directed toward increasing knowledge and understanding in fields related to long-term national security needs and covering the physical sciences (physics, chemistry, biology, and mathematics) , the engineering sciences (mechanics, electronics, computer, energy conversion, aeronautics, and materials), and the environmental sciences (atmospheric and terrestrial). It covers approximately 450 grants and contracts with leading academic researchers and over 800 graduate students yearly, and supports research at over 120 institutions in 41 states. Additionally, 5% of Army funding of university research is committed to Historically Black Colleges and Universities/Minority Institutions (HBCU/MI).

FY 1997 Accomplishments:

- 21902 -Advanced materials research in optics has led to the development of gradient index relay lenses which are more affordable for target acquisition optical systems.
  - Advanced chemistry research synthesized new polymer structures with high solvent resistance, high strength and flexibility for Army materials.
  - Advanced biosciences research to incorporate multiple signal generators of high fluorescence intensity thereby providing a strategy for ultrasensitive approach to biological detection.
  - Developed a durable, ice-phobic coating for specific applications by means of molecular engineering.
  - Improved numerical simulations of boundary layer turbulence in atmospheric boundary layer and improved models for contaminant flows through porous media.
- 23648 -Research in mathematical and computer sciences designed controllers for dynamic simulation of human/soldier systems using a recursive formulation of workspace control.
  - Developed multicast modulation techniques that deliver multiple levels of information based on receiver capability.
  - Developed algorithms for a fully 3-D electromagnetic simulation for mine detection.
  - Developed a theory of acoustic propagation in intermittent atmospheric turbulence to explain large, fluctuating sound energy in shadow zones to enhance acoustic detection of unseen vehicle movement.
  - Developed a computationally economic, fast Floquest theory for efficiently determining helicopter stability in forward flight.

Total 45550

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences
PROJECT: BH57	

FY 1998 Planned Program:

•	21403	- Advance electronics research to develop quasi-optical circuits with high efficiency and high power at high millimeter wave frequencies. - Advance materials research to provide improved microstructural control of ceramics suitable for armor applications. - Advance physics research to exploit the properties of nanometer-sized clusters of atoms to construct materials with unique functionality.
•	27670	- Advance chemistry research in dendrimers and hyperbranched polymers as a new class of nanoscopic building blocks. - Advance research in the area of micro-mechanical mechanisms governing friction and wear of high temperature surfaces in engines. - Advance knowledge-base sciences in critical issues of complex reasoning and machine learning for multimedia digital information environments. - Advance biological sciences research in gene expression to determine the neural mechanisms that facilitate alertness and attention.
•	1075	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	50148	

FY 1999 Planned Program:

•	26709	- Design electromagnetic adaptive materials and structures for sensing and monitoring applications and for camouflage. - Develop 3-D microelectromechanical devices from high strength and high temperature materials to re-engineer heat engines at the micro level. - Integrate analytical and numerical techniques of structural modeling with computer graphics and visualization methods for "smart" materials applications.
•	31375	- Develop new antenna structures to optimize the new quasi-optical architectures. - Advance biosciences research to develop mechanisms by which enzymes from thermophilic microorganisms can tolerate extreme temperatures. - Conduct research in quantum computational analysis to develop revolutionary devices which can solve several types of "unsolvable" problems. - Develop a wide range of metal matrix composites using modified models of mismatched induced superplasticity. - Advance chemistry research to develop vesicles which can simultaneously visually identify the exact location of chemical agents and also destroy them.
Total	58084	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	46812	58174	56475
Appropriated Value	46812	51807	
Adjustments to Appropriated Value	-1262	-1659	
FY 1999 President's Budget	45550	50148	58084

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-8026).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH66

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH66 Advanced Structures Research	1281	1327	1391	1468	1505	1541	1583	Continuing	Continuing

A. Mission Description and Justification: 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); design and analyses of composite structures with crashworthiness as a goal; and the control of aircraft interior noise levels. These areas have application to the development of design tools for improved helicopter structures and dynamic response. This structures-focused technology includes reductions in vehicle vibratory loads, improved vehicle stability, advanced fatigue methodologies for metallic structures, improved composites technology throughout the vehicle, and long-term development of an integrated stress-strength-inspection technology. These technologies will extend service life, reduce maintenance costs, and enhance the durability of existing and future Army vehicles. The improved tools and methods will enable the design and use of composite structures that can better address the cost, weight, performance, and dynamic interaction requirements of future platforms, and ultimately result in safer, more affordable vehicles. As agreed under Project Reliance, this is the only project for rotorcraft and ground structures basic research within the DoD. No related effort is being conducted within DoD.

FY 1997 Accomplishments:

- 1281 - Developed improved modeling capability for `On-blade' active control to investigate both smart materials and passive structural concepts; enhanced the Piezoelectric Blade Aeroelasticity Analytical Model and the Comprehensive Analytical Model for Rotorcraft Aerodynamics and Dynamics (CAMRAD - II) analyses to focus on vibration reduction; designed a prototype twist actuated actively controlled rotor blade to validate these concepts.
  - Performed crashworthiness finite element analysis of a Lear Fan energy absorbing subfloor section and a full-scale Lear Fan aircraft to define their load transfer characteristics prior to full-scale crash tests.
  - Developed and applied 3D finite element models (FEMs) to center-cracked stiffened panels to predict the influence of rivet stiffness crack arrest, and to calculate delamination fracture toughness criteria for tapered composite laminates. Transition results to an ASTM standard for fatigue delamination onset.
  - Conducted low velocity impact experiments on thick composites made from glass and glass/ceramic hybrids, to study incidental damage effects and to extend the existing thin structures knowledge base. Investigated fracture mechanics total life models and rotorcraft load interaction effects.

Total 1281

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences
	PROJECT: AH66

FY 1998 Planned Program:

•	1322	- Design, fabricate, and test an actively controlled (embedded twist control) rotor system using the Aeroelastic Rotor Experimental System (ARES) testbed. Conduct CAMRAD-II analyses to develop control law definitions and to investigate passive concepts for the active rotor program. - Modify the tiltrotor version of the University of Maryland Aeroelastic Rotor Code (UMARC) to predict the stability of a free-flight system, and to study the aeroelastic response of tilt rotor systems using active controls for stability augmentation. - Conduct a full-scale crash experiment on a retrofitted full-scale Lear Fan aircraft to study the crashworthiness of its energy absorbing subfloor and to evaluate the scaling laws that apply to tensile coupons under large deformation. - Extend the utility of low velocity impact models (involving damage resistance and residual strength) to encompass stitched composite panels; investigate the effects of secondary adhesive bonds and 3D reinforcements on composite stringer strength; and evaluate the structural parameters that control crack growth geometry in stiffened panels. - Validate 3D FEM composite flexbeam strength and fatigue life predictions for combined tension/torsion loading, performing parametric studies on rotorcraft flexbeam geometry anomalies and on the influence of flexbeam lay-up and material form on strength and fatigue durability.
•	5	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	1327	

FY 1999 Planned Program:

•	1391	- Conduct hover and forward flight testing of a twist actuated active rotor system in the Transonic Dynamics Tunnel to address vibration reduction. - Incorporate active control and smart material analytical models into the tilt rotor version of UMARC and correlate the results with test data taken from an actively-controlled stability augmentation system. - Correlate finite element models of the Lear Fan full-scale aircraft with data from crash test, and transition the results to the technical community. - Publish test standards to measure delamination onset and fracture toughness of composite laminates, develop probabilistic method for analyzing low velocity impact resistant in composite panels, and develop fatigue analysis for arbitrary flexbeam lay-up under combined tension/torsion loads.
Total	1391	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1287	1405	1465
Appropriated Value	1287	1370	
Adjustments to Appropriated Value	-6	-43	
FY 1999 President's Budget	1281	1327	1391

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BH67

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH67 Environmental Research - Army Material Cmd	3445	4758	3718	3923	4022	4120	4231	Continuing	Continuing

A. Mission Description and Justification: This project focuses basic research on innovative technologies for both industrial pollution prevention (P2) that directly supports the Army industrial base and for non-stockpile chemical warfare (CW) site remediation. The objective of the pollution prevention work is to invest 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. The goal is to reduce the cost of remediating a site by at least 50% verses the use of conventional methods. Pollution prevention thrusts include: environmentally acceptable advanced non-radioactive, non-toxic and lightweight alternative structural materials to enhance weapon system performance; substitutes for ozone-depleting chemicals as solvents, refrigerants, and firefighting agents for military unique applications; energetic synthesis and process improvements to eliminate the use of hazardous materials and to minimize the generation of wastes from manufacturing operations; and surface protection alternatives to hazardous paints, cadmium, chromium, and chromate conversion metal and composite surfaces. CW thrusts include establishing the ecotoxicity of CW compounds, environmental fate and effect of CW compounds in soils and biodegradation of CW compounds. This project is linked to the Tri-Service Environmental Quality R&D Strategic Plan and addresses environmental technology requirements addressed in that plan.

FY 1997 Accomplishments:

•	3445	- Synthesized cyclic nitramine using enzymatic methods. Transitioned enzymatic work into "Green Energetics" program. - Completed basic research work in aqueous processing of fibers and composites and initiate technology transfer to exploratory development. - Developed biotechnological methods to treat chemical warfare (CW) contaminated soil, determine CW agent fate, and assess environmental risk.. - Released final report on halon alternative compounds research and transition to commercial sector for potential non-military applications. - Identified an environmentally benign fluid that will eliminate volatile organic compounds (VOC) presently used to process pyrotechnic flares.
Total	3445	

FY 1998 Planned Program:

•	1978	- Develop optimized microbial consortia to biodegrade CW agents/products. - Identify supercritical fluid solvents for demil/recycling of triple base propellant. - Develop corrosion-resistant coatings, and plasma based decoating technologies.
•	1410	- Complete fabrication and examination of specimens prepared with hollow, cylindrical, coating targets. - Continue bioceramics Langmuir-Blodgett studies, reverse micelle, or other suitable systems to mimic natural processes. - Conduct aqueous processing studies with elastomeric proteins for coatings.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BH67

FY 1998 Planned Program: (continued)

•	1259	- Complete characterization of energetic products and spent catalysts. - Complete study of fundamental physical and chemical characteristics of propellants which influence the ballistic temperature coefficient during combustion. - Investigate chemical conjugates and other intermediate byproducts during biological degradation of explosives in soil.
•	111	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	4758	

FY 1999 Planned Program:

•	824	- Investigate new nanoscale composites of montmorillonite clay in polyesters and nylon to increase production and crystal type. - Modify aqueous based coatings to optimize functional properties for specific applications such as attaching peptides to polymers to accelerate chemical/biological warfare agent degradation..
•	911	- Optimize techniques for supercritical fluid triple-base demil/recycling. Transition to applied research. - Identify techniques for accelerating formation of self-assembled monolayer protective coatings.
•	799	- Complete fabrication and examination of specimens prepared with wire-wrapped, solid, cylindrical, coating targets.
•	1184	- Complete characterization, evaluation, and model validation of a Cylindrical Magnatron Sputtering (CMS) device and transition to applied research. CMS device may be critical capability needed to apply other than heavy metals to the inside of gun barrels. Elimination of use of heavy metals is key environmental goal.
Total	3718	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4798	5709	4917
Appropriated Value	4798	4909	
Adjustments to Appropriated Value	-1353	-151	
FY 1999 President's Budget	3445	4758	3718

Change Summary Explanation: Funds reprogrammed (-1353) in FY 1997 to higher priority requirements.
Funds reprogrammed (-1199) in FY 1999 to Project BT25 of this PE to realign work and for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH68

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH68 Processes in Pollution Abatement Technology	334	361	424	448	460	470	483	Continuing	Continuing

A. Mission Description and Justification: This project provides fundamental understanding of the physical, chemical and biological properties and mechanisms that control the degradation and treatment of hazardous wastes on military installations. This research is used to obtain basic technical information necessary for the design of treatment systems for both cleanup of existing hazardous waste sites and control of future hazardous waste generation. Wastes of concern include explosives, propellants, chemical agents and smokes. This project supports applied research efforts in Program Element 0602720A, Projects AF25 and DO48.

FY 1997 Accomplishments:

•	334	- Completed enzymatic studies of explosives degradation. - Isolated/identified microbial genera and define pathways in nitrocellulose (NC), nitroglycerine (NG), and dinitrotoluene (DNT) degradation. - Developed and applied molecular monitoring tools to determine impacts of explosives contaminates on in-situ microbial communities.
Total	334	

FY 1998 Planned Program:

•	351	- Provide implementation guidance on microbial destruction of TNT in soils. - Complete studies on explosives bioprocessing in flow through bioreactors.
•	10	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	361	

FY 1999 Planned Program:

•	424	- Continue determination of fundamental microbiological processes impacting the biodegradation of explosives and their byproducts. - Complete minimal growth requirements for bacteria involved with destruction of energetic wastes.
Total	424	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	343	427	447
Appropriated Value	343	373	
Adjustments to Appropriated Value	-9	-12	
FY 1999 President's Budget	334	361	424

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS04

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS04 Military Pollutants and Health Hazards	570	609	657	680	683	686	687	Continuing	Continuing

A. Mission Description and Justification: This project provides basic research in innovative, less costly, and less time consuming toxicity assessment methods for determining potential human health and environmental effects of military-unique hazardous wastes and chemicals, including explosives, propellants, and smokes. These new testing techniques will help to prioritize hazardous waste and waste treatment technologies and screen new Army chemicals for potential toxic effects. The work is conducted at US Army Biomedical Research and Development Laboratory (USABRDL) and US Army Center for Health Promotion and Preventive Medicine (CHPPM).

FY 1997 Accomplishments:

•	570	- Explored improvements in specific environmental toxicity methods (USABRDL).
		- Identified additional sentinel biomonitoring systems (USABRDL).
		- Continued exploration of cross-species extrapolation of non-mammalian bioassay systems (USABRDL/CHPPM).
		- Refined identification of methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
Total	570	

FY 1998 Planned Program:

•	594	- Continue to explore improvements in specific environmental toxicity methods (USABRDL).
		- Identify additional sentinel biomonitoring systems (USABRDL).
		- Continue exploration of cross-species extrapolation of non-mammalian bioassay systems (USABRDL/CHPPM).
		- Refine identification of methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
•	15	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	609	

FY 1999 Planned Program:

•	657	- Continue to explore improvements in specific environmental toxicity methods (USABRDL).
		- Identify additional sentinel biomonitoring systems (USABRDL).
		- Continue exploration of cross-species extrapolation of non-mammalian bioassay systems (USABRDL/CHPPM).
		- Refine identification of methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
Total	657	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS04

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	585	718	750
Appropriated Value	585	628	
Adjustments to Appropriated Value	-15	-19	
FY 1999 President's Budget	570	609	657

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences	PROJECT BS13

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS13 Science Base/Medical Research infectious Disease	8036	8632	10456	11033	11313	11588	11901	Continuing	Continuing

A. Mission Description and Justification: This project funds basic research on medical countermeasures for naturally occurring diseases which are militarily significant due to their potential impact on military operations. Development of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations.

FY 1997 Accomplishments:

- 1934 Discovered 17 new malaria liver stage proteins recognized by immune cells that are candidates for vaccine testing. Systematically explored a number of malaria genes and their expressed proteins as vaccine antigens in animals to screen for inclusion in a malaria vaccine. Investigated an outbreak of *Plasmodium vivax* malaria in U.S. and Korean soldiers in Korea. Developed a system to evaluate sequestrin, a malaria protein associated with binding of parasites to capillary walls and severe disease.
- 693 Identified cellular enzymes in the malaria parasite that may be potentially useful targets for candidate antimalarial drugs.
- 31 Expanded monitoring of emerging resistance patterns in malaria parasites. Evaluated new technologies for study of drug resistance in the laboratory. Evaluated parasites from Korean and U.S. forces in the demilitarized zone of Korea, and persons in Nigeria, Thailand, Indonesia, Kenya, and Peru, documenting the spread of resistance into new areas.
- 612 Identified several epitopes on *Shigella* protein virulence proteins that will be used to study feasibility of creating a vaccine to protect individuals across all *Shigella* species. Identified genetic sequences for PCR primers to support *Shigella* diagnostic device development, which ultimately will be used for far-forward diagnosis of *Shigella* directly from stool samples.
- 352 Refined the vaccine to protect against enterotoxigenic *Escherichia coli* (ETEC) diarrheal disease by optimizing the laboratory antigen microencapsulation process and selecting a suitable gelatin capsule and enteric coating for the microsphere particles.
- 314 Discovered that bile acids, normally found in the intestinal tract, play a global role in allowing *Campylobacter* to produce diarrheal disease, having an effect on at least four different *Campylobacter* proteins; this observation could be a key in identifying the *Campylobacter* proteins most relevant to vaccine development. Identified three new antigens on the surface of *Campylobacter* that could also be important components of a subunit vaccine.
- 278 Identified several dengue, *Shigella* and ETEC antigens that are candidate reagents for development of diagnostic tests.
- 825 Documented the emergence of dengue-2 virus in the Amazon region of Peru, suggesting a new threat to military operations in that region. Refined understanding of dengue virus infection and immune mechanisms contributing to severe disease.
- 664 Evaluated effectiveness of antiviral drugs against Ebola in laboratory assays. Established an animal model for lethal Ebola infection for screening potential candidate antiviral drugs and vaccines.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS13

FY 1997 Accomplishments: (continued)

- 495 Conducted epidemiology studies in Egypt, Indonesia, Nepal, Peru, Thailand and Vietnam to partially characterize the threat of hepatitis E to U.S. forces.
- 250 Developed multiple new assay methods for detecting the organism that causes scrub typhus utilizing PCR, dried blood spots and rapid technologies for detection and typing of *Orientia tsutsugamushi* from human tissue and from infected chiggers.
- 135 Identified a soluble antigen for use in development of a *Leishmania* immunodiagnostic assay.
- 175 Prepared a mutant vaccine strain of Type B Meningococcus with increased, stable expression of a conserved surface protein.
- 396 Recognized for its unique status in the DoD, USAMRIID was acknowledged by the World Health Organization (WHO) as a Collaborating Center for Viral Hemorrhagic Fevers as a result of extensive expertise and contributions in handling viruses requiring the highest biosafety containment possible (Ebola, Marburg).
- 792 Identified five chemical candidates to replace DEET as an insect repellent. Identified a protein produced by mosquitoes that triggers *Plasmodium* fertilization and that could be a target to prevent malaria transmission.
- 90 Conducted basic studies at the vaccine pilot production facility to determine optimal methods of scale-up for vaccine production under Good Manufacturing Practices (GMP) conditions to provide scientific basis for procedures used in pilot production runs.

Total 8036

FY 1998 Planned Program:

- 1653 Evaluate *Plasmodium falciparum* malaria DNA vaccines consisting of genes encoding one or multiple proteins in animal models. Study tactics to increase the immune response to malaria vaccines such as different prime-boost regimes and protocols that incorporate cytokines proteins. Evaluate and compare natural and vaccine-induced immune responses to malaria parasites and malaria proteins. Prepare a candidate *Plasmodium vivax* vaccine.
- 1485 Construct small insert *Plasmodium falciparum* chromosome 2 library and begin sequencing of that chromosome in support of the malaria genome project. Develop techniques for making large insert libraries that will expedite sequencing efforts.
- 401 Identify at least five different target proteins for structure-based drug design of novel antimalaria drugs.
- 55 Conduct surveillance for new emerging resistance patterns in malaria parasites worldwide. Improve detection of drug resistant malaria to discover those soldiers who remain infected following treatment.
- 550 Identify additional epitopes on *Shigella* protein virulence proteins that will be used to study feasibility of creating a vaccine to protect individuals across all *Shigella* species. Investigate the possible relationship between reactive arthritis, major histocompatibility complex type HLA-B27, and *Shigella* infection at a field site in Thailand, to provide additional vaccine safety data.
- 441 Develop a PCR assay for rapid detection of ETEC as a cause of diarrheas. Identify and characterize new ETEC surface antigens.
- 336 Determine the role in pathogenesis and immunity of *Campylobacter* proteins that are induced by bile acids. Develop and use expression systems to identify new *Campylobacter* proteins induced during infection and assess their roles in pathogenesis and immunity.
- 250 Evaluate several candidate technologies for far-forward rapid malaria diagnosis.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS13

FY 1998 Planned Program: (continued)

- 732 Identify and characterize potential components to future live-attenuated, killed, recombinant, and DNA dengue virus vaccines. Identify and characterize potential components to future dengue diagnostic assays.
- 686 Identify and characterize potential components to future vaccines to protect against Lassa Fever, Congo Crimean Hemorrhagic Fever, Sandfly Fever and hantavirus related illness.
- 177 Identify and characterize potential components of future diagnostic tests for hepatitis E.
- 227 Identify genes from antibiotic-resistant scrub typhus to develop and define genetic markers and mechanisms of antibiotic resistance.
- 133 Identify and characterize *Leishmania* antigens and PCR primer sequences for diagnostic test development.
- 127 Analyze specificity of bactericidal antibodies induced in animals and humans by a NOMV vaccine against bacterial meningitis.
- 367 Perform extensive surveillance of febrile illnesses, respiratory disease, encephalitis, diarrhea, hemorrhagic fever and other conditions in at least two countries in Asia, South America, and Africa to identify new infectious disease threats to soldiers.
- 716 Analyze chemical structure of insect repellent candidates using state-of-the-art computer programs. Isolate antigens to be used in developing a rapid immunological method for testing sand flies for Leishmaniasis, a growing military threat; Develop tactics for controlling sand flies in the Middle East. Determine the dry season habitat of the malaria vector *Anopheles gambiae* in Kenya. Identify genes or antigens that could be used in development of a diagnostic test for detection of pathogens in vectors. Develop a PCR assay to detect the organism carried in chiggers causing scrub typhus.
- 80 Explore additional basic methods of vaccine production at the Vaccine Pilot Production Facility, expanding studies to include adjuvant research.
- 216 Small Business Innovative Research/Small Business Technology Transfer Programs.

Total 8632

FY 1999 Planned Program:

- 2039 Assess functional antibody responses to the *Plasmodium falciparum* MSP-1 protein and design modified MSP-1 proteins that will induce protective antibodies. Characterize memory T cell immune responses to lead vaccine antigens. Incorporate initial data produced from malaria genome project into vaccine development efforts.
- 1623 Continue sequencing of Chromosome 2 malaria genome project, and as completed, begin on a new chromosome. Develop bioinformatics capability to rapidly identify the best gene targets from the sequence data for entry into the malaria vaccine development and structure-based drug development programs.
- 1066 Identify at least five different target proteins for structure-based drug design of novel antimalaria drugs.
- 626 Determine best approach for a *Shigella dysenteriae* vaccine. Identify monoclonal antibodies to *Shigella* virulence proteins that could be used in a dipstick immunodiagnostic assay for *Shigella* in dysenteric stools.
- 389 Study uptake and processing of microspheres in animals to understand how to stimulate maximum immune response. Explore expression vectors for four defined ETEC colonization factor genes to identify candidate ETEC strains for live, avirulent vaccines. Explore an improved animal model for ETEC diarrhea.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences
	PROJECT: BS13

FY 1999 Planned Program: (continued)

- 360 Develop a system to stably inactivate virulence genes for use in live-attenuated *Campylobacter* vaccines. Identify bacterial and human factors associated with post-infectious reactive arthritis and Guillain-Barre syndrome.
- 281 Select specimen processing procedures that yield optimal sensitivity and specificity in isolation of nucleic acids from medical specimens of whole blood, urine, stool, and spinal fluid to support development of a hand-held system for far-forward diagnosis of infectious diseases. Develop rapid diagnostic tests for far-forward diagnosis of enteric pathogens directly from stool specimens.
- 838 Identify and characterize potential components to future live-attenuated, killed, recombinant and DNA dengue virus vaccine. Identify and characterize potential components to future dengue diagnostic assays.
- 834 Identify and characterize potential components to future assays for hantavirus.
- 163 Genetically characterize North African and Nepali isolates of the hepatitis E virus (HEV) to assist in identifying potential components of future HEV vaccines.
- 265 Explore new technologies that could be applied to identification of drug resistant strains of *Orientia tsutsugamushi,* the cause of scrub typhus.
- 171 Define and characterize the role and effects of cytokines in *Leishmania* infection and resistance to infection.
- 134 Conduct molecular studies of optimized and multivalent OMP vaccines to protect against bacterial meningitis.
- 159 Conduct surveillance at global field sites to determine the current risk that cholera poses to deployed troops. Identify technologies that are appropriate for development of a cholera vaccine.
- 320 Expand surveillance to identify emerging pathogens that could put deployed soldier at risk for febrile illnesses, respiratory disease, encephalitis, hemorrhagic fever and other conditions.
- 848 Synthesize by computer modified versions of the most efficacious candidate insect repellent. Develop wicking assays for the detection of insect vectors carrying *Leishmania* and mosquitoes carrying dengue virus.
- 340 Explore novel and improved methods of vaccine production and adjuvant research at the Vaccine Pilot Production Facility.

Total 10456

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	8253	10209	11357
Appropriated Value	8253	8908	
Adjustments to Appropriated Value	-217	-276	
FY 1999 President's Budget	8036	8632	10456

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-1577).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS14

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS14 Science Base/Combat Casualty Care Research	3650	3832	4212	4444	4556	4667	4792	Continuing	Continuing

A. Mission Description and Justification: This project conducts research to understand the basic mechanisms of combat related trauma. This research identifies trauma related topic areas, develops exploratory techniques, and initiates the experimental models necessary to support in-depth trauma research studies. This research is the basis for the development of trauma treatment and surgical procedures to extend the "brass 10 minutes" and achieve a "golden hour" following trauma 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.

FY 1997 Accomplishments:

- 1208 Completed examination of feasibility of fibrin bandages for use in combat wounds. Began identifying resuscitative technologies to ameliorate central and peripheral neural injury.
- 974 Identified molecular mechanisms of central nervous system damage occurring secondarily to trauma and brain ischemia. Explored basic mechanisms of organ failure in shock.
- 429 Explored role of endocrine and other mediators in burn wound infection and hypermetabolism. Continued microbiological surveillance of burn victims.
- 209 Continued animal testing of miniature, fiber optic, catheter-based blood gas monitor for base deficit determinations.
- 389 Conducted additional evaluations of potential countermeasures for smoke inhalation injury in small and large animal injury models. Evaluated countermeasures for musculoskeletal injury.
- 441 Identified additional candidate technologies as non-invasive sensors, sensor fusion mechanisms or chip-based, local data-processing systems to improve diagnostics and treatment decisions far forward.

Total 3650

FY 1998 Planned Program:

- 400 Examine feasibility of "Smart Tourniquet" for hemostasis of combat limb injuries.
- 135 Test feasibility of microwave warming catheter for intravenous fluid resuscitation of combat casualties.
- 769 Test feasibility of medical decision assist algorithm to enhance first responder capabilities.
- 286 Explore feasibility of novel technologies or concepts to support research on dental trauma or maxillofacial injury.
- 844 Continue examining molecular mechanisms of central nervous system damage after brain trauma.
- 594 Evaluate small volume resuscitation fluids as therapy for massive prehospital hemorrhage.
- 361 Identify cytokine gene activation in tissues after hemorrhagic shock.
- 200 Evaluate antimicrobial modalities in the prevention and treatment of burn-associated chondritis.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS14

FY 1998 Planned Program: (continued)

•	147	Establish human bronchial epithelial cell culture system to examine cytoprotectant compounds.
•	96	Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	3832	

FY 1999 Planned Program:

•	1204	Determine feasibility of high speed data acquisition and parallel processing in handling real-time acquired physiological data in a hand-held or body- worn computer.
•	815	Evaluate ability of medical decision assist algorithms to predictably triage and assist in deciding initial diagnoses.
•	400	Determine feasibility of using text search engines as an enabling technology in medical translation.
•	949	Evaluate pharmaceutical mechanisms to counter central nervous system injury after trauma.
•	844	Develop antioxidant pharmacologics to block ischemia-reperfusion injury in gut after hemorrhage or trauma.
Total	4212	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3749	4523	4702
Appropriated Value	3749	3954	
Adjustments to Appropriated Value	-99	-122	
FY 1999 President's Budget	3650	3832	4212

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-691).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS15

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS15 Science Base/Army Operational Medicine Research	5396	5162	6516	6876	7051	7222	7417	Continuing	Continuing

A. **Mission Description and Justification:** The scientific and technical objectives for this project focus 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 non-ionizing radiation directed energy, blast, jolt, vibration, noise, and toxic industrial chemicals as environmental contaminants are also investigated under this project. Specific tasks include delineating injury and effect thresholds, mechanisms, and sites of action. Emphasis is on protection, sustainment, and enhancement of the physiological and psychological capabilities of military personnel under combat operations in all environments. The six main thrust areas include neuromodulation of stress and cognition, metabolic regulation, control of regional blood flow, oxidative stress interventions, tissue remodeling/plasticity, and biomechanical/biodynamic mechanisms of injury.

FY 1997 Accomplishments:

•	1190	Characterized effects of antioxidant nutrients for preventing stress-induced suppression of immune function.
•	1008	Identified nutritional and pharmacological strategies to reduce incidence and severity of cold-induced injuries.
•	1971	Characterized the time course of injury from high-peak power, short-pulse duration microwave radiation.
•	1227	Defined the role of environmental chemical exposure and reactive oxygen activity on immunotoxicity.
Total	5396	

FY 1998 Planned Program:

•	627	Identify nutritional and pharmacological strategies to reduce incidence and severity of altitude-related illnesses.
•	375	Explore role of enzyme regulation in preventing stress-induced brain glutamate surges.
•	875	Identify useful biomarkers of exposure to toxic industrial chemicals to serve as warning mechanism for deployed troops.
•	710	Map laser retinal lesions to assess chronic effects of accidental off-axis exposure to current laser rangefinders/designators.
•	908	Determine daily patterns of metabolism (energy expenditures and core temperature) in extreme conditions of Ranger's training.
•	674	Explore mechanisms of thermoregulatory "fatigue" after repeated multiple cold exposures.
•	325	Determine appropriate stress diagnostics for field assessment of severely stressed soldiers.
•	539	Develop novel simulation models for sleep management system.
•	129	Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	5162	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS15

FY 1999 Planned Program:

•	956	Develop in vivo photoreceptor imaging in primate models to enhance assessment of laser retinal injury and repair mechanisms.
•	405	Evaluate candidate ergogenic aids suitable for ration supplementation to facilitate cognitive and psychomotor performance in stressful environments.
•	509	Test efficacy of local vasodilators to maximize regional dry heat loss.
•	1326	Explore effects of muscle damage and fatigue on thermoregulatory responses to cold.
•	586	Evaluate stimulants to maintain performance in CONOPs scenario.
•	834	Develop physiological markers to differentiate compensable stress from noncompensable stress.
•	1000	Investigate neurological and biochemical basis of stress-induced physical symptoms and immune deficits.
•	900	Identify biomarkers of toxic effects of industrial chemicals in order to rapidly identify those troops exposed to contaminants and initiate remedial actions.
Total	6516	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5543	6094	6863
Appropriated Value	5543	5327	
Adjustments to Appropriated Value	-147	-165	
FY 1999 President's Budget	5396	5162	6516

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-932).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS16

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS16 Science Base/Combat Dentistry Research	447	0	0	0	0	0	0	0	447

A. Mission Description and Justification: This project supports biomedical research directed toward understanding basic biological mechanisms underlying repair of militarily relevant maxillofacial injuries. This research is of fundamental importance to the development of treatments that enhance survival and sustain warfighting capability following battle and nonbattle injuries.

FY 1997 Accomplishments:

•	447	Developed capability to fabricate bone replicas from three-dimensional in-house obtained data using CAD/CAM algorithms and in-house machine tools. Conducted Base Realignment and Closure Commission (BRAC)-mandated move to co-locate dental assets with Navy at Great Lakes Naval Station.
Total	447	

FY 1998 Planned Program: Project tasks and funding restructured to PE 0601102A, Project BS14.

FY 1999 Planned Program: Project tasks and funding restructured to PE 0601102A, Project BS14.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	459	0	0
Appropriated Value	459		
Adjustments to Appropriated Value	-12		
FY 1999 President's Budget	447	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS17

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS17 Molecular Biology/Military HIV Research	762	423	457	483	495	507	520	Continuing	Continuing

A. Mission Description and Justification: This project provides for basic research for early diagnosis and identification of technologies to design prevention and treatment of HIV. The present emphasis is on identification and comparison of HIV strains from many geographical locations, characterization of etiologic agents and definition of tests for epidemiological surveys to design a vaccine to prevent disease. Current policy prohibits OCONUS assignments of antibody positive service members. A safe and effective vaccine for prevention of infection and intervention will permit all service members to become worldwide deployable.

FY 1997 Accomplishments:

•	762	Evaluated preclinically oligomeric proteins as vaccine candidates based upon information obtained from worldwide variability of the HIV genome. Studied transmission kinetics of newly-introduced HIV types. Determined potential for an alphavirus-vectored HIV DNA recombinant vaccine construct.
Total	762	

FY 1998 Planned Program:

•	412	Evaluate HIV sub-unit peptides as vaccine candidates to combat worldwide HIV strains. Develop methods to evaluate international threat assessment of HIV strains. Complete study of transmission kinetics of newly introduced HIV recombinant strains.
•	11	Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	423	

FY 1999 Planned Program:

•	457	Develop methods to evaluate the international threat of various HIV strains.
Total	457	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	783	499	482
Appropriated Value	783	436	
Adjustments to Appropriated Value	-21	-13	
FY 1999 President's Budget	762	423	457

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS18

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS18 Marine Derived Biocatalysts	619	0	0	0	0	0	0	0	619

A. Mission Description and Justification: Biocatalysts (enzymes) which degrade organophosphorus chemical agents and other hazardous defense industry-related materials will be isolated from marine microorganisms. Gene codings for the production of these biocatalysts will be cloned and expressed in suitable bacterial or insect cell systems and produced by fermentation in large scale (i.e. gram). Both genetic and bioreactor variables will be optimized for efficient biomanufacture of active, stable, hazardous material degrading enzymes.

FY 1997 Accomplishments:

•	619	Isolated and purify Organophorus Acid Anhydrolase and other hydrolytic or oxidoreductase enzyme candidates and test activity. Cloned genes and expressed in suitable vector. Scaled up fermentation and produce gram quantities.
Total	619	

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	636	0	0
Appropriated Value	636		
Adjustments to Appropriated Value	-17		
FY 1999 President's Budget	619	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS19

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS19 Telemedicine Research	0	0	534	552	556	558	558	Continuing	Continuing

A. Mission Description and Budget Item Justification: The purpose of this program is to perform research contributing to superior combat casualty care for troops through faster diagnosis and treatment while allowing on-site health care providers to consult with specialists worldwide. This work will focus on developing the means to determine soldier physiological status and aiding medical diagnosis and treatment. A significant thrust area will work to ascertain the sensors most relevant to determine change in soldier physiological status.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program:

•	534	Investigate techniques for measurement of diverse physiological information from soldiers in order to determine those changes related to reduced levels of functioning.
Total	534	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value			
Adjustments to Appropriated Value			
FY 1999 President's Budget	0	0	534

Change Summary Explanation: Funding: FY 1999 - Funding reallocated from other projects to initiate research program in this area.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AT22

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT22 Soil and Rock Mechanics	1685	1822	2070	2184	2239	2294	2356	Continuing	Continuing

A. Mission Description and Justification: Basic research in this project develops the fundamental knowledge base required by the Army in the field of civil engineering. Current emphasis is on: determining and quantifying the non-linear, hysteretic response of deformable soils to transient loadings resulting from high-speed curvilinear vehicle maneuver; defining the constitutive behavior and penetration mechanics (including plastic deformation and microfracture mechanics) associated with projectile impact on complex geologic and structural materials; development of mathematical models needed for first principle analyses of explosive-induced ground shock and high-velocity projectile impact; development of analytic models and advanced construction materials for the design and construction of permanent or expedient operating surfaces both within CONUS and within a theater of operations; investigation of soil electromagnetic properties that affect in-situ obstacle discrimination and development of adaptive or responsive construction materials suitable for camouflage, concealment, and deception measures for fixed or semi-fixed assets. These technologies provide the basis for applied research to provide: analytical capabilities for mobility assessments; hardened battlefield positions, fixed facilities, and semi-fixed assets; multispectral camouflage, concealment, and deception for fixed facilities; and advanced vertical and horizontal construction materials in PE 0602784A, Project AT40.

FY 1997 Accomplishments:

•	1685	- Developed first-principle computer code to calculate long-rod penetrator performance during normal impact against concrete targets. - Documented soil/climatological relationships for predicting/evaluating soil-moisture strength world wide. - Developed substrate specifications for materials to host responsive/passive concealment and camouflage deception (CCD) laminate materials. - Developed dynamic constitutive models for pavement materials and continue formulation of traffic distribution model.
Total	1685	

FY 1998 Planned Program:

•	1776	- Conduct subscale tests and calculational analyses of hard-target penetrators against advanced concretes. - Determine appropriate combinations of responsive/passive composite materials as a function of environment and facility type. - Validate models for predicting the durability and dynamic behavior of pavement materials. - Conduct soil tests in centrifuge to collect patterns of soil response to wheeled vehicle loadings..
•	46	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	1822	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AT22

FY 1999 Planned Program:

•	2070	- Complete first-principle code calculations simulating oblique-impact long-rod penetration tests against concrete targets. - Incorporate selected responsive/passive materials into/onto substrate host. - Complete analytical models for predicting traffic distribution, cohesive soil moisture response, and compaction behavior. - Develop analytic model describing influence of partial soil saturation on surface shear strength.
Total	2070	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1730	2095	2180
Appropriated Value	1730	1880	
Adjustments to Appropriated Value	-45	-58	-110
FY 1999 President's Budget	1685	1822	2070

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-273).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AT23

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT23 Basic Research/Military Construction	1460	1540	1797	1896	1945	1991	2045	Continuing	Continuing

A. Mission Description and Justification: This project supports development of fundamental knowledge essential to develop the leap ahead technologies required to solve Army and Defense (via Project Reliance) unique problems in the planning, programming, design, construction, and sustainment of force projection platforms and energy and utility infrastructure to achieve the infrastructure cost reduction goals of the current national military strategy. This project supports exploratory development efforts in Program Element 0602784A, Projects AT41 and AT45. This project also supports related Defense Modeling and Simulation Office-funded applications, and has significant dual-use application potential.

FY 1997 Accomplishments:

•	1460	- Investigated models for self-responding composites for infrastructure applications. - Developed models to predict the behavior of materials under load histories simulating earthquakes.
Total	1460	

FY 1998 Planned Program:

•	1502	- Develop engineer interaction protocols, common facility component representations, and facility knowledge sharing algorithms to enable the development of an open collaborative engineering designer system. - Develop an understanding of active magnetostrictive tagging of construction materials for monitoring structural health. - Develop understanding of full 3-D behavior of steel building systems via testing on triaxial shock test facility.
•	38	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	1540	

FY 1999 Planned Program:

•	1797	- Develop collaborative engineering methodologies to enable asynchronous design and engineering of facilities. - Characterize Electrical Time Domain Reflectometry for evaluation of structural health of large concrete structures. - Continue 3-D response analysis of steel buildings.
Total	1797	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences	PROJECT: AT23

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1500	1818	1892
Appropriated Value	1500	1589	
Adjustments to Appropriated value	-40	-49	
FY 1999 President's Budget	1460	1540	1797

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-278).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AT24

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT24 Snow, Ice and Frozen Soil	1075	1137	1328	1403	1437	1472	1512	Continuing	Continuing

A. Mission Description and Justification: This project is the only focused DoD basic research program investigating the physical, chemical, and electrical properties of snow, ice, and frozen soil and characterization of dominant winter and cold regions processes impacting military materiel, operations, and facilities. It provides the knowledge base for exploratory development to support modeling and simulation and product improvements as well as leading to reduced life-cycle costs and increased readiness and operability in extreme cold, high altitude and seasonal winter conditions around the world. Products are directly input to PE 0602784A, Project AT42, as well as specific Navy and Air Force science and technology efforts, and forms the basis for much civilian applied research in these areas. It provides the fundamental knowledge base for developing concepts and approaches to upgrade materiel and doctrine for more effective performance in these challenging conditions.

FY 1997 Accomplishments:

•	1075	- Developed first principles radar scattering model for ice.
		- Initiated development of 2- and 3-D models for freeze/thaw process for saturated soils. Program to be completed in FY 2000.
		- Developed analysis of atmospheric icing persistence; developed a dynamic model of ice inclusion size distribution.
Total	1075	

FY 1998 Planned Program:

•	1108	- Quantify the rapid and dynamic evolution of millimeter wave radar response in temperate snow conditions.
		- Parameterize role of snow cover in turbulent exchange of heat and moisture in boundary layer.
		- Quantify dominant acoustic propagation processes for mapping snow covered terrain.
•	75	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	1137	

FY 1999 Planned Program:

•	1328	- Develop vectorized wave propagation code for viscoelastic/porous media.
		- Develop computer model to analyze ice properties derived from satellite microwave footprints..
		- Develop procedures for mapping regional rime ice loads.
Total	1328	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences
	PROJECT: AT24

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1104	1343	1399
Appropriated Value	1104	1174	
Adjustments to Appropriated Value	-29	-37	
FY 1999 President's Budget	1075	1137	1328

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-206).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BT25

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BT25 Environmental Research - Corps of Engineers	4205	3004	4750	5012	5139	5264	5406	Continuing	Continuing

A. **Mission Description and Justification:** This project provides the basic research needed to develop the technologies to address Army issues in the cleanup, compliance, conservation, and pollution prevention areas. The focus in cleanup provides the basic knowledge needed to develop physical, chemical and biological technologies to clean up the Army's contaminated sites. In compliance and pollution prevention, efforts address knowledge gaps vital to maintaining compliance and preventing pollution at non-industrial installations. The focus in conservation is on landform and ecological modeling, the feasibility of development and propagation of resilient plant species for rehabilitation of damaged lands, and fundamentals of training and test activity noise as they might be applied to reducing adverse effects on mission activities. This project will also examine the underlying requirements for comprehensive environmental modeling and simulation products to address environmental issues. The project supports exploratory development efforts in PE 062720A, Projects AF25, D048, and A896. Sixty-five percent (65%) of the funds in this project are used to support extramural research via a Broad Area Announcement requesting work supporting in-house laboratory efforts.

FY 1997 Accomplishments:

- 2989 - Evaluated remote monitoring technologies for threatened and endangered species responses to Army training.
  - Developed erosion control techniques using cryptogramic soil crusts.
  - Identified fundamentals of spatial data visualization and registration.
  - Investigated fundamental science of biosensor technology for application to cleanup site characterization.
  - Evaluated soil, snow, ice, and contaminant parameters necessary to provide data fusion to describe contaminant transport processes in cold regions;
  - Determined transportation mechanisms in heterogeneous multiphase soil systems.
- 1216 - Realigned from Project BH67 of this Program Element to expand environmental research to provide the basic knowledge needed to develop physical, chemical, and biological technologies to clean up Army contaminated sites; to maintain compliance and prevent pollution at Army installations; to complete validations and scaling comparisons and transition to site assessment and restoration programs and to conduct landform and ecological modeling.

Total 4205

FY 1998 Planned Program:

- 2929 - Explore innovative site characterization sensor technologies and fundamental effects of complex media/contaminant interactions on sensor responses.
  - Continue mathematical formulations for multi-contaminant groundwater transport mechanisms and analyze characteristics in heterogeneous media.
  - Investigate bio-geochemical processes at low/freezing temperatures with quantified rates of activity and suppression/stimulation.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BT25

FY 1998 Planned Program: (continued)

- Continue investigation of chemical conjugates and other intermediate byproducts during biological degradation of explosives in soil.
- Identify reaction mechanism and pathway for electrochemical reduction of energetic compounds in water.
- Develop an integrated hillslope and channel evolution model as an investigation and prediction tool.

• 75 - Small Business Innovative Research/Small Business Technology Transfer Programs

Total 3004

FY 1999 Planned Program:

• 4001 - Explore fundamentals of physical/chemical response of unexploded ordnance on candidate detection sensors.
- Improve theory, scaling, and computational tools for simulating fate and transport of contaminants in groundwater.
- Explore fundamentals of organic compound fate in freeze-thaw environments and combined biological/geochemical/geophysical measurement and detection.
- Complete description of major biological degradation pathways of major explosives types; e.g., contaminant and media.
- Develop kinetic and mechanistic understanding of sonochemical destruction of nitro containing compounds.
- Determine plant varieties with improved resilience to military traffic and suitable for revegetation of training lands.

• 749 - Complete description of major biological degradation pathways of major explosives types; e.g., contaminant and media.
- Combine low-temperature, bio-geochemical fate of mixed organics and metals with discontinuous permafrost models.
- Establish cause/effect relationship of military stressors and ecosystem responses.

Total 4750

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3070	3608	4001
Appropriated Value	3070	3100	
Adjustments to Appropriated Value	+1135	-96	
FY 1999 President's Budget	4205	3004	4750

Change Summary Explanation: Funding: FY 1997: Funding realigned (+1135) from Project BH67 of this PE to enhance efficiency of Army environmental research effort.

Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-604).
Funding: FY1999: Funds realigned (+749) from Project BH67 of this PE to enhance efficiency of Army environmental research effort.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: A305

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A305 Automatic Target Recognition Research	1122	1122	1174	1240	1270	1301	1336	Continuing	Continuing

A. Mission Description and Justification: This project focuses on the low depression angle, short range battlefield environment with its very challenging ground clutter problem, including areas not being addressed by the other Services, such as: automatic model-based generation of automatic target recognition (ATR) search trees; ATR physically implemented on the focal plane array; model-based automatic recognition of one dimensional infrared signals; information-based and learning based theories applied to target signature analysis; and for target acquisition and endgame.

FY 1997 Accomplishments:

- 1122 - Modularized learning algorithms to speed-up the performance of FLIR detector ATR
  -Applied learning theory to the ATR problem in order to automate the feature selection process.
  -Developed fast model-based LADAR recognition algorithms for Night Vision & Electronic Sensors Directorate (NVESD) target acquisition/target detection application

Total 1122

FY 1998 Planned Program:

- 1113 -Provide single and multi-frame synthetic aperture radar/forward looking infrared/television (SAR/FLIR/TV) compression algorithms for tactical reconnaissance, surveillance, and target acquisition (RSTA) and munitions communication links.
  -Extend FLIR ATR algorithm performance to include limited on-the-fly training.
- 9 - Small Business Innovative Research/Small Business Technology Transfer Programs.

Total 1122

FY 1999 Planned Program:

- 1174 -Provide real-time robust video compression algorithms for FLIR for use on existing battlefield communication links.
  -Enhance 2nd generation FLIR ATR capabilities to handle extended ranges (4 km) and high clutter.

Total 1174

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: A305

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1132	1186	1237
Appropriated Value	1132	1157	
Adjustments to Appropriated Value	-10	-35	
FY 1999 President's Budget	1122	1122	1174

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: A31B

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A31B Infrared Optics Research	2228	2202	2302	2429	2491	2551	2620	Continuing	Continuing

A. Mission Description and Justification: This project sustains the Army's theoretical and experimental research in night vision and electro-optic technologies. It generates new technology to obtain unprecedented awareness of the battlefield to continue to "own the night," notwithstanding increased foreign competition. To achieve these objectives, focal plane arrays with significantly improved performance for major platforms and low cost night vision aids that allow for a wide distribution will be required. Therefore, research is focused on materials, devices and techniques required for the development of high performance smart dual color staring infrared focal plane arrays (IRFPAs) and uncooled IRFPAs with moderate performance. For the high performance IRFPAs, mercury cadmium telluride (HgCdTe) detector arrays and quantum well infrared photon detector (QWIPs) are investigated. Research for uncooled IFRPAs is based on development and analysis of thin film ferro-electric materials and novel detector architectures with improved thermal isolation structures. Uncooled IRFPAs will also have significant civilian applications.

FY 1997 Accomplishments:

•	2228	-Developed processing techniques for thin film ferroelectric materials. -Optimized film deposition techniques. -Determined optimum application for competing QWIP structures. -Demonstrated feasibility of HgCdTe dual color design.
Total	2228	

FY 1998 Planned Program:

•	2202	-Design, grow, and test infrared detector structures based on new antimonide/arsenide material structure. -Demonstrate QWIP detector array with significant improved quantum efficiency. -Demonstrate dual color HgCdTe and QWIP focal plane arrays. -Analyze trace level impurities and dopants in II-VI class semiconductor materials for advanced sensors.
Total	2202	

FY 1999 Planned Program:

•	2302	-Determine normal incidence performance of polytype based alignment detector structures. -Demonstrate advanced thin film ferroelectric IRFPA. -Demonstrate large area HgCdTe dual color IR FPA. -Determine upper state lifetime for quantum well devices
Total	2302	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE
	February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic Research	0601102A Defense Research Sciences	A31B

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2233	2330	2425
Appropriated Value	2233	2272	
Adjustments to Appropriated Value	-5	-70	
FY 1999 President's Budget	2228	2202	2302

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: B52C

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
B52C Mapping and Remote Sensing	2138	2248	2623	2768	2838	2907	2985	Continuing	Continuing

A. Mission Description and Justification: This project supports research in fundamental topographic sciences to improve the tactical commander's knowledge of the battlefield; to extract natural and man-made features from reconnaissance imagery in near-real time; to exploit terrain reasoning/artificial intelligence techniques for distributive interactive simulation and for combat planning and operations; to support unmanned/autonomous vehicle navigation using sensor enhanced dynamic data bases; and to explore the potential of space technology to provide real-time terrain intelligence, command and control, and targeting support. The research provides the theoretical underpinnings for Program Element 0602784A, Project A855.

FY 1997 Accomplishments:

•	2138	- Performed terrain feature extraction using Multispectral/Interferometric Synthetic Aperture Radar (IFSAR) data. - Incorporated Iterative Orthophoto Refinement (a smoothing technique) into Digital Elevation Model software. - Studied and assessed factors contributing to the overall reliability of terrain analysis models.
Total	2138	

FY 1998 Planned Program:

•	2192	- Develop terrain feature extraction protocols from integrated Multispectral/Hyperspectral/IFSAR imagery. - Devise neural network image data classification capability. - Examine the effects of the terrain data layers on the reliability of terrain analysis models.
•	56	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	2248	

FY 1999 Planned Program:

•	2623	- Determine optimal combination of sensor information for generation of topographic data (elevation, feature, imagery). - Evaluate geostatistical wavelet technique for performing image compression. - Upgrade climate atmosphere model parameters to enhance tactical decision aids. - Explore and prototype methods for automated data capture characterizing and quantifying models and the dependant relationships across terrain, threat, and activity constraints.
Total	2623	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences	PROJECT: B52C

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2196	2655	2763
Appropriated Value	2196	2176	
Adjustments to Appropriated Value	-58	-72	-140
FY 1999 President's Budget	2138	2248	2623

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reductions (-407).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: B53A

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
B53A Battlefield Environment and Signature	3523	3470	3629	3829	3925	4020	4129	Continuing	Continuing

A. Mission Description and Justification: This project provides in-depth understanding of the complex atmospheric behavior associated with electro-magnetic propagation, transport and diffusion, and remote sensing, which affect Army operations and systems such as electro-optics, smoke deployment and target designators. The project supports Project Reliance sub-areas of lower atmospheric sciences and terrestrial sciences with a lead role in boundary layer processes and interactions over terrain.

FY 1997 Accomplishments:

- 3523 - Performed basic research towards the development of a new generation of self-learning, self-adapting, passive all-optical systems based on neural network principals.
  - Developed analytical solutions to the coupled nonlinear atmospheric diffusion-advection, Navier-Stokes and propagation equations to provide ultra-fast solutions for obscuration, chemical and biological hazard prediction on the digitized battlefield.
  - Developed a laser-based method for rapid point detection of biowarfare agents.
  -Improved acoustic prediction models to include moving sources; developed theory for the effects of atmospheric turbulence on acoustic tracking arrays.

Total 3523

FY 1998 Planned Program:

- 3470 - Test and validate the boundary layer model of airflow over complex terrain and within and above vegetative canopies and built-up areas for Army tactical scales.
  - Develop horizontal transilient turbulence theory (an alternative method of describing the effects of turbulence, capable of handling the realistic case of multiscale effects in a single step, substantially reducing computation time), that includes surface layer effects.
  - Develop rapid methods for the detection of small, but potentially lethal, concentrations of harmful bacteria and protein toxin aerosols; determine fluorescence signatures of polydisperse aerosols.
  - Incorporate horizontal radiative transport into the boundary layer illumination and radiative balance model to improve contrast calculations for target acquisition.
  - Complete a prototype 3-D acoustic propagation model for inclusion into tactical acoustic decision aids.
  - Develop principals for high-resolution, intelligent, adaptive imaging of extended source targets embedded in complex images.
  -Complete an ultraviolet and visible wavelength propagation model to include multiple scattering effects.

Total 3470

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: B53A

FY 1999 Planned Program:

•	1777	- Test and evaluate the boundary layer model of airflow for the stable, nocturnal boundary layer conditions to predict transport and diffusion of smokes and chemical/biological agents. - Develop robust probability distribution functions of turbulence over non-uniform surfaces to enable accurate and timely predictions of transport and diffusion of chemical agents. - Develop a biowarfare agent point detector capable of sorting and collecting suspect biological warfare (BW) agent particles for use in antibody or DNA-based BW agent identifiers; experimentally validate Army models for fluorescence detection of BW aerosols. -Complete development of a technique to detect bacterial spores in the atmosphere.
•	1852	- Develop a suite of experimental techniques, image processing, and metrics for a state-of-the-art determination of atmospheric contrast transmission for target acquisition. - Determine the effect of limited complex terrain on atmospheric acoustics. - Develop adaptive control techniques for active imaging using a combined approach based on nonlinear and adaptive optics.
Total	3629	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3530	3672	3822
Appropriated Value	3530	3581	
Adjustments to Appropriated Value	-7	-111	
FY 1999 President's Budget	3523	3470	3629

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: B74A

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
B74A Human Engineering	2239	2474	2590	2732	2801	2869	2947	Continuing	Continuing

A. Mission Description and Justification: This project supports research on soldier performance, including the areas of visual, auditory, cognitive, and stress-related performance. The objective is to identify, describe and manage underlying human-system interface factors critical to the design of Army weapon systems. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP), the Science and Technology Objectives (STOs), and the Army Modernization Plan. All work under this PE is part of the "Human-Systems Interfaces" Tri-Service Reliance Panel.

FY 1997 Accomplishments:

- 2239 -Continued auditory performance studies addressing human ability to maintain a situation awareness of environments containing multiple sound sources and the effect of practice in detecting and localizing sound signals in noise.
  -Conducted studies to evaluate critical perceptual variables, (e.g., hyperstereopsis) and the effect on the use of night vision devices in military operations.
  -Validated noise hazard model with hearing loss data and with time-varying middle ear muscle system (long acting waveforms) characteristic of enclosed crew compartments.
  -Conducted studies on the effects of stress on voice recognition system efficacy.
  -Defined the vision parameters that affect performance in teleoperation, and began development of a human driving performance model.

Total 2239

FY 1998 Planned Program:

- 2458 -Complete report on the effects of spatial separation on the detection and localization of sound signals presented in noise; continue to explore the effects of practice and learning on human auditory performance.
  -Continue investigation of hyperstereopsis and its effect on visual perception and depth compression for night vision goggle resolution and field of view design guidelines.
  -Conduct a helmet mounted display field study examining design tradeoffs in information display format and the relative impact on soldier cross-country navigation performance.
  -Continue verification and validation of the noise hazard model with hearing loss data. Conduct field experiment with the previously developed auditory hazard meter to determine user applications.
  -Publish report on the effects of stress on voice recognition system efficacy. Conduct studies on the relationship between stress and complex cognitive functioning.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT B74A

FY 1998 Planned Program: (continued)

-Investigate and report on quantification of allentional field of view (FOV) under various divided attention conditions as a predictive measure of driving ability and navigation.

•	16	-Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	2474	

FY 1999 Planned Program:

•	2590	- Complete data collection efforts on human auditory processes in detecting sound in various environments and estimating the distance from the sound source. -Publish results of previous studies examining the interaction effects of field-of-view, ocular configuration, and image resolution on task performance using night vision devices in tactical settings; develop draft set of operational metrics for measuring depth perception and visual attention. -Publish results of previous helmet-mounted display studies. Conduct an investigation of the attentional conflicts induced by the use of helmet mounted displays. -Develop random incidence corrector and calibration procedures for a "general damage" auditory model. Submit impulse noise standards for Committee on Hearing and Bioacoustics (CHABA) review. -Refine previously developed psychological stress measures and investigate the effects of stress on selected perceptual processes. -Demonstrate a quantitative methodology for measuring operator performance of teleoperated devices and validate in field studies.
Total	2590	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2255	2620	2728
Appropriated Value	2255	2552	
Adjustments to Appropriated Value	-16	-78	
FY 1999 President's Budget	2239	2474	2590

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: B74F

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
B74F Personnel Performance and Training	2347	957	2465	2601	2667	2731	2805	Continuing	Continuing

A. **Mission Description and Justification:** This project conducts behavioral science research in areas with high payoff opportunities for improved personnel performance and training, including: methods for faster learning and improved skill retention; leader effectiveness for improved team performance; understanding the impact of societal trends on Army readiness; and improving the match between soldier skills and their jobs to optimize performance. Research is also focused on issues of small-team performance, leadership, and training to ensure that personnel performance and training research keep pace with future mission, structural, technological, equipment, and personnel changes.

FY 1997 Planned Program:

•	2347	- Completed research on impact of spatial abilities, e.g., distance estimation, on performance in virtual reality (VR) environments. - Determined the effects of Army service on individuals' post-Army careers and life course experience. - Completed analysis of the effects of stress, as measured by electroencephalography, and mental states on elite performance. - Completed another stage of research measuring the effects of peacekeeping service on unit cohesion, morale, and retention. - Developed preliminary findings to understand the role of charismatic variables and shared mental models in effective leadership.
Total	2347	

FY 1998 Planned Program:

•	933	- Develop a set of techniques for improving the retention and generalizability of procedural skills needed in digitized environments. - Provide a blueprint and perspective on key Army After Next (AAN) human and organizational issues through a national conference to ensure that personnel performance and training research stay ahead of future changes in force structure and mission requirements. - Test the effects of shared goals and mental models on team performance.
•	24	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	957	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: B74F

FY 1999 Planned Program:

•	2465	- Determine the practices that lead to successful accomplishment of peacekeeping operations based on multi-national experiences. - Determine the role of transformational leadership behavior on platoon performance. - Develop a model to maximize training effectiveness and efficiency for selected Army tasks, such as topographic map reading. - Develop methods and techniques for effective leadership to maximize individual and unit performance with an increasingly diversified workforce. - Continue research on the influence of gender/race/ethnic diversity on cohesion, morale, and readiness.
Total	2465	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2411	987	997
Appropriated Value	2411	987	
Adjustments to Appropriated Value	-64	-30	
FY 1999 President's Budget	2347	957	2465

Change Summary Explanation: Funding: FY 1999: Funds reprogrammed to this project (+1468) to fund critical leadership and gender/race related research.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	43614	45138	48459	50799	51769	52755	53826	Continuing	Continuing
BH50 Telecommunications Research	6533	9992	9805	10286	10492	10706	10945	Continuing	Continuing
BH53 Advanced Distributed Interactive Simulation Research	658	574	2078	2151	2163	2173	2173	Continuing	Continuing
BH54 Advanced Sensors Research	6912	10217	10005	10495	10705	10924	11168	Continuing	Continuing
BH56 Advanced Displays Research	4260	4500	4772	5006	5106	5210	5327	Continuing	Continuing
BH59 University Centers of Excellence	5500	4084	4590	4750	4776	4798	4798	Continuing	Continuing
BH62 Electronechanics and Hypervelocity Physics	9574	9277	9369	9887	10138	10383	10663	Continuing	Continuing
BH64 Materials Center of Excellence	2713	1781	2400	2518	2568	2621	2679	Continuing	Continuing
BH65 Microelectronics Center of Excellence	2713	1913	2500	2622	2675	2730	2791	Continuing	Continuing
BH73 National Automotive Center of Excellence	4751	2800	2940	3084	3146	3210	3282	Continuing	Continuing

Mission Description and Budget Item Justification: The Army's initiative to create three open, federated laboratories is an innovative and forward thinking approach focusing the talents of industry and academia on critical technology needs of the Army. The federated laboratory is a partnership between the Army Research Laboratory (ARL) and the private sector involving cooperative agreements, integrated management and staff rotation, education and communication. The basic construct of a federated laboratory is to continue strong in-house involvement to meet Army-unique requirements where there is little external expertise in the technologies, and to forge direct associations with industry/university consortia with recognized competencies in specific technology areas where the centers of expertise are definitely outside of the Government (i.e. telecommunications). Under the federated laboratory approach, ARL formed partnerships with consortia consisting of at least one each of an industrial company, a major university, and a Historically Black College or University/Minority Institution (HBCU/MI). Long-term cooperative agreements (5 years) were established in three key areas with consortia which have become "virtual labs" within ARL and function as any other ARL division. Research is jointly planned and executed and Army scientists and engineers are intermingled with consortia researchers through long term rotational assignments. The federated laboratory approach for ARL is in accordance

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers

with the 1991 Base Realignment and Closure, and the Department of Defense mandate to exploit private sector research and reduce infrastructure. This program element also includes the Army's Centers of Excellence, which are the centerpiece of academic linkage to Army R&D organizations. Centers of Excellence continue to be an integral part of the Army's research investment strategy, along with single investigator programs and Army laboratory research. Centers have proven to be highly effective in many applications-oriented projects, in areas such as rotary wing technology and electronics. Centers couple state-of-the-art research programs with broad-based graduate education programs to increase the supply of scientists and engineers in areas of Army importance. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and DoD Project Reliance. The projects in this PE include basic research efforts directed toward providing fundamental knowledge for the solution of military problems and therefore are correctly placed in Budget Activity 1.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH50

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH50 Telecommunications Research	6533	9992	9805	10286	10492	10706	10945	Continuing	Continuing

A. Mission Description and Justification: This project establishes long term collaboration between the Army Research Laboratory and competitively selected industry/university consortia headed by Lockheed Sanders, Nashua, NH, for the purpose of leveraging world class research relevant to Army needs. Battlefield telecommunications involve the reliable, timely, and secure electronic transport of multi-media information over heterogeneous, digital networks exhibiting dynamic topologies. The technical areas addressed under this project are: wireless battlefield digital communications; tactical/strategic interoperability; information distribution; and multi-media concepts.

FY 1997 Accomplishments:

• 6533 - Investigated secure, high-capacity multiple access schemes.
- Investigated scaleable techniques for network self-organization, connectivity tracking, resources allocation, and mobility management.
- Developed realistic models for heterogeneous networks.
- Developed methods for formal specification and testing of communications, control, and network management.
- Investigated techniques for providing data format independence for the organization, maintenance, synchronization, and access of heterogeneous information.
- Investigated joint source coding and packet reconstruction techniques for distributing multimedia over corrupted channels.
- Developed data compression algorithms with high resolution, low complexity, low latency, and context sensitivity.
- Developed efficient algorithms for intermedia and interparticipant multimedia synchronization.

Total 6533

FY 1998 Planned Program:

• 9739 - Develop and demonstrate protocols that support seamless connectivity between satellite and terrestrial segments to optimize communication links between various levels of command.
- Evaluate the applicability of asynchronous transfer module (ATM) technology to multi-rate battlefield wireless environments.
- Develop formal testing and validation methodologies for network simulation models for Army battle commands systems.
- Develop and demonstrate an executable hybrid network simulation to validate commercial specifications in Army communication systems.
- Develop and demonstrate techniques to support push-pull flow control among information servers based on real-time network events to improve information transfer on the battlefield.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH50

FY 1998 Planned Program: (continued)

- Develop and demonstrate scalable multimedia compression techniques which track the rate-distortion curve as the rate is reduced by traffic or bandwidth. to enhance wireless battlefield communication

•	253	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	9992	

FY 1999 Planned Program:

•	9805	- Develop and demonstrate alternative signaling protocols for call hand-off, origination, delivery, and internet protocol mobility in a highly mobile battlefield environment. - Develop and demonstrate a network management system based on a next-generation, software-based, fault-tolerant distributed object computing platform and a multi-tier network architecture to manage tactical communications networks. - Demonstrate tactical data exchange across multiple platforms using adaptive flow control and routing, meta data queries, and user-controllable threshold criteria to enhance seamless information transfer on the battlefield. - Demonstrate packetization and error recovery methods for multimedia communications over wireless battlefield channels. - Demonstrate intermedia and interparticipant multimedia synchronization using submillisecond time synchronization to provide multimedia applications to the tactical network.
Total	9805	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	6710	9160	10143
Appropriated Value	6710	10310	
Adjustments to Appropriated Value	-177	-318	
FY 1999 President's Budget	6533	9992	9805

Change Summary Explanation: Funding: FY 1998: Congressional increase for Advanced Telecommunications and Information Distribution Research Program (+1150); undistributed Congressional reductions (-318).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH53

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH53 Advanced Distributed Interactive Simulation Research	658	574	2078	2151	2163	2173	2173	Continuing	Continuing

A. Mission Description and Justification: The Army Center of Excellence in Information Sciences (ACEIS) at Clark Atlanta University (HBCU/MI) will perform basic (6.1) research in information science within its designated research areas. The research focuses on the mid to far-term needs of information systems for the Army. The program addresses new and emerging technologies to meet the needs of a digital force in the 21st Century. It performs research in information science with emphasis in the following areas: interactive and intelligent systems; database and information systems; and distributed and parallel systems. Current research activities align with the Digitization and Communication Sciences Research Program in the software and intelligent systems and the information distribution areas. Work in this project was previously accomplished in PE 0601102A/BH57. The project also supports the Army High Performance Computer Resource Center at the University of Minnesota beginning in FY99. This effort is restructured from project AH48, PE 0601102A.

FY 1997 Accomplishments:

•	658	- Developed training Neural Networks for forecasting battlefield weather conditions, logistics distribution problems, and other areas. - Developed algorithms to study stability properties of communications systems. - Developed data model tools/techniques for complex systems such as command and control systems.
Total	658	

FY 1998 Planned Program:

•	559	- Develop test bed for virtual environments providing knowledge based design and comparative analysis of pattern recognition by navigating through different approaches efficiently and transparently. - Apply intelligent data base capabilities to provide solutions (applied technologies) to Army logistics problems. - Apply parallel processing techniques to tactical command and control.
•	15	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	574	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers
	PROJECT BH53

FY 1999 Planned Program:

•	643	- Extend virtual environments using neural nets and fuzzy logic. Incorporate advanced data mining techniques into intelligent data base capabilities. - Investigate technologies for information distribution in a wireless mobile environment.
•	1435	- Develop highly parallel solvers for sparse linear systems for applications to solve problems in fluid flow, structural mechanics, electromagnetics and heat transfer. - Develop mesh-free methods for large deformation analysis of solids and structures; capability to model crack and shear band growth is essential to first principles modeling of the physics of weapons effects. - Develop fast and efficient parallel mesh generation/regeneration algorithms for use in fluid-object (mesh moving) applications or solution adaptive computations. - Extend working techniques for simulation of parachute inflation fluid-structure interactions and apply them to parachute fluid structure interactions for full 3D parachute models. - Conduct research into the application of high performance computing to advanced materials science addressing issues which are of relevance to the US Army ranging from electronic devices to structural components to advanced concepts in food preservation and packaging.
Total	2078	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	675	729	745
Appropriated Value	675	592	
Adjustments to Appropriated Value	-17	-18	
FY 1999 President's Budget	658	574	2078

Change Summary Explanation: Funding: FY99 ARL efforts restructured to this project (+1333) from PE 0601102A.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH54

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH54 Advanced Sensors Research	6912	10217	10005	10495	10705	10924	11168	Continuing	Continuing

A. Mission Description and Justification: This project establishes long term collaboration between the Army Research Laboratory and a competitively selected industry/university consortia headed by Lockheed Sanders, Nashua, NH, for the purpose of leveraging world class research relevant to Army needs. Advanced sensors are the elements of systems that view the environment and convert the basic raw sensor data into meaningful information suitable for transmission over tactical networks. The technical areas addressed under this project are: multidomain smart sensors, to include multispectral infrared focal plane arrays; multisensor fusion automatic target recognition algorithms, to include synthesis of sensor modeling; radar sensors, to include atmospheric and terrain effects on propagation; and signal processing, capitalizing on commercially available hardware.

FY 1997 Accomplishments:

•	3455	- Completed design of multispectral infrared (IR) Focal Plane Array; develop long range laser radar (LADAR), and identified means for integrating laser/detector structures. - Determined performance of large area staring IR Focal Plane Arrays
•	3457	- Demonstrated signal processing for Multi-Domain Smart Sensors (MDSS) using off chip hardware and selected algorithms. - Delivered baseline Forward Looking Infrared/MMW Radar algorithm and three sensor signature/scene modeling environments. - Evaluated the effectiveness of various target discrimination features for a foliage penetration radar; develop techniques to synthesize clutter data by extrapolating/interpolating from existing millimeter wave clutter data bases.
Total	6912	

FY 1998 Planned Program:

•	9956	- Conduct feasibility demonstration of Multi-Domain Smart Sensor (MDSS), select algorithms for on-chip processing. - Complete a 3-sensor image processing environment addressing concealment, camouflage and deception (CC&D), obscuration, and articulation. - Complete selected millimeter wave (MMW) common module sub-assemblies, test low angle tracking algorithms, complete phenomenological description of foliage penetration radar; develop and test feature sets for ground penetrating radar; design wide-band digital beamformer. - Integrate hybrid optical signal processor/digital signal processor (OSP/DSP) into testbed; demonstrate 10x improvement in size, speed, power; resolve on-chip processing trade-offs for MDSS. - Demonstrate microsensor technology to detect battlefield targets.
•	261	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	10217	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers
	PROJECT BH54

FY 1999 Planned Program:

- 10005 - Complete large area multi-color focal plane and components for active imaging; implement selected algorithms in integrated circuit structures.
  - Complete a 4-sensor image processing environment.
  - Deliver MMW common modules technology and integrate into a fully functional testbed configuration; insert upgrades into ARL ultra-wide band (UWB) testbed for use in elevated conditions and conduct foliage penetratings/ground penetration (FOPEN/GPEN) experiments to study algorithm effectiveness.
  - Demonstrate hybrid OSP/DSP for specific application; demonstrate 30x improvement in size, speed and power.
  - Investigate improved microsensor algorithms for networking and target detection.

Total 10005

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7100	9392	10883
Appropriated Value	7100	10542	
Adjustments to Appropriated Value	-188	-325	
FY 1999 President's Budget	6912	10217	10005

Change Summary Explanation: Funding: FY 1998: Congressional increase for Advanced Sensors (+1150); undistributed Congressional reductions (-325).

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH56

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH56 Advanced Displays Research	4260	4500	4772	5006	5106	5210	5327	Continuing	Continuing

A. Mission Description and Justification: This project establishes a competitively selected university/industry consortium headed by Rockwell International Corporation, Cedar Rapids, IA, to provide solutions for the many requirements for information assimilation on the battlefield. Displays and control constructs are the interface between human users and computers. This consortium will develop display subsystem architecture which can provide access to all information of practical use, provide data visualization in an efficient manner and use the advanced hardware and software technologies to address the human sensory modality without overloading the user and degrading performance. Work in this project differs from the Defense Advanced Research Projects Agency's (DARPA's) program, which aims to establish a domestic capability for display hardware. The technical areas being addressed under this project are: human-computer interface in an information rich environment; display configuration, real time visualization, architecture, information presentation, and control coupling.

FY 1997 Accomplishments:

- 4260 - Demonstrated operational data planning displays; developed algorithms for managing objects in 3-D Battlefield Visualization databases and displays; developed scalable techniques that identified and scheduled information for displays that maximize value of information.
  - Investigated the techniques for presentation and interaction with terrain and battle-related information on virtual reality displays; developed reliable object alignment systems that resolved registration problems with Augmented Reality.
  - Implemented design guidelines for development of components that enhanced a soldier's ability to understand multiple messages, which increased situational awareness in a minimized time span; developed methods that predicted potential enemy courses of action and consequences of tactical options.
  - Investigated the architectures for integration of speech, gesture and gaze in display control for hands-free operations.
  - Developed principles of multimodal displays and controls.
  - Investigated the display stabilization methods and architectures for using display in moving platforms; implement noise cancellation techniques to enhance speech recognition in noisy environments.
  - Refined and validated current Display Description Language (DDL) evaluation metrics and developed new multidimensional metrics.
  - Developed novel image compression methods specifically tailored for distributed databases with multiple display resolutions.

Total 4260

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH56

FY 1998 Planned Program:

•	4388	- Implement a virtual battlefield testbed; implement capabilities supporting visualization of 3-D battlefields, including a prototype system for intelligent information filtering. Integrate architecture with U.S. Army Communications and Electronics Command (CECOM) Digital Integration Lab (DIL), Ft Monmouth, and U.S. Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC) Joint Virtual Laboratory. - Develop techniques for assignment of value functions to information objects; develop scheduling algorithms that maximize value and define interface for transport of information to display system. - Implement architectures for integration of speech, gesture and gaze in display control; develop methodology to utilize tactile information; develop prototype components for user-sensitive auditory displays for rapid message understanding and situation awareness. - Demonstrate selected research results in Advanced Technology Demonstrations (ATDs), Prairie Warrior, Logistics Anchor Desk or Tactical Operations Center (TOC), as well as CECOM's Battle Planning Visualization Center - Correlate subjective information display metrics with objective display measurements to develop basis for automated display resolution evaluations. - Develop method for determining level of alertness and response to critical visual information; develop principles of virtual displays of combat-related information.
•	112	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	4500	

FY 1999 Planned Program:

•	4772	- Implement visual presentation language; integrate architectures for integration of speech, gesture and gaze in display control; integrate value function techniques into information presentation architectures; integrate value function techniques into information presentation architectures. Continue validation of consortium findings in Army operational environments, including Force XXI; integrate display stabilization methods in Army moving platforms programs such as C2V, M1A1 and M2. - Implement automated display resolution evaluation techniques, scheduling algorithms and assimilation architectures; integrate decision support prediction methodologies into architectures. - Implement principles for development of virtual displays of combat-related information, to facilitate accurate perception and representation of the information; integrate 3-D model based image compression coding system into information presentation and assimilation architecture.
Total	4772	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601104A University and Industry Research Centers
	PROJECT: BH56

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4376	4643	5272
Appropriated Value	4376	4643	
Adjustments to Appropriated Value	-116	-143	
FY 1999 President's Budget	4260	4500	4772

Change Summary Explanation: Funding: FY99 funds reprogrammed (-500) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH59

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH59 University Centers of Excellence	5500	4084	4590	4750	4776	4798	4798	Continuing	Continuing

A. Mission Description and Justification: The Army's University Centers of Excellence (COE) provide loci for focused research in areas of strategic importance. Army Centers of Excellence are active in the fields of rotary-wing technology, advanced fuel cell technology, the foundations of image science, and science, mathematics and engineering (SME) education of minority students. The Army's Centers have significant collaborative participation by Historically Black Colleges and Universities/Minority Institutions (HBCU/MIs) and all future Army Centers will be formed in partnership with an HBCU. In addition, industry will be encouraged to "buy into" future Army Centers of Excellence to leverage and synergize the investment in these collaborative efforts.

FY 1997 Accomplishments:

•	3500	- Conducted interdisciplinary investigations at Penn State, U. of Maryland, and Georgia Tech on topics of specific relevance to rotorcraft science and technology base in conjunction with the National Rotorcraft Technology Center - Advanced the ability to recognize targets by developing a hierarchical, modular structure for 2D object recognition and applying deformable templates to thermodynamic infrared scene variability at Washington University.
•	2000	- Developed improved methods of studying battery failures at the Illinois Institute of Technology with potential for selecting materials other than the commercially available lithium ion to prevent such failures in next generation batteries.
Total	5500	

FY 1998 Planned Program:

•	2684	- Conduct interdisciplinary investigations at Penn State, U. of Maryland, and Georgia Tech on topics of specific relevance to rotorcraft science and technology base in conjunction with the National Rotorcraft Technology Center. - Develop algorithm independent, fundamental bounds on determining the position and orientation of targets imaged by any sensor at Washington University's Center on image analysis and metrics.
•	1301	- Conduct advanced fuel cell and advanced battery research at Illinois Institute of Technology with emphasis on lithium-ion/metal oxide and nickel/hydride batteries and direct oxidation methanol fuel cells. - Support science, mathematics and engineering (SME) education at Contra Costa College to strengthen academic programs in SME and attract under-represented minority students to these programs.
•	99	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	4084	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601104A University and Industry Research Centers
	PROJECT: BH59

FY 1999 Planned Program:

•	2750	- Conduct interdisciplinary investigations at Penn State, U. of Maryland, and Georgia Tech on topics of specific relevance to rotorcraft science and technology base in conjunction with the National Rotorcraft Technology Center. - Extend the bounds on determining position and orientation to scenes with structured clutter and Washington University's Center on image analysis and metrics.
•	1840	- Conduct advanced fuel cell and advanced battery research at Illinois Institute of Technology with emphasis on lithium-ion/metal oxide and nickel/hydride batteries and direct oxidation methanol fuel cells. - Support science, mathematics and engineering (SME) education at Contra Costa College to strengthen academic programs in SME and attract under-represented minority students to these programs.
Total	4590	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5676	5314	6110
Appropriated Value	5676	4214	
Adjustments to Appropriated Value	-176	-130	
FY 1999 President's Budget	5500	4084	4590

Change Summary Explanation: Funding: FY 1998: Congressional earmark for Federated Laboratories (-1100).
FY 1999: Rebaselining of 6.1 Basic Research funding.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH62

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH62 Electronechanics and Hypervelocity Physics	9574	9277	9369	9887	10138	10383	10663	Continuing	Continuing

A. Mission Description and Justification: Electromechanics and hypervelocity physics support critical Army research relating to electromechanical components (electromagnetic launchers and power supplies) for applications to electromagnetic (EM) and electrothermal-chemical (ETC) guns. Additionally, this project provides for research, testing 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 Electric Armaments Program strategy, highest emphasis has been placed on advancing the state-of-the-art in pulsed power and on establishing the utility of hypervelocity projectiles. 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 developmental with potential applications for anti-armor, artillery and air defense.

FY 1997 Accomplishments:

- 9636 - Conducted studies and provided critical information on gouging, armature/ rail interface interactions, performance of hybrid armatures, high performance materials for EM applications and improved railgun efficiency; conducted integrated launch package modeling and feasibility tests; performed medium scale testing for solid armature designs; validated the updated version of EMAP3D code which models electromagnetic phenomena and initiated work on a stress module.
  - Conducted experiments to demonstrate mass-velocity tradeoff studies of advanced penetrators against reactive targets; selected several novel penetrator designs and initiated feasibility studies to identify most promising novel kinetic energy penetrator designs.
  - Planned and conducted Electric Gun Technology Short Course with Fort Knox Future Combat System personnel as target audience; continued to operate the technical information center; continued summer intern and West Point Cadet summer research programs; participated in planning of next Electromagnetic Launch (EML) Symposium and conducted peer reviews of papers submitted for EML presentation.
  - Conducted assessments of critical pulsed power components and systems including technology for high current, fast recovery, light weight switches and graphite reinforced plastic structures in rotating pulsed power machines. Analyzed electric gun system requirements with coupled inclusion of thermal models.

Total 9636

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers
	PROJECT BH62

FY 1998 Planned Program:

•	9111	- Conduct tests to obtain critical data on gouging and armature/rail interface interactions focusing on damage resistant rails. - Conduct laboratory experiments on sub-scale hypervelocity penetrators of novel configurations to determine the effectiveness against multiple spaced plates, explosive reactive armors and advanced armor materials and configurations. Design and scale up successful novel penetrator candidates for larger scale testing in FY99. - Plan and conduct Hypervelocity Physics II and Advanced Materials courses; continue to update the data base of the technical information center dedicated to electric gun technologies and hypervelocity physics; expand the summer apprentice and West Point Cadet summer intern projects; conduct a high school out-reach project to encourage young students to pursue careers in science and technology, conduct EML Symposium. - Identify and assess a variety of pulsed power alternatives; recommend the best options for use in an all electric Future Combat System (FCS); assist the Army in working with industry to demonstrate that a practical compact pulsed power system can be mated to an ETC or EM gun.
•	166	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	9277	

FY 1999 Planned Program:

•	9369	- Demonstrate efficient hypervelocity gun launch of lethal launch packages with sufficient gun rail life and projectile accuracy to compete with conventional gun technology. - Conduct studies and experiments at near full-scale to show superior defeat of advanced armors with hypervelocity penetrators. - Provide electric armaments community with up-to-date technical reports and information through facilities at the technical information center. - Establish the system utility of the EM gun concept and support the exit criteria compulsator demonstration conducted in the Army Electric Gun Program 0602618AH75.
Total	9369	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9833	8573	10532
Appropriated Value	9833	9573	
Adjustments to Appropriated Value	-259	-296	
FY 1999 President's Budget	9574	9277	9369

Change Summary Explanation: Funding: FY99 Rebaseline of 6.1 Basic Research Funding.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH64

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH64 Materials Center of Excellence	2713	1781	2400	2518	2568	2621	2679	Continuing	Continuing

A. Mission Description and Justification: This project promotes long-term collaboration between the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD and University/Industry Research Centers for the purpose of conducting world class research and exploiting fundamental breakthroughs in materials science relevant to Army needs. Basic research in materials science and engineering is focused on the Army's armor, armament and soldier protective mission and related Defense Science Research Objectives. The project currently emphasizes advanced materials characterization, composite materials and dendritic polymers research for lightweight, structural armor and armaments; integrated and multifunctional composites; chemical biological barrier materials and other critical applications. Current collaborative research agreements are with the University of Delaware; Johns Hopkins University, Baltimore, MD; and Michigan Molecular Institute. This work is closely coordinated with the ARL in-house materials research project funded through PE 0601102A, Project AH42.

FY 1997 Accomplishments:

•	2713	- Used unique non destructive evaluation technique to characterize the microstructure developed in ceramic sintering process to develop controls for processing microstructurally tailored ceramics. - Demonstrated single-resin vacuum assisted resin infusion processing of thick section integral composite armor materials. - Developed and patented novel materials (hyperbranched PEOX, dendigraft polymers, metallodendrimers and encapsulated inorganic nanocomposites) for applications such as chemical/biological agent resistant coatings and elastomers, structural adhesives, lightweight composite materials and high strength fibers and textiles for ballistic protection.
Total	2713	

FY 1998 Planned Program:

•	1736	- Characterize graded metal matrix composites using near-field ultrasonic probe technology - Fabricate, characterize, and model of multilayer Nb/Si, Ni/Si, and Cu02 foils designed for self-propagating, exothermic reaction-joining of metals and ceramics. - Characterize the role of inclusions on hydrogen transport in multilayer metallic films. - Establish process for multi-resin co-injection of integral composite armor material. - Measure and analyze dispersion and dissipation phenomena of shock wave propagation in woven fabric composites. - Synthesize and characterize structure of novel hyperbranched and dendrigraft polymers and encapsulated inorganic nanocomposites.
•	45	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	1781	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers
	PROJECT BH64

FY 1999 Planned Program:

•	2400	- Establish process for selective/control transport of penetrants in tailored "smart" polymers. - Characterize SiC surfaces and thermal cycling effects on electrical, structural and metallurgical properties of SiC contacts and interfaces. - Establish process for co-injection of stitched, integral composite armor materials. - Formulate mathematical model to represent progressive damage in fiber-reinforced, polymer composites under shock loading. - Formulate micromechanics model incorporating the polymer-fiber interphase region to predict processing and moisture effects on residual stress and other critical composite material properties. - Characterize dendrimer/hyperbranched polymer-fiber surface treatment and composite structure. - Formulate and characterize multi-functional dendritic polymer coatings.
Total	2400	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2838	2384	3064
Appropriated Value	2838	1838	
Adjustments to Appropriated Value	-125	-57	
FY 1999 President's Budget	2713	1781	2400

Change Summary Explanation: Funding: FY99 funds reprogrammed (-664) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH65

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH65 Microelectronics Center of Excellence	2713	1913	2500	2622	2675	2730	2791	Continuing	Continuing

A. Mission Description and Justification: The Microelectronics Research Collaborative Program (MCRP) will establish a long term collaboration between ARL Physical Sciences Directorate and universities to ensure a seamless, synergistic cooperative work environment to provide the Army the key technologies and analytical support necessary to assure supremacy in future land warfare. The goals of this effort are to conduct innovative research and exploit new concepts in solid-state physics, electronics engineering and chemical/electrochemical engineering, and provide mutual exchange of public and private sector researchers working at each other's institutions. The technical areas being addressed under this project are: Nanoelectronics/Optoelectronics; Electrochemistry/Energy Science; Biological/Chemical Detection; High Frequency and Quasi-optical Electronics; Piezoelectronics; Microelectromechanics.

FY 1997 Accomplishments:

•	1360	-Detected one-dimensional image of electron spin resonance using magnetic resonance force microscope -Demonstrated high sensitivity of optical tapered fiber chemical and biological detector for organic biological molecules. -Investigated the optical properties of strained quantum well devices and their potential application as detectors for terahertz radiation.
	1353	- Developed moulding technique for low cost manufacturing of teraherz components. -Investigated electrical properties of GaN and their potential applications
Total	2713	

FY 1998 Planned Program:

•	938	- Continue research and development of membranes for methanol fuel cells and investigation of molecular transport mechanisms. Study the synthesis and process of carbon electrodes for charged storage applications. - Perform research related to the synthesis and deposition of electroluminescent polymers for high resolution, flat panel display applications. - Exploit new concepts and advances in microelectromechanical devices, ultra-miniature sensors, actuators, transducers, and microresonators for smart, lightweight, inexpensive battlefield sensors.
•	931	- Continue research to determine selected physical properties of piezoelectric materials to support manufacturing science in acoustic microtechnology. -Research and develop quartz microsensor arrays.
•	44	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	1913	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers
	PROJECT BH65

FY 1999 Planned Program:

•	2500	-Perform research in ultra-small/nano-scale electronic/photonic device structures addressing modeling, materials, nanofabrication, characterization, and measurement of performance for high-speed signal processing. -Investigate heterostructures, materials, optical sources, detectors, waveguides, phase shifters, and optoelectronic integrated circuits for optical signal processing and optoelectronic component technology. -Study device physics of optoelectronic (OE) devices as well as design, fabrication, radio frequency (RF)/optics integration and optical interconnects. Investigate the device physics, fabrication methods, and characterization of electronic and OE devices operating in the millimeter-wave, terahertz, and light-wave domains for radar, communications-on-the-move, and target acquisition. -Explore new materials, components and fabrication techniques to improve performance, increase safety, and reduce life-cycle costs of high density primary and rechargeable batteries and fuel cells for man-portable applications. -Conduct fundamental research into new classes of chemical/biological microminiature sensors interfaced with micro-optoelectronic circuitry, multi-toxin sensor arrays, and ultra-sensitive detection materials for miniature, low-cost detectors.
Total	2500	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2838	2492	3063
Appropriated Value	2838	1975	
Adjustments to Appropriated Value	-125	-62	
FY 1999 President's Budget	2713	1913	2500

Change Summary Explanation: Funding: FY99 funds reprogrammed (-563) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH73

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH73 National Automotive Center of Excellence	4751	2800	2940	3084	3146	3210	3282	Continuing	Continuing

A. Mission Description and Justification: The Center of Excellence for Automotive Research, established in 1994, is a key element of the basic research module of the National Automotive Center (NAC), located at the U.S. Army Tank-Automotive Research, Development, and Engineering Center (TARDEC). The Center of Excellence for Automotive Research is an innovative university/industry/government consortium leveraging commercial dual use technology for the Army through on-going and new programs in automotive research, allowing significant cost savings while maximizing technological productivity. The selected university partners include: University of Michigan, University of Iowa, University of Wisconsin, Wayne State University, and Howard University, while key industry partners include the "Big Three" U.S. automotive manufacturers.

FY 1997 Accomplishments:

•	4751	-Completed initial simulation models related to off-road dual-need vehicle dynamics. -Developed unique structural analysis techniques related to component performance and reliability. -Continued experimental validation of vehicle simulation models. -Continued development of dual-need virtual prototyping infrastructure.
Total	4751	

FY 1998 Planned Program:

•	2730	-Complete overall vehicle simulation model. -Complete dual-need virtual prototyping infrastructure. -Continue experimental validation of models using state-of-the-art transient prototypes.
	70	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	2800	

FY 1999 Planned Program:

•	2940	-Complete optimization of dual-need overall simulation network. -Complete experimental validation of fully functional system model using advanced hardware prototypes. -Finalize detailed mechanism of effective government, industry and academia partnering and provide recommendations for future relevant tasks.
Total	2940	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE
	February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic Research	0601104A University and Industry Research Centers	BH73

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4881	2889	3154
Appropriated Value	4881	2889	
Adjustments to Appropriated Value	-130	-89	
FY 1999 President's Budget	4751	2800	2940

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602105A Materials Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	14339	12415	10137	11344	12513	13190	13011	Continuing	Continuing
AHM1 Hardened Materials	0	2907	0	0	0	0	0	0	2907
AH84 Materials	14339	9508	10137	11344	12513	13190	13011	Continuing	Continuing

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. Project AH84 is directed toward developing materials technology that will make our heavy forces lighter and more deployable, and our light forces more lethal and survivable. Project HM1 focuses on developing the materials technology needed so that future strategic missile interceptors can meet stringent performance requirements. Work in this program element has been coordinated with the other military services through the Materials/Processes Area Plan to prevent duplication of effort and to maximize the return on investment. These projects include non-system specific development efforts pointed toward specific military needs and, therefore, are appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602105A Materials Technology

PROJECT: AHM1

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AHM1 Hardened Materials	0	2907	0	0	0	0	0	0	2907

A. Mission Description and Justification: This project focuses on developing the materials technology for critical components needed to meet the stringent requirements of strategic interceptors. Materials development for the advanced composite shroud (ACS) will enable expansion of the battle space for strategic interceptors by allowing systems to be flown at conditions 3 times more stringent than the current state of the art. This technology program is managed by the Army Research Laboratory, Aberdeen Proving Ground, MD, with contractual efforts at Fiber Materials, Incorporated, of Biddeford, ME (prime), and includes as subcontractors Crystal Systems, Inc., of Salem, MD, and Lockheed/Martin Corp., of Sunnyvale, CA.

FY 1997 Accomplishments: In FY97 and previous years this effort was funded through Congressional plus-ups to PE/PROJ 0602105A/H84 Materials Technology.

FY 1998 Planned Program:

- 2835 - Conduct full-scale sled test at Holloman, AFB, verifying the separation dynamics of the ACS at flight conditions.
- 72 - Small Business Innovation Research/Small Business Technology Transfer Programs.

Total 2907

FY 1999 Planned Program: Project not funded in FY1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		3000	
Adjustments to Appropriated Value		-93	
FY 1999 President's Budget	0	2907	0

Change Summary Explanation: Funding: FY 1998: Project is a Congressional add.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602105A Materials Technology	PROJECT AH84

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH84 Materials	14339	9508	10137	11344	12513	13190	13011	Continuing	Continuing

A. Mission Description and Justification: This project provides the technical foundation for materials technology in metals, ceramics, polymers, and composites essential for their optimum application to future Army systems. It also provides the technology base required for solving materials-related problems in individual soldier support equipment, armor, armaments, aircraft, ground and combat vehicles and combat support. 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. Areas of study in these developments are in characterization, to include high strain rate characterization, processing, and fabrication of these materials. Additional efforts provide materials solutions for improved performance, durability, and cost reduction in Army unique systems. The work is conducted at the Army Research Laboratory, Aberdeen Proving Ground, MD and Hampton, VA and provides required technologies for advanced development programs at the Armaments Research, Development and Engineering Center, Picatinny Arsenal, NJ; the Tank and Automotive Research, Development and Engineering Center, Warren, MI; the Aviation Research, Development and Engineering Center, Huntsville, AL; the Natick Research, Development and Engineering Center, Natick, MA; and the Missile Research, Development and Engineering Center, Huntsville, AL.

FY 1997 Accomplishments:

- 10339 - Correlated lightweight materials' dynamic properties to improvements in ballistic response for application in ultra lightweight personnel protection (bullet proof vests)
  - Investigated novel approaches to combining low cost titanium and other lightweight materials for incorporation into future armor and other Army systems.
  - Demonstrated chemical agent resistant coatings (CARC) which satisfy the Clean Air Act and provide enhanced chemical survivability along with improved weathering and durability.
  - Combined sensor based manufacturing techniques and on-board life monitoring for use in manufacture of composite components with greater logistic supportability for future armored vehicles.
  - Demonstrated performance of thick film, low loss phase shifter materials for applications at 25 Ghz for an extremely low cost, lightweight radar antenna.
  - Evaluated several Non Destructive Evaluation (NDE) methods for use on Composite Armored Vehicle (CAV) thick polymer sections and other CAV components.
- 4000 - Developed composite materials (hardened materials) for use in ballistic missile structures.

Total 14339

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602105A Materials Technology
	PROJECT AH84

FY 1998 Planned Program:

•	9508	- Provide component ferroelectric material for full scale phase shift antenna. License ferroelectric formulation patents. - Produce transparent armor material in a prototype configuration for individual soldier protection. - Develop refractory metal based warhead liners using novel processing techniques. - Provide modeling and simulation codes as guidelines to improving the ballistic resistance of ultra lightweight armor material. - Evaluate novel processing methods for improved chemical resistance of polymers/elastomers for chemical/biological agent protection of Army systems. - Develop integral composite structures that combine structural capabilities with ballistic performance without collateral damage. - Develop novel armor plate and ballistically tolerant metallic materials using laser processing.. - Enhance laser ultrasonic inspection technology to detect and characterize flaws in ground and air vehicles; flight test the Mission Intensity Counter to improve the intensity vs. component damage rate model; advance active suspension control technology by incorporating brake induced vibration data.
Total	9508	

FY 1999 Planned Program:

•	10137	- Demonstrate enhanced ballistic performance and dynamic response of ultra lightweight armor materials. - Demonstrate advanced polymeric/barrier materials that offer improved performance and durability in Army chemical defense applications. - Develop computer models that determine the structural as well as ballistic performance of complex composite material systems. - Optimize processing of fabricating ballistically resistant hybrid laminate. - Develop rapid prototyping of ballistically tolerant novel components via laser processing - Develop processing techniques for fabrication of nano-materials to replace depleted uranium in penetrators. - Develop advanced NDE methodology for improved structural analysis and flaw/damage detection in composites; incorporate dynamic data into smart materials model; test active suspension system control for ground vehicles.
Total	10137	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	14530	9811	10979
Appropriated Value	14530	9811	
Adjustments to Appropriated Value	-191	-303	
FY 1999 President's Budget	14339	9508	10137

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	19140	25855	18738	19532	20996	21260	21829	Continuing	Continuing
AH15 Ground Combat Identification Technology	3520	3364	3570	3475	3641	3744	3861	Continuing	Continuing
AH16 S3I Technology	13067	14962	12317	13044	14174	14296	14673	Continuing	Continuing
A140 High Power Microwave (HPM) Technology	2553	2684	2851	3013	3181	3220	3295	Continuing	Continuing
A142 Passive Millimeter Wave (MMW) Camera	0	4845	0	0	0	0	0	0	4845

Mission Description and Budget Item Justification: The objectives of this program are: (1) to provide sensor, signal and information processing technology for advanced reconnaissance, intelligence, surveillance, and target acquisition (RISTA), 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 (2) to determine and reduce the susceptibility and vulnerability of Army equipment and systems to nuclear and radio frequency (RF)/high power microwave (HPM) environments. Three critical technologies are addressed to increase the combat effectiveness of tactical Army forces: (1) high power microwave (HPM) technology; (2) combat identification technology; (3) sensors, signatures, signal and information processing (S3I) technology. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Force Modernization Plan and Project Reliance. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability

PROJECT: AH15

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH15 Ground Combat Identification Technology	3520	3364	3570	3475	3641	3744	3861	Continuing	Continuing

A. **Mission Description and Budget Item Justification:** This program provides the enabling technology necessary to demonstrate advanced Combat Identification (CI) concepts and systems for all aspects of ground combat. The hardware and software improvements and modeling and simulation advances provided by this project are essential to ensure needed advancements in point-of-engagement target identification (ID) and accurate, timely situational awareness (SA). The operational impact realized is reduced fratricide and a significant increase in combat effectiveness. CI is also strongly related to the Army's larger objective of Battlefield Digitization and synergistically supplements that effort by feeding friendly position information from the platform level into the command and control network.

FY 1997 Accomplishments:

•	3520	- Completed virtual simulation of Battlefield Combat Identification System (BCIS) Digital Data Link (DDL), completed constructive modeling of air-to-ground CI systems, and completed initial virtual and constructive simulations of dismounted soldier CI system. - Demonstrated prototype Combat Identification Dismounted Soldier (CIDDS) systems in an operational field experiment sponsored by the Dismounted Battlespace Battle Lab (DBBL) and determined best technical approach for both Land Warrior integrated CIDDS function and stand-alone CIDDS system for other dismounted soldiers. Initiated integration into Land Warrior system and transition to Engineering, Manufacturing & Development (EMD) for stand-alone CIDDS system.
Total	3520	

FY 1998 Planned Program:

•	3292	- Complete integration of CIDDS function into Land Warrior equipment suite and demonstrate as part of Force XXI Land Warrior Early User Testing under the Consolidated Land Warrior program. - Analyze and develop target ID concepts for the remaining engagement scenarios for the dismounted soldier, to include soldier-to-vehicle, vehicle-to-soldier and helicopter-to-soldier. - Improve the model fidelity for the chosen CI air, ground and dismounted soldier solutions to support validation of techniques, tactics and procedures (TTPs), create leave-behind training capabilities, and support requirements definition and technology selection for the Land Warrior.
•	72	– Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	3364	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability — PROJECT: AH15

FY 1999 Planned Program:

•	3570	- Complete prototyping and initiate and complete integration of the CI functions for the dismounted soldier, to include soldier-to-vehicle, vehicle-to-soldier and helicopter-to-soldier. - Complete virtual simulation experiments of the complete CI architecture.
Total	3570	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3604	3532	3552
Appropriated Value	3604	3532	
Adjustments to Appropriated Value	-84	-168	
FY 1999 President's Budget	3520	3364	3570

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability

PROJECT: AH16

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH16 S3I Technology	13067	14962	12317	13044	14174	14296	14673	Continuing	Continuing

A. Mission Description and Justification: This project provides for the synergistic development of sensors, signal processors, and automatic target recognition (ATR) technology for RISTA, fire control, smart munitions and fuzing systems. In the RISTA and fire control area, the project will develop and demonstrate: (1) advanced ultra wide band (UWB) radar technology for adverse weather, wide-area detection, location and recognition of tactical ground targets concealed in foliage, and buried mines; (2) innovative algorithms for the detection, discrimination, and classification of stationary targets from a low flying helicopter; (3) ATR algorithms that synergistically use outputs of forward looking infrared (FLIR), millimeter wave (MMW) radar and laser radar (LADAR) sensors to identify combat vehicles and perform signature predictions in many bands (infrared, visible, MMW, and LADAR) from targets and backgrounds at specified times, weather conditions and locations; (4) affordable, lightweight target acquisition radar technology for man-portable and battlefield platform applications: (5) advanced optical processing techniques to automatically process, at the sensor, the received signals into target information of sufficiently narrow bandwidth to be compatible with Army communication systems; (6) concept validation of the passive MMW camera. Project goals in the smart munitions and fuzing sensor area include development of advanced microwave, millimeter wave (MMW), acoustic, electrostatic, and LADAR technologies to reliably sense low-cross section targets in high countermeasures and clutter environments. These technologies support the Force XXI modernization efforts, the Army battlefield digitization effort, Advanced Technology Demonstrations/Advanced Concept Technology Demonstration (ATDs/ACTDs) such as: Intelligent Minefield; Target Acquisition; Remote Sentry; Rapid Force Project Initiatives; and systems such as: Longbow; advanced submunitions, standoff fuzing for anti-armor munitions, proximity fuzing, range finding for bursting munitions, smart mines, multi-option fuze for artillery; guided and unguided tank, mortar and artillery ammunition; and anti-aircraft applications including projectile and missile fuzing.

FY 1997 Accomplishments:

- 2303 - Developed an initial version of a target signature generator which accepts user inputs sensor parameters, target description and sensor-to-target geometrics.
  - Extended MMW radar track accuracy measurements to armored targets in defilade.
  - Prototyped and evaluated multi-level situational awareness agents that operate over a distributed computing environment.
  - Developed a battlefield visualization architecture that allows for reusability of third party software modules by creating a clear division of interfaces between applications, domain information, and display technologies creating the foundation for future battlefield systems to utilize a common display architecture for 3D environments.
- 6406 - Provided initial transition of foliage penetration (FOPEN) technology to receiving Research, Development, and Engineering Center (RDEC) by supplying point design for FOPEN radar with supporting algorithms; performed characterization of sub-surface mine signatures.
  - Implemented advanced waveform processing in software and benchmark; evaluated adding advanced moving target indication (MTI) and stationary target indication (STI) algorithms to processor suite

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602120A Sensors and Electronic Survivability
	PROJECT AH16

FY 1997 Accomplishments: (continued)

- Tested advanced real beam radar target/clutter separation techniques in end-to-end algorithm evaluation facility and provided report; applied data compression techniques to signature storage to enhance vehicle classification capability; tested self-regulation concepts on diverse clutter data.
- - Developed algorithms and architectures for image processing and demonstrate two-dimensional optical processors with high throughput.

4358 - Extended performance envelope of the FLIR/MMW model-based algorithm to more difficult scenarios involving 10-20 classes of vehicles, moderate to heavy clutter, and up to 40% occlusion; initiated development of multi-sensor synthetic aperture radar (SAR)/thermal images ATR.

- Demonstrated GPS performance for projectiles and missiles. Developed LADAR for smart munitions applications.
- Expanded acoustic real time tracking and identification to include a broader base of ground and air targets.

Total 13067

FY 1998 Planned Program:

- 1478 - Develop a set of algorithms, methods, and Application Programmers Interface (API) based software subsystems, and modules to enhance the display, access and focus of battlefield information.
  -Exploit improved processing and algorithms for the real-time transformation of sensor and environmental information, such as integrated weather and battlefield environment with terrain data into a unified battlefield visualization.
  - Develop a multi-modality human/computer subsystem which enables the user to interact with multiple displays and/or display modalities through more natural interfaces such as gesture, eyetracking, and natural language.
- 4589 -Demonstrate target acquisition and tracking of ground vehicles using 35 Ghz wideband polarimetric testbed.
  -Report on capability to perform UWB SAR processing steps in real-time on an airborne platform.
  -Demonstrate stationary target discrimination techniques for real beam radars that increase probability of detection in diverse environments.
- 2288 -Demonstrate two-dimensional imager with on-chip processing in hybrid optical/digital architecture running detection and identification algorithms
- 1424 -Extend the operational envelope of SAR ATR approaches to robustly address the full variation of sensor geometrics provided by operational sensors.
  -Double synthetic scene generation speed while maintaining physical realism.
- 2769 -Conduct test firings of GPS tracking of artillery projectiles.
  -Implement acoustic algorithms to detect artillery and missile launches, small arms fire and algorithms to resolve closely spaced targets.
  -Demonstrate acoustic algorithms to track large target formations.
  -Complete brassboard frequency modulated/continuous wave (FM/CW) LADAR with low-cost architecture in an armaments RDEC submunition configuration.
  -Demonstrate processing of hyperspectal images with Advanced Optical Transfer Function (AOTF).
- 2414 -Execute congressional plus-up for the Projectile Detection and Cueing system (PD Cue).
  -Improve sniper location discrimination algorithms.
  -Investigate and implement alternate vehicle configurations.

Total 14962

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability — PROJECT: AH16

FY 1999 Planned Program:

- 1843 -Develop a set of advanced software subsystems which will enhance seamless information access, low level event detection, and synchronized operations to transition to Army Research, Development and Engineering Centers (RDECs) to Advanced Technology Demonstrations and Advanced Concept Technology Demonstrations (ATDs and ACTDs).
  -Extend software agent concept to include seamless information access over complex heterogeneous multi-databases.
- 4384 -Integrate second generation STI algorithms into wideband testbed.
  -Report on performance of UWB SAR algorithms to provide reliable discrimination of mines in clutter.
  -Improve stationary target classification for real beam radars by using adaptively weighted mean square error metrics and efficient multi-resolution template pruning strategies.
- 2143 -Demonstrate smart imager in hybrid optical digital architecture running real-time algorithms on imager data with reduced power requirements.
- 2560 -Demonstrate acoustic target formation tracking.
  -Develop low-cost high resolution three-dimensional radar imaging for munitions.
  -Demonstrate integration of diffractive optical elements with the vertical cavity surface emitting laser (VCSEL) array for electro-optical processor
- 1387 -Perform multi-sensor cross cueing studies between SAR ATR and moving target indicator/electro-optic (MTI/EO) sensors for unmanned aerial vehicle (UAV)-borne multi-sensor SAR payloads.
  -Model urban-type clutter in the visible, infrared and millimeter wave in high resolution synthetic scenes.

Total 12317

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	13151	12992	13116
Appropriated Value	13151	15492	
Adjustments to Appropriated Value	-84	-530	
FY 1999 President's Budget	13067	14962	12317

Change Summary Explanation: Funding: FY 1998 funding increased by Congress (+2500) for PD Cue (Counter sniper Detection Technology).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability / PROJECT: A140

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A140 High Power Microwave (HPM) Technology	2553	2684	2851	3013	3181	3220	3295	Continuing	Continuing

A. Mission Description and Justification: The objective of this project is to develop the tools, techniques and methodology to assess the susceptibility and vulnerability of Army equipment and systems to various types of radio frequency (RF)/highpower microwave (HPM) environments, and to identify, develop, and evaluate the technologies required to protect and harden US equipment as well as to enable weaponization. This program is coordinated and, when appropriate, leveraged with HPM programs in the Air Force, Navy, Defense Special Weapons Agency, National Labs, University Consortia and relevant industry and foreign partners.

FY 1997 Accomplishments:

- 2553 - Modeled physical phenomena and incorporated into electronic warfare analysis simulation tools for radar and RF sensors.
  - Developed electromagnetic susceptibility assessment tools and methods and conducted HPM susceptibility assessments (through experimentation and analyses) of foreign and US Army assets including munitions, communications equipment and avionics to support ATDs and ACTDs.
  - Conducted HPM hardening technology development and demonstrations centering on technology to protect US assets on the digital battlefield. Focus was on electro-optic and monolithic microwave integrated circuit (MMIC) limiters and silicon carbide (SiC) device technology.
  - Constructed HPM sources, antennas and support equipment to dramatically increase field test capability.
  - Relocated Pulsed Power Center from Ft. Monmouth, NJ, to Adelphi Laboratory Center, Adelphi, MD, to support HPM technology focus on high average power sources and components.
  - Completed first-order design for wideband klystron amplifier. Deliverables included technical papers and presentations.
  - Established a Silicon Carbide Epi-Layer Facility with Mississippi State University under a Cooperative Research and Development Agreement and Small Business Technology Transfer (STTR) Program.

Total 2553

FY 1998 Planned Program:

- 2645 -Develop and enhance current susceptibility tools and measurement methodologies that can be implemented to perform high power radio frequency (HPRF), HPM, and electromagnetic environment (EME) susceptibility assessments on US and foreign assets. Focus on fuzes and Tank and Automotive Research, Development and Engineering Center (TARDEC)-supplied targets.
  - Evaluate and quantify the impact of RF/HPM threats to FORCE XXI and Army After Next (AAN) elements and critical command, control, communications, computers and intelligence (C4I) assets and networks. Develop the tools and methodologies to assess the susceptibilities of electronic equipment (including commercial off-the-shelf [COTS]) to RF/HPM threats and evaluate mission degradation. Focus will be give to infrastructure assets related to transportation (road and rail) and communication (asynchronous transfer module [ATM] nets).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602120A Sensors and Electronic Survivability
	PROJECT A140

FY 1998 Planned Program: (continued)

- Complete preliminary design for improved high average power Reltron HPM source buncher and output cavities and beam stop. Design Reltron test bed and beam stick. Report progress in papers and conferences.
- Complete design of buncher cavity, preliminary design of beam stick, modulator and diagnostics for high average power broadband klystron amplifier. Deliverables will include technical papers and presentations.
- Design broadband HPM antennas for use on Army vehicles and field tests.
- Formulate experimental, numeric and analytic models and techniques that will permit high confidence cost-effective assessments and evaluations of stand-alone and networked equipment exposed to RF/HPM threats. These efforts will concentrate on the evaluation of RF propagation and the effects of building structures in enhancing RF susceptibilities of contained equipment (an observed but ill understood problem).
- Formulate and model the data and information flow, into, out of, and within the Abrams M1A2 and Longbow Apache AH64-D.

• 39 - Small Business Innovation Research/Small Business Technology Transfer Programs.

Total 2684

FY 1999 Planned Program:

• 2851 -Evaluate and quantify the impact of RF/HPM threats to FORCE XXI and Army After Next (AAN) elements and critical C4I assets and networks. Develop the tools and methodologies to assess the susceptibilities of electronic equipment (including COTS) to RF/HPM threats and evaluate mission degradation. Efforts will concentrate on emerging system technologies such as the All Electric Vehicle and Individual Soldier Systems and Sensors.
- Enhance susceptibility tools and measurement methodologies and conduce HPM susceptibility assessments (through experimentation and analyses) of foreign and US assets to support ATDs and ACTDs. Focus on targets from TARDEC and air defense threat lists.
- Complete design of improved high average power Reltron HPM source test bed including modulator, cavities, electron gun and beam stop. Report progress in papers and conferences.
- Complete design of beam stick and output cavities for high average power broadband klystron amplifier and report on possibilities for size and weight reduction. Report progress in papers and conferences.
- Develop high power small element antenna arrays for use on Army platforms and field tests.
- Evaluate new components, materials, and software algorithms that will lead to the development of mitigation measures to eliminate or reduce the impact of RF/HPM on the future digital battlefield. New discrete component technologies will be evaluated for mitigation applications.
- Formulate experimental, numeric and analytic models and techniques that will permit high confidence cost-effective assessments and evaluations of stand-alone and networked equipment exposed to RF/HPM threats. Initiate the development of a tactical network performance code with specific degradation models for particular nodes and transmission links.
- Validate benign and threat effects Abrams and Longbow Apache information flow models, and transfer to U.S. Army Communications and Electronics Command's (CECOM's) suite of System Performance Models.

Total 2851

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability — PROJECT: A140

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2596	2770	3014
Appropriated Value	2596	2770	
Adjustments to Appropriated Value	-43	-86	
FY 1999 President's Budget	2553	2684	2851

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability

PROJECT: A142

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A142 Passive Millimeter Wave (MMW) Camera	0	4845	0	0	0	0	0	0	4845

A. Mission Description and Justification: Development technology for a passive/active MMW imaging system to demonstrate its performance capabilities as a covert all-weather surveillance and target acquisition system. Perform research on enabling MMW technologies in support of passive/active MMW imaging. These funds have been provided to ARL as a result of Congressional interest for the development of a Passive MMW Camera (PMC). The FY98 funds complete the assembly of a flight-worthy PMC on an airborne test platform which may allow map-of-the-earth navigation and obstacle avoidance, reconnaissance, landing guidance, and search and rescue mission scenarios under conditions of adverse weather.

FY 1997 Accomplishments: Project not funded in FY 1997.

FY 1998 Planned Program:

•	4723	- Develop a flight worthy passive millimeter wave (MMW) imaging system for integration into an airborne test platform. - Develop enabling MMW antenna and receiver technologies for sensor systems.
•	122	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	4845	

FY 1999 Planned Program: Project not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		5000	
Adjustments to Appropriated Value		-155	
FY 1999 President's Budget	0	4845	0

Change Summary Explanation: Funding: FY 1998 funding (+5000) added by Congress specifically to support maturation and testing of the Passive MMW imaging technology.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602211A Aviation Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	20637	22211	29746	30041	31734	32831	33554	0	Continuing
A47A Aeronautical and Aircraft Weapons Technology	17957	19536	26626	26914	28401	29482	30133	0	Continuing
A47B Vehicle Propulsion and Structures Technology	2680	2675	3120	3127	3333	3349	3421	0	Continuing

Mission Description and Budget Item Justification: The objective of this program element (PE) is to conduct applied research in rotary wing vehicle (RWV) technologies for transition to advanced development technology demonstrations that support development of new and / or upgraded DoD / Army rotorcraft systems in support of Joint Vision 2010 and Army After Next. RWV offer a practical solution to many of the DoD / Army's operational needs because of their ability to operate efficiently and effectively below tree top level for nap-of-the-earth (NOE) missions. Accordingly, RWV require significantly different analysis and design challenges compared with traditional fixed wing vehicles which fly at higher altitudes. The Army Aviation Science and Technology program's functional organization, supported by the National Aeronautics and Space Administration (NASA) at three co-located activities, is the focal point for DoD efforts in rotorcraft technology. Technical areas include aeromechanics, aerodynamics, flight controls, aeroacoustics, structures, propulsion, reliability and maintainability, safety and survivability, mission support equipment, aircraft system synthesis, advanced helicopter analysis, flight simulation, aircrew-aircraft integration, and aircraft weapons integration. The work in this PE is consistent with the Department of Defense Technology Area Plans, DoD Joint Warfighting Science and Technology Master Plan, DoD Reliance Agreements (for which the Army is the lead service for the development of rotorcraft science and technology), the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and a coordinated government / industry / academia national RWV Technology Development Approach. This PE also supports the National Rotorcraft Technology Center (NRTC), a partnership of government, industry and academia, whose primary objective is to ensure the continued superiority of U.S. military rotorcraft systems through focused technology projects with a near term (2-3 year) return on investment, enabling rapid technology insertion into military and commercial rotorcraft. The Army and NASA provide funding for NRTC which is matched by industry. Army, NASA, Navy, and Federal Aviation Administration (FAA) provide staffing and support for the NRTC operations. Projects in this PE include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

Work in this PE is performed by contractors including Boeing Company, Mesa, AZ and Philadelphia, PA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Lockheed Martin, Atlanta, GA; General Electric, Lynn, MA; AlliedSignal Engines, Phoenix, AZ; Sikorsky Aircraft, Stratford, CT; Rolls Royce, Indianapolis, IN; Kaman Aerospace Corp., Bloomfield, CT; Pratt & Whitney, Hartford, CT; and United Technologies Research Center, Hartford, CT. Additionally, work in this PE is performed by universities including Arizona State University, AZ; Georgia Institute of Technology, GA; Ohio State University, OH; Penn State University, PA; Purdue University, IN; Texas A&M, TX; University of Southern California, CA; University of Florida, FL; University of Illinois, Il; University of Maryland, MD; University of Michigan, MI; University of Utah, UT; Virginia Polytechnic Institute and State University, VA; Wichita State University, KS; Cornell University, NY; Iowa State University, IA; Prairie View A&M College, TX; University of Dayton, OH; University of Texas Automation and Robotics Institute, TX.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology

Primary in-house developers include Aviation and Missile Command (AMCOM), Redstone Arsenal, AL; Aeroflightdynamics Directorate / AMCOM, NASA Ames Research Center, Moffett Field, CA; Aviation Applied Technology Directorate/AMCOM, Ft Eustis, VA; Vehicle Technology Center (VTC) /Army Research Laboratory (ARL), NASA Langley Research Center, Hampton, VA; and Vehicle Technology Center/ARL, NASA Lewis Research Center, Cleveland, OH.

This program adheres to DoD Defense Reliance Agreements on Aeropropulsion and Air Vehicles (Rotary Wing) for which the Army is designated the lead DoD agency for rotorcraft technology with oversight and coordination provided by the Joint Directors of Laboratories. Technology products from this PE directly transfer to technology demonstrations conducted under PE 0603003A (Aviation Advanced Technology). Joint coordination of efforts, where applicable, is conducted with the National Aeronautics and Space Administration (NASA) Aeronautics Program; PE 0602122N, Aircraft Technology; and PE 0602201F, Aerospace Flight Dynamics. To eliminate duplication the PE efforts are coordinated throughout the rotorcraft community by joint program reviews, exchange of program data sheets, research and technology resumes, technical reports; inter-service liaison; government/industry/academia participation in the annual program development and refinement process for NRTC projects; attendance at scientific meetings and conferences; participation in the Joint Aeronautical Commander's Group, the Technical Cooperation Program (TTCP), NASA Research and Technology Committees, and the North Atlantic Treaty Organization (NATO) Advisory Group on Aerospace Research and Development (AGARD). Efforts under this PE transition to and provide risk reduction for Demonstration/Validation and Engineering Development programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). Some efforts also transition to the field through PE 0203752A (Aircraft Engine Component Improvement Program). In addition, this PE's deliverables provide technical support to PE 0604223A (RAH-66 Comanche), PE 0604816A (Longbow), and PE 0203744A (Aircraft Modifications/Product Improvement). Active joint Service programs supported: The Tri-Service Integrated High Performance Turbine Engine Technology (IHPTET) program and Navy/Army Joint Advanced Health and Usage Monitoring System (JAHUMS) Advanced Concept Technology Demonstration (ACTD) program. International Cooperative Agreements include Information Exchange on Engine Environmental Protection under the Master Information Exchange Agreement IEA-A-94-UK-1425 titled Advanced Tactical Helicopters and Associated Technology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology	PROJECT A47A

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A47A Aeronautical and Aircraft Weapons Technology	17957	19536	26626	26914	28401	29482	30133	0	Continuing

A. Mission Description and Justification: The purpose of this project is to conduct applied research of technologies for DoD / Army RWV systems improvements in operational effectiveness and combat mission capability including increased strategic and tactical mobility / deployability, air-to-ground and air-to-air combat, improved fire power, increased aircraft and aircrew survivability, increased reliability and reduced maintenance, and increased combat sustainability. Work in this project maintains world excellence in rotorcraft technology through the study of advanced technologies and their applications to rotorcraft. Areas of investigation and research consist of the following: fluid mechanics, dynamics, aerodynamics, advanced flight control technology, handling qualities, aircraft and weapons interaction, Radio Frequency (RF), Infrared (IR), visual electro-optical (EO) and acoustic signature reduction, weight reduction, advanced materials applications, internal / external loads, militarization of propulsion/structures technology, engine specific component technologies in support of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) initiative goal demonstrators, advanced smart materials applications, flight simulation, improved aircrew machine integration and pilot-vehicle interface, improvements in reliability and maintainability, combat damage repair of new materials, vulnerability reduction to Nuclear Biological Chemical (NBC), ballistic, and advanced energy threats, crashworthiness, and logistics reductions. These technologies are being developed for application to current as well as future DoD / Army rotorcraft systems. This project also supports work done under the auspices of the National Rotorcraft Technology Center (NRTC). NRTC addresses five critical military / civil rotorcraft technology thrusts as follows: (a) process and product improvement for affordability, quality and environmental compliance; (b) enhanced rotorcraft performance; (c) passenger and community acceptance; (d) expanded rotorcraft operations; (e) technologies to support harmonized military qualification and civil certification. NRTC projects are identified and developed by industry and evaluated and approved by government on an annual basis to ensure they are supportive of DoD rotary wing goals and objectives. Funding increases for this project from FY97 thru FY98 and FY99 are required to support rotorcraft component technology demonstrations and the transition of this 6.2 technology to approved major 6.3 technology demonstrations planned for FY99-02 in support of DoD modernization plans, Joint Vision 2010 and Army After Next. Increases will support work conducted through contracts and in-house efforts in the areas of operational and support costs reduction, structural airframe weight reduction, variable geometry rotor systems, propulsion system fuel and weight reductions and advanced concepts development. Demonstrated technology will support development of the future DoD Joint Transport Rotorcraft (JTR) identified to potentially replace the aging Army CH47D Chinook and Navy CH53 Super Stallion helicopters, and potential upgrades of Army systems such as the AH-64 Apache, RAH-66 Comanche, UH-60 Blackhawk and USMC AH-1 Cobra could be supported as well.

FY 1997 Accomplishments:

- 8748 - Investigated and evaluated aeromechanics analysis/models for on-blade control rotor to reduce vibration/noise, weight and system cost.
  - Conducted tear down inspection to support installation of research flight controls in the joint Army/NASA Rotorcraft Aircrew Systems Concepts Airborne Laboratory (RASCAL).
  - Transitioned emerging Control Designer's Unified Interface (CONDUIT) design tool technology to industry.
  - Performed preliminary man-machine design analysis system (MIDAS) workstation usability evaluation and architecture design.
  - Conducted simulation to refine rotorcraft cargo handling load operations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602211A Aviation Technology
PROJECT: A47A	

FY 1997 Accomplishments (Continued):

- Performed simulation experiments on neural net torque predictions for helicopter maneuver envelope cueing / limiting.

- Performed rotorcraft weaponization integration analysis for air to air weapons and low cost precision kill (LCPK) and investigated concepts for non-lethal weapons (NLW).
- Completed hardware / software design validation of integrated flight and fire control (IFFC) system.
- Established joining methods for composite airframe primary structures; conducted experiments on active real-time composite resin cure process to reduce costs; predicted dynamic stresses and impulse loaded fittings; and designed lightweight, crashworthy landing gear components using metal matrix composite materials.

•	1045	- Completed design for a lightweight, high efficient ceramic turbine for IHPTET / Joint Turbine Advanced Gas Generator (JTAGG) Phase II. - Completed design for an Army / Air Force cooled ceramic matrix composite vane for IHPTET / JTAGG Phase III critical high temperature condition and performed rig tests on a centrifugal compressor.
•	4624	- Performed preliminary validation of advanced visual / electro-optical detection model. - Completed crashworthy modeling and simulation computer code evaluation; conducted investigation in acoustic fault detection. - Completed screen tests of ceramic leading edge materials for low cost dielectric (RF transparent) rotor blade sand/rain erosion protection.
•	3000	- Completed component development / test / validation and transitioned NRTC technology to government and industry partners in: Health and Usage Monitoring System (HUMS) open architecture specification, thermoforming process for complex fairings, superplastic forming of aluminum alloys, active tail vibration control concept for tilt rotor, global positioning system guided noise abatement approach, and fatigue and crack growth analysis. - Conducted NRTC technology efforts in the areas of low cost and efficient composite structures, reduced manufacturing and operating costs, active flight controls, increased reliability and flight safety, enhanced vehicle performance, noise and vibration reduction, fretting fatigue, icing protection and ultrasafe drive train design.
•	918	- Provided payment for services for Defense Finance and Accounting System (DFAS).
Total	18335	

FY 1998 Planned Program:

•	6680	- Complete RASCAL research flight control system flight qualification; perform Beta test evaluation of emerging CONDUIT design tool capabilities via Cooperative Research and Development Agreement (CRADA) with industry; complete simulation demonstration of benefits of cyclic control envelope limiting and cueing and transition technology to helicopter Active Control Tech (HACT) demo and fielded systems. - Test refined multi-element hi-lift airfoil with improved drag characteristics at low lift. Develop design for active elevon-controlled model rotor demonstration. Define optimized blade aerodynamic geometry for Advanced Configuration Rotor demonstrator to improve rotor efficiency, noise, & vibratory loads. Benchmark rotor air load prediction capability against prediction effectiveness metric.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602211A Aviation Technology	PROJECT: A47A

FY 1998 Planned Program (Continued):

- Complete MIDAS cockpit design system software development with 2nd generation cognitive models; test new situation awareness model in MIDAS by comparison with pilot ratings.

•	1901	- Perform IFFC evaluation and simulation. - Conduct Airborne Manned / Unmanned Systems Technology (AMUST) performance integration trade studies. - Conduct LCPK integration studies.
•	1816	- Perform coupon tests of advanced multi-spectral pigments, improve crashworthiness predictive codes and validate with component and full scale crash test data to tailor the codes to Army rotorcraft; complete development and testing of acoustic drive train monitor; design advanced oil debris analysis system for improved diagnostics and prognostics.
•	1192	- Provide man-machine integration support to Rotorcraft Pilot Associate.
•	1619	- Perform bond testing of lightweight all-composite joints to validate structural integrity; fabricate aluminum matrix landing gear drag beam; conduct structural dynamic modeling of airframe fittings for improved structural integrity; perform screening tests of advanced polymeric based leading edge materials for low dielectric rotor blade sand / rain erosion protection; define matrix of advanced engine IR suppression concepts via computational fluid dynamics (CFD) flowfield analysis.
•	1077	- Complete design of monolithic ceramic low pressure (LP) turbine airfoil and attachment configuration consistent with IHPTET / JTAGG Phase III conditions; complete design of advanced high pressure (HP) compressor for IHPTET / JTAGG Phase III; conduct preliminary design of inter-metallic composite (IMC) spar/shell HP turbine blade; and conduct fabrication trials of Army / Air Force cooled ceramic matrix composite (CMC) turbine vane.
•	4322	- Complete component development / test / validation and transition of NRTC technology to government / industry partners from: HUMS diagnostic database, resin transfer molded tailrotor blade, main rotor pitch case testing, automated rotor blade surface finish process, high speed blade core carving process, composite swashplate design; tiltrotor groundwash model tests, active horizontal tail control flight test, rotor / antenna interaction prediction model, helicopter maneuver loads data analysis; interior noise reduction isolator mount and prediction methodology, gear design methods testing; simulator evaluation of synthetic vision and decision aiding tools, water and soil crash dynamics and crashworthy fuel tank methodology. - Conduct NRTC technology efforts in the areas of low cost and efficient composite structures, reduced manufacturing and operating costs, active flight controls, increased reliability and flight safety, Master Cure Simulation System, enhanced vehicle performance, noise and vibration reduction, noise certification metric and ultrasafe drivetrain design with an emphasis on technologies validation and technology transition.
•	929	- Provide payment for services for Defense Finance and Accounting System (DFAS).
Total	19536	

FY 1999 Planned Program:

•	8731	- Expand cargo slung load handling qualities (HQ) criteria for forward speed & lateral axis; perform RASCAL flight validation of CONDUIT control system design tool methods.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602211A Aviation Technology
	PROJECT: A47A

FY 1999 Planned Program (Continued):

- Test oscillatory blowing concept to substantially improve stall and increase rotor max blade loading maneuverability; hover test Active Elevon-Controlled Rotor (AECR) demonstrator. Test Advanced Concept Rotor (ACR) model demonstrator to improve rotor efficiency, noise, and vibratory loads; Apply hybrid methods for rotorcraft interactional aerodynamic predictions.
- Complete validation, verification and acceptance (VV&A) of MIDAS; transition to industry through Cooperative Research and Development Agreement (CRDA).

•	1923	- Develop advanced technologies for a variable geometry rotor for Army After Next air mobility concept.
•	2663	- Conduct NLW and Rotorcraft Air Combat Enhancement (RACE) demonstration weapon integration studies; conduct preliminary design for low cost precision kill (LCPK) integration concepts; complete AMUST system definition / integration trade study and transition results to hardware demonstration.
•	2162	- Conduct test of aluminum matrix landing gear beam to verify crashworthiness; fabricate pin reinforced composite primary structure to improve ballistic tolerance; conduct composite structural joint test on a fuselage sub-assembly to validate structural integrity.
•	1407	- Complete fabrication of ceramic LP turbine and initiate rig testing; fabricate advanced HP compressor for IHPTET / JTAGG Phase III; complete design of IMC spar/shell HP turbine blade; fabricate finalized design of an Army / Air Force cooled CMC HP turbine vane and complete design of high strength/high stiffness engine shaft.
•	3300	- Conduct full-scale crash testing of Advanced Composite Airframe Program (ACAP) helicopter to correlate with structural modeling results; improve total energy absorption of crashworthy landing gear struts using digital control techniques. - Conduct coupon test of advanced Radar Absorbing Material (RAM) / Radar Absorbing Structures (RAS) compatible multi-spectral pigment / binder systems; complete evaluation of ceramic and polymer based leading edge materials for low dielectric rotor blade sand / rain erosion protection, finalize development of full-scale concept; fabricate and test subscale engine IR suppressor concepts. - Complete development and testing of advanced oil analysis system for helicopter drive train component diagnostics and prognostics.
•	5575	- Complete component development / demonstration / test / validation and transition of NRTC technology to government / industry partners from: corrosion sensors evaluation; integrated helicopter design architecture and tools; composite swashplate fabrication; validated interior noise reduction methodology, models, and mounts; flight test of decision aiding system; and composite life prediction methodology. -Continue NRTC technology efforts in noise certification procedure; water and soil crash dynamics; crashworthy fuel tank design concepts / criteria and energy absorbing airframe structure.
•	865	- Provide payment for services from the DFAS.
Total	26626	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602211A Aviation Technology
PROJECT: A47A	

B. Project Change Summary

	FY1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	19213	24410	27152
Appropriated Value	19213	20222	
Adjustments to Appropriated Value	-878	-4874	
FY 1999 President's Budget	18335	19536	26626

Change Summary Explanation:

Funding: FY 1998 adjustments due to Congressional decrease (-4188) to maintain FY 1997 funding level and undistributed Congressional reductions (-686).

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602211A Aviation Technology

PROJECT: A47B

COST (In Thousands)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A47B Vehicle Propulsion and Structures Technology	2680	2675	3120	3127	3333	3349	3421	0	Continuing

A. Mission Description and Justification: The purpose of this project is to conduct applied research of generic propulsion and structures technology in support of DoD / Army Rotary Wing Vehicle (RWV) improvements. Areas of investigation and research include concepts of: small airflow gas turbines; high temperature materials; mechanical drive systems; integrated composites structural integrity; low cost manufacturing concepts; aerodynamic loads; and aeroelastic interactions. The propulsion technology in this project supports the goal of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) / Joint Turbine Advanced Gas Generator (JTAGG) program and the Army Aviation Research, Development and Engineering Center (RDEC). The goal of IHPTET is to demonstrate technology which would double propulsion system capability for a wide range of potential future RWV applications.

FY 1997 Accomplishments:

- 1551 -Completed fabrication and installation of the waverotor warm cycle experimental facility, and initiated experimental program to demonstrate that the waverotor offers increased specific power with reduced specific fuel consumption.
  -Completed a detailed thermo-mechanical model of the ceramic matrix composite nozzle which supports the cooled ceramic system approach to high temperature environments of advanced turbine engines.
  -Completed performance testing and analysis of an advanced two stage 5:1 compression ratio axial compressor which validated the design tool for customer use.
  -Completed face gear transmission component testing and identified improvements for the manufacturing process that will avert premature failure. Completed data acquisition for compression system dynamic model and control design for active compressor stability enhancement which will increase the efficiency of compressor operation, and reduce fuel consumption.
- 1129 - Completed Transonic Dynamics Tunnel calibration; completed redesign of aeroelastic rotor experimental system (ARES) II platform, fabricated required components, and initiated bench and hover tests; constructed new tilt rotor hover test facility, and conducted initial hover test of the refurbished transmission system on the wing and rotor aeroelastic test system (WRATS) tiltrotor model.
  - Determined structural and flight loading requirements for an innovative composite fuselage concept for improved crashworthiness; refined XV-15 exterior acoustic source pressure predictions to improve correlation's with surface pressure measurements; began structural dynamic ground vibration tests of a composite aircraft fuselage for model properties for comparisons with NASTRAN (NASA developed) finite element model predictions in preparation for interior noise control studies.
  - Conducted fatigue tests on riveted test coupons to assess crack growth rate and total fatigue life of riveted structures; implemented 2D to 3D transition element into advanced shell finite element (FE) code; started an investigation of potential rapid inspection of composites by combining different nondestructive evaluation (NDE) technologies through data fusion.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology	PROJECT A47B

FY 1997 Accomplishments (Continued):

- Conducted strength and stiffness tests of tailored composite panels; fabricated calibrated bond test coupons to investigate adhesive cracking caused by microstructure defects.

Total 2680

FY 1998 Planned Program:

• 1563 - Complete laser velocimetry mapping of splittered rotor compressor stage, which will aid in the design of lighter weight and less costly high compression engines by reducing the number of required compressor stages.
- Complete the development of a waverotor operating map and characterize the waverotor start-up process.
- Conduct aerodynamic and heat transfer tests for advanced transonic turbine blading to enable development of more efficient turbine cooling designs.
- Complete seeded fault diagnostic / prognostic spiral bevel gear tests which will validate crack propagation prediction codes for use in future advanced lightweight gear designs.
- Demonstrate a robust expert system controller for high temperature magnetic bearings that will enable operation of critical gas turbine mechanical components in the environmental conditions projected for IHPTET / JTAGG Phase III.
- Provide methodology and design for control of the compressor stability enhancement system to achieve increased engine operating efficiency.

• 1112 - Determine potential for increasing inherent lag damping in rotor systems using elastic couplings; perform aeroelastic tailoring study for soft-inplane tilt rotor design, fabricate a parametrically variable soft-inplane hub for the WRATS tiltrotor model, and perform hover test.
- Correlate structural dynamic test data of composite aircraft fuselage with NASTRAN model predictions.
- Fabricate the innovative composite design fuselage specimens and verify under simulated crash test conditions that they meet crashworthiness criteria.
- Conduct fatigue tests on structural panels to validate fatigue life and crack growth rates of actual riveted aircraft structures.
- Develop FE model based on solid-to-shell transition elements for debond analysis of stitched interface.
- Develop NDE data fusion software using probability based criteria for combining different methods to classify defects; validate durability and damage tolerance models for composite structures; evaluate NDE methods to measure strength of bonded structures.

Total 2675

FY 1999 Planned Program:

• 1804 - Couple a waverotor with a simulated gas turbine engine rig and demonstrate a successful solution of the most difficult waverotor / turbomachinery integration issues.
- Demonstrate readiness of micro electromechanical systems (MEMS) micro sensor and actuator technology applied to engine components for control and diagnostic purposes which will improve lightweight engine performance and reliability.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602211A Aviation Technology / PROJECT: A47B

FY 1999 Planned Program (Continued):

- Complete analysis and performance testing of an advanced compressor stage for IHPTET / JTAGG Phase III.
- Conduct validation tests on thermal behavior of high speed gearing in support of advanced lightweight gearing systems.
- Complete high temperature rig testing of magnetic bearings system.

• 1316 - Complete aeroelastic tilt rotor model test of an aggressive active control system for vibration reductions during simulated maneuvers; fabricate a new low-noise tilt rotor blade and hub loads versus conventional stiff-inplane hub; validate the scaled innovative composite fuselage concept for improved crashworthiness technology through fabrication and testing of a full-scale prototype fuselage.
- Validate fracture mechanics models for predicting crack link-up in riveted aircraft structures; validate strength and fatigue life methods for composite structures; develop prototype remote system and specifications to measure bond strength and test on adhesively bonded structures; evaluate NDE data fusion methodology using field measurements.
- Develop adaptive architecture methodology to automate 2D to 3D transition in nonlinear structural analysis.

Total 3120

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2685	2872	3129
Appropriated Value	2685	2760	
Adjustments to Appropriated Value	-5	-197	
FY 1999 President's Budget	2680	2675	3120

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602270A Electronic Warfare (EW) Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	14845	18925	16249	17699	18221	18465	18754	Continuing	Continuing
A442 Tactical Electronic Warfare Technology	8405	8872	9429	9730	10025	10168	10343	Continuing	Continuing
A906 Tactical Electronic Warfare Techniques	6440	7146	6820	7969	8196	8297	8411	Continuing	Continuing
A936 Shortstop	0	2907	0	0	0	0	0	0	2907

Mission Description and Budget Item Justification: This program investigates electronic warfare (EW) technologies for current and future systems. The efforts in EW will enable the Army to deny the enemy use of the radio spectrum for command, control, communications and computer intelligence purposes, and provide a decisive advantage to our operational forces against the full range of traditional and non-traditional threat forces. Electronic countermeasures (ECM) and self protection developments will protect Army forces from a broad range of radio frequency (RF) surveillance/tracking systems, advanced RF/ electro-optical infrared (EOIR) missiles and smart munitions. Applied research is also being done on automated intelligence fusion systems and techniques for managing assets on the battlefield. Work in this program will lead to winning the battlefield information war by controlling the electromagnetic spectrum and conducting successful electronic disruptive/destructive operations inside the enemy decision cycle. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), Science and Technology Objectives (STOs) and the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on electronic warfare. This program includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. It is related to and fully coordinated with efforts in PE 0602782A (Command, Control and Communications (C3) Technology), PE 0602709A (Night Vision and Electro-Optics Technology), PE 0603789F (C3 Intelligence Technology Development), PE 0603270A (Electronic Warfare Technology), PE 0604270A (Electronic Warfare Development), and PE 0603745A (Tactical Electronic Support Systems - Advanced Development) in accordance with the ongoing Reliance joint planning process. This program is primarily managed by Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Monmouth, NJ.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602270A Electronic Warfare (EW) Technology

PROJECT: A442

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A442 Tactical Electronic Warfare Technology	8405	8872	9429	9730	10025	10168	10343	Continuing	Continuing

A. Mission Description and Justification: This project performs applied research on electronic warfare sensor and countermeasure (CM) technologies for self protection of air and ground platforms, area protection against radar-directed weapons (i.e., jamming of enemy counter mortar/counter battery radars), combat surveillance and target acquisition. The following technology areas are investigated:

- Infrared (IR) countermeasures (IRCM) technologies that provide air and ground platforms with the capability to detect and jam heat-seeking surface-to-air missiles and anti-tank guided missiles with active IR sources, or to decoy them with flares or other devices.
- Self-protection radar countermeasures/warning technologies that provide air and ground platforms with warning and jamming against radar-directed air defense weapons, and jamming of top attack/smart munitions/ artillery-delivered radio proximity fuses.
- Laser warning and countermeasures technologies that provide air and ground platforms with laser rangefinder and designation warning and jamming capability against laser-aided and electro-optically-directed threats including laser beamrider missiles.
- Electronic support (ES) technologies that provide the capability to intercept, direction find, and locate current and emerging hostile non-communications emitters for targeting and tactical situational awareness.
- Area protection radar countermeasures - technologies that provide radar stand-off and stand-in jamming and deception in support of ground forces.

FY 1997 Accomplishments:

- 3119 – Demonstrated fully interactive survivability simulation between Communications-Electronics Command survivability integration laboratory/digital integration laboratory and Ft. Rucker Aviation Test Bed to provide user feedback and real time testing and evaluation of new situational awareness scenarios for survivability, targeting and combat ID.
  – Conducted ECM trials versus J band radar
  – Conducted ECM flight test against advanced multi-band air defense radars.
- 3304 – Completed development of far off axis laser warning receiver and field test against laser designated threats.
  – Completed assessment of advanced pointing/tracking technology to increase directed IRCM output on target
  – Measured laser CM effectiveness on foreign IR missiles.
  – Evaluated 2 micron diode laser array (10 Watt) for multi-band IRCM application.
- 1982 – Reconfigured Manpack ES Measures (ESM) system for use as airborne synthetic aperture radar cueing system. Flight tested and successfully demonstrated on surrogate unmanned aerial vehicle (UAV).
  – Completed development of high-speed impulse detection and characterization technology to improve situational awareness on the battlefield.
  – Established countermeasures to exploit digital radars.
  – Demonstrated efforts to target non-conventional sensors to develop "surgical" countermeasures techniques.

Total 8405

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602270A Electronic Warfare (EW) Technology / PROJECT: A442

FY 1998 Planned Program:

•	2970	– Test low cost specific emitter identification, location and targeting techniques in the Survivability Integration Laboratory (SIL) and link to Ft. Rucker's aviation testbed for user evaluation and doctrine development for new EW technologies and capabilities. – Complete phased array radar digital model to support ECM development.
•	3645	– Develop key technologies for a single multispectral sensor module for RF and missile warning to replace multiple sensors on aircraft and ground vehicles. – Complete the tri-service work on the digital advanced special IR missile to support the multispectral countermeasures demonstration.
•	2189	– Continue laboratory demonstrations for the low probability of intercept (LPI) appliqué receiver and the high speed impulse detector to enable common module electronic intelligence (ELINT) system (CMES) to perform rapid detection, characterization and direction finding of low-power impulse emitters. – Demonstrate capability to detect and process impulse signals from an airborne platform. – Continue development of technology to deceive imaging, meteorological, and non-conventional sensors and perform laboratory demonstration of prototype. – Investigate radar countermeasures to locate and deceive countermortar counterbattery radar systems.
•	68	– Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	8872	

FY 1999 Planned Program:

•	3295	– Complete development of the fiber optic remote antenna assembly and integrate into PM-Aviation Electronic Combat (AEC) suite of integrated RF countermeasures testbed for survivability integration lab and flight tests and transition to the integrated situational awareness and targeting (ISAT) demonstration. – Complete precision ultra-high frequency (UHF)/millimeter wave (MMW) precision direction finding. – Conduct survivability systems integration lab and flight tests, and transition to ISAT. – Continue development of jamming techniques against bi-static, low probability of intercept (LPI) and impulse radars.
•	2777	– Develop on/off board jamming techniques and continue test and simulation work on IRCM jamming effects against multiple threat targets. – Develop non mechanical laser steering techniques.
	1000	– Develop multi-octave antennas for use against multi-spectral surface to air missiles, top attack munitions, and anti-aircraft mines.
•	2357	– Conduct laboratory demonstrations of the adaptive matched filter receiver to improve the capability of CMES to detect/characterize modern signals in the presence of a heavy conventional signal environment. – Perform laboratory demonstration of ESM capability against impulse radars for Program Manager (PM) Signal Warfare. – Demonstrate the advanced special countermeasures lab prototype in the field.
Total	9429	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602270A Electronic Warfare (EW) Technology / PROJECT: A442

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	8599	9155	9957
Appropriated Value	8599	9155	
Adjustments to Appropriated Value	-194	-283	
FY1999 President's Budget	8405	8872	9429

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 EXHIBIT)

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602270A Electronic Warfare (EW) Technology

PROJECT: A906

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A906 Tactical Electronic Warfare Techniques	6440	7146	6820	7969	8196	8297	8411	Continuing	Continuing

A. Mission Description and Justification: This applied research program involves technologies that provide the capability to intercept, direction find (DF) and locate current and emerging threat communications emitters for targeting, tactical situation awareness, and disruption/destruction of enemy command, control and communications (C3) systems. It specifically develops essential electronic attack (EA) components and techniques for advanced jammers and smaller, lower power, lightweight, common modules for advanced systems to counter communications associated with modern threat C3 systems. In addition, it will provide remote capability to intelligence and electronic warfare common sensor system (IEWCS) with EA algorithms that allow the system to disrupt, deny or destroy threat communication signals. These efforts provide critical technology underpinnings for friendly force ownership of the electromagnetic spectrum. This program also involves fusion (automated assimilation and synthesis) of battlefield intelligence data. It specifically involves development and demonstration of fusion technology to automate manpower intensive command and control information from battlefield sensors, enabling friendly commanders to operate inside of the enemy decision cycle. Resultant enhancements will support joint C3 warfare, by denying threat forces access to their own C3 systems and operating within the decision cycle of threat C3 systems that survive.

FY 1997 Accomplishments:

- 3900 – Completed testing of high frequency (HF) antenna technology and developed terrain and feature servers for information warfare on-the-move .
  – Acquired, analyzed, and exploited modern tactical communications systems to develop strategies and updated IEWCS threat system database.
  – Completed prototype sensor asset management tools and techniques. Tools were demonstrated by 104th Military Intelligence at Task Force XXI
- 2540 – Completed software prototype tools and techniques for airborne asset management capability intended for IEWCS upgrade.
  – Completed prototype of advanced terrain reasoning and generic tools for effectively tasking and receiving multi-intelligence sensor data.
  – Developed advanced communications jamming techniques to be utilized against evolving threat communications systems.

Total 6440

FY 1998 Planned Program:

- 3318 – Develop laboratory exploitation techniques against wideband commercial communication signals used for military purposes.
  – Identify and develop command and control (C2) protect operational capabilities for deployed information systems and components.
  – Demonstrate laboratory exploitation capability against low power advanced communication system.
  – Develop breadboard of a field programmable gate array -based (FPGA) signal analysis/attack control system for potential IEWCS upgrade.
- 3828 – Continue smart agent tools for effectively tasking and receiving multi-intelligence sensor data to support common ground station demonstration.
  – Continue advanced terrain reasoning tools and techniques and development of signal intelligence (SIGINT) correlation, templating and associated terrain reasoning tools to enhance CGS and All Source Analysis System (ASAS).
  – Execute simulation project to assess incorporating information from airborne survivability equipment with conventional SIGINT assets.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A Electronic Warfare (EW) Technology
	PROJECT A906

FY 1998 Planned Program: (continued)

- Begin prediction and assessment tools for electronic attack against modern communications signals.

Total 7146

FY 1999 Planned Program:

- 3390
  - Implement attack algorithms against modern communication and information systems, both military and commercial in a laboratory environment.
  - Demonstrate Electronic Support/Electronic Attack tactics techniques and procedures in controlled RF environment against a core signal set.
  - Develop countermeasure analysis tools focusing on network protection.
- 3430
  - Complete airborne asset management tools and techniques and integrate into IEWCS multi-sensor tasking and reporting tools.
  - Utilize COTS/GOTS software to enhance database storage and retrieval techniques.
  - Continue development of SIGINT correlation, templating and associated terrain reasoning tools to enhance CGS and ASAS.

Total 6820

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/FY1999 President's Budget	6911	7373	8194
Appropriated Value	6911	7373	
Adjustments to Appropriated Value	-471	-227	
FY1999 Presidents Budget	6440	7146	6820

Change Summary Explanation: Funding: FY 1999 funds reprogrammed (-1374) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602270A Electronic Warfare (EW) Technology

PROJECT: A936

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A936 Shortstop	0	2907	0	0	0	0	0	0	2907

A. Mission Description and Budget Item Justification The objective of this Congressional special interest program is to enhance the Shortstop electronic protection system. These funds will be realigned to PE 0604270A, Electronic Warfare Development to more accurately reflect the work being accomplished.

FY 1997 Accomplishments: Program funded in PE 0604270A, project DL18.

FY 1998 Planned Program:

- 100 Continue development of 1553 instrumentation data interface.
- 1000 Develop Low-Profile Rigid Antenna.
- Conduct threat assessment and develop simulation.

600

- Develop countermeasure techniques.

900

- Conduct live fire testing.

234

- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).

73

Total 2907

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/FY1999 President's Budget	0	0	0
Appropriated Value	0	3000	
Adjustments to Appropriated Value	0	-93	
FY1999 Presidents Budget	0	2907	0

Change Summary Explanation: Funding: FY 1998 funds added (+3000) by the Congress for the Shortstop electronic protection system.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602303A Missile Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	28677	24238	25180	28460	26560	27549	26549	Continuing	Continuing
A205 Solid State Dye Lasers	3813	2907	0	0	0	0	0	0	6720
A214 Missile Technology	24864	21331	25180	28460	26560	27549	26549	Continuing	Continuing

Mission Description and Budget Item Justification: This applied research program element is designed to provide the Army with missile, rocket, and unmanned vehicle technology for enhancement of existing assets. Its overall objective is to provide a continental U.S. (CONUS)-based Army with weapon systems enabling immediate world-wide deployment of forces with the capability to initially contain and ultimately achieve decisive victory against hostile forces equipped with modern weapons. The program element is driven by U. S. Army Training and Doctrine Command (TRADOC) Battle Labs and mission area analyses of deficiencies in the areas of close combat, fire support, air defense, intelligence/electronic warfare, and the priorities set forth in the Army Science and Technology Master Plan. The program element is focused on technologies which enhance weapon system deployability, flexibility, lethality, survivability, and affordability. Work within the program is conducted through system simulation, virtual prototyping, concept synthesis, hardware development, and focused technology demonstrations. The work in this program element is consistent with the resource constrained Army Science and Technology Master Plan, the Army Modernization Plan and Project Reliance. Work in this program element is related to and fully coordinated with efforts in PE 0602702E (Tactical Technology), PE 0602602F (Conventional Munitions), PE 0603601F (Conventional Weapons Technology), PE 0601104A (University and Industry Research Centers), PE 0603313A (Missile and Rocket Advanced Technology), PE 0603654A (LOSAT Advanced Concept Technology Demonstration), PE 0602782A (Command, Control and Communications (C3) Technology), PE 0605601A (Army Test Ranges and Facilities) in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. This program element includes non-system specific development efforts focused on specific military needs and therefore is appropriate to Budget Activity 2. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602303A Missile Technology

PROJECT: A205

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A205 Solid State Dye Lasers	3813	2907	0	0	0	0	0	0	6720

A. Mission Description and Justification: Funds for this program were provided by Congress in FY 97 and FY 98. The effort will be completed in FY98 and will require no additional funds. This program leverages technologies developed under PE 0602307A/ Project A139 (Laser Technology). Project A205 provides for the development of dye laser technologies appropriate to future directed energy weapons, battlefield remote sensing, and the transfer of these technologies to medical applications. This project focuses on developing technologies related to the use of directed energy as a weapon against hardened targets, based on the fact that optical and radio frequency components are inherently vulnerable to laser radiation in their operating bands. Solid state dye lasers provide wavelength agile sources for a variety of military anti-sensor applications as well as the wavelength diversity necessary for medical applications. The program's objectives center around development of compact, efficient pulsed devices with wavelength diversity and extended service life. This program is closely coordinated with the other services through the Joint Directors of Laboratories (JDL) Reliance Panel on Conventional Weapons. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM) Redstone Arsenal, AL. Major contractors include Textron Defense Systems (Wilmington , MA) and Physical Sciences Inc (Andover MA).

FY 1997 Accomplishments:

•	1500	- Developed and characterized solid host dye laser materials.
•	1400	- Developed zig-zag laser with objective to demonstrate system operation.
•		- Integrated diffractive optic into zig-zag laser.
•	913	- Evaluated solid host dye laser materials.
•		- Investigated short wavelength dye lasers.
•		- Investigated oscillator/amplifier utilizing solid host dye materials.
Total	3813	

FY 1998 Planned Program:

•	1100	- Develop and characterize advanced solid host dye laser materials.
•	1000	- Adapt zig-zag resonator for use with solid dye laser gain media.
•	734	- Develop and characterize novel dye laser pump sources.
•	73	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	2907	

FY 1999 Planned Program: Project not funded in FY 99.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology
	PROJECT A205

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3916	0	0
Appropriated Value	3916	3000	
Adjustments to Appropriated Value	-103	-93	
FY 1999 President's Budget	3813	2907	0

Change Summary Explanation: Funding: FY 1998 program added by Congress.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602303A Missile Technology

PROJECT: A214

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A214 Missile Technology	24864	21331	25180	28460	26560	27549	26549	Continuing	Continuing

A. Mission Description and Justification: This project is focused on missile and rocket technologies that support high fire power/logistic support weight ratio concepts for the early entry forces. Efforts address concepts that 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. This project encompasses seven major areas: missile guidance systems; air defense target acquisition systems; multi-spectral missile seekers; high fidelity system level simulations; missile aerodynamics and structure; smart, stealthy, smokeless missile propulsion; and focused technology integration/demonstrations. As efforts in these technology areas mature, work is transitioned to PE 0603313A (Missile and Rocket Advanced Technology) to support demonstrations of capabilities for early entry forces in the Rapid Force Projection Initiative (RFPI), Future Missile Technology Integration (FMTI), Low Cost Precision Kill for 2.75 inch rockets, and an advanced light weight hypervelocity missile. Technologies being developed focus on improvements to existing missile systems.

FY 1997 Accomplishments:

- 9628 - Missile guidance systems - demonstrated low cost, low weight/volume guidance and control package for insertion into DoD missile systems; demonstrated software for advanced operating system and developed software reuse approaches.
  - Air defense target acquisition systems - demonstrated advanced integrated air defense fire control target acquisition algorithms and multi-sensor suites; tested active/passive target recognition algorithms in operational scenarios; evaluated automatic target recognition algorithms for integrated missile systems.
  - Multi-spectral missile seekers - demonstrated missile seeker search and hand-off techniques applicable to autonomous target acquisition.
  - High fidelity system level simulations – Completed wideband digital quadrature modulator design and completed conversion of radar environmental models to new configurations; improved millimeter wave multiscatterer radar modeling techniques and developed a model validation technique for infrared signature development.
  - Missile aerodynamics and structure – implemented modeling codes for aerodynamic, structural, warhead fusing, and missile concept evaluation; completed 1st generation active protection systems/counter active protection systems (APS/CAPS) test bed radar, designed and breadboarded 2nd generation jammers, and completed initial model of midterm APS threat.
- 10303 - Smart, stealthy, smokeless missile propulsion - demonstrated and tested advanced propulsion concepts including air turbo rockets, advanced solid propulsion, gel motors, and hybrid concepts.
  - Focused technology integration/demonstrations - executed Multimode Airframe Technology sled test; conducted ground testing of flightweight ducted rocket engine demonstration for Japan Cooperative Program.
- 4933 - Conducted compact kinetic energy missile (CKEM) technology demonstration concept definition, missile subsystem trades, and initial critical demonstrations in propulsion and guidance and control.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology	PROJECT A214

FY 1997 Accomplishments: (continued)

- Demonstrated the ability of novel kinetic energy penetrators to defeat future explosive reactive armor technology anticipated for fielding in the 2010-2015 time frame on advanced threat tanks.

Total 24864

FY 1998 Planned Program:

- 11410 - Missile guidance systems – Complete seeker design for High Quantities Anti-Materiel Submunition (HI-QUAMS) which provides a smaller seeker that will lead to a 5-10x improvement in stowed kills for MLRS/ATACMS when attacking lightly armored, highly-valued targets. Complete sensor requirements for detection, characterization, and/or identification of masked and concealed targets for Army missile cueing. Complete IR polarimetry demonstrations. Develop fly-over-shoot-down imaging tracking algorithms.
  - High fidelity system level simulations - Improve wideband digital quadrature modulator processing speeds to 10 megasamples/sec and implement custom ASIC design capability; establish XPATCH beta site for multiscatterer radar modeling. Extend infrared signature validation tools; design and implement software for the general-purpose IR scene injection 'model board' with realtime 2-dimensional convolution capability
  - Missile aerodynamics and structure – Complete canard/grid fin roll control interaction wind tunnel test, complete elliptical body wind tunnel test, develop CRAFT time-accurate, finite-volume, Navier-Stokes computational fluid dynamics model. Complete preliminary design and evaluate seeker dome for air and missile defense; demonstrate feasibility of composite airframes and structures.
- 9921 - Smart, stealthy, smokeless missile propulsion –Evaluate pintle materials and high exponent propellant, and demonstrate multiple thrust levels; develop and evaluate minimum signatures solid propulsion propellants; develop advanced oxidizer fuel gels for long range, survivable, multi-mission capabilities which reduce assets required.
  - Focused technology integration/demonstrations - Demonstrate a motor and propulsion concept of the compact kinetic energy missile technology. Conduct assessment and analysis of new missile technologies; demonstrate necessary accuracy in Hardware-in-the-Loop simulation for a low cost accurate control package for the 2.75" rocket that will provide reduced cost per kill, minimized collateral damage and greatly increased number of stowed kills over the present fielded system.; complete and evaluate preliminary packaging/dispensing concept design for MLRS Smart Tactical Rocket (MSTAR).

Total 21331

FY 1999 Planned Program:

- 13640 - Missile guidance systems - Complete signature tests for difficult targets and masked helicopters, assess tracker, automatic target recognition, and non-cooperative target recognition on wide spectrum realistic data sets and targets which will develop acquisition technologies for defeating classes of targets which are difficult or impossible to defeat presently. Complete sensor design for a anti-radiation guidance kit to defeat highly mobile air defense radars being rapidly proliferated worldwide.
  - High fidelity system level simulations - Design ASIC circuits for improvements to millimeter wave tapped delay signal generation and extend intermediate frequency processing into the digital domain; extend and validate software for realtime IR scene injection capability via general-purpose Model Board development with specific interface designs; design Ka-band RF/analog front end for the target verification monitor.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602303A Missile Technology / PROJECT: A214

FY 1999 Planned Program (Continued):

- Missile aerodynamics and structure – Evaluate microelectromechanical (MEMS) devices for lift enhancement; upgrade grid fin analytical model, investigate and model turbulent exhaust plume chemistry and solid carbon oxidation; complete final design, prototype fabrication, and ground testing of seeker dome for air and missile defense.

• 11540 - Smart, stealthy, smokeless missile propulsion - Demonstrate high performance, minimum signature solid propulsion, complete actuator and control integration and complete axial pintle component design; develop gel flightweight component - for long range, survivable, multi-mission capabilities which reduce assets required; demonstrate proof of concept of accurate age assessment through non-destructive evaluation to field aged samples for service life extension.

- Focused technology integration/demonstrations – Demonstrate/validate flightweight compact hypervelocity missile technology propulsion concepts; wind tunnel test Low Cost Precision Kill (LCPK) stable airframe; package navigation and turbojet for Tele-Operated Precision Kill and Targeting Missile.

Total 25180

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	25228	22335	24002
Appropriated Value	25228	22335	
Adjustments to Appropriated Value	-364	-1004	
FY 1999 President's Budget	24864	21331	25180

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602308A Modeling and Simulation Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	20107	20339	27981	31552	34427	36600	38580	Continuing	Continuing
AC90 Advanced Distributed Simulation	9053	9664	10078	10682	11036	11221	11455	Continuing	Continuing
AC99 Advanced Concepts & Technology	11054	10675	12453	13870	13391	13379	13125	Continuing	Continuing
A636 Army After Next Applied Research	0	0	5450	7000	10000	12000	14000	Continuing	Continuing

Mission Description and Budget Item Justification: Work in this program element (PE) advances development and use of modeling and simulation, including Advanced Distributed Simulation (ADS), related to Army-specific experiments/demonstrations and industry participation at the U. S. Army Training and Doctrine Command (TRADOC) Battle Labs, Army's Force XXI, and Army After Next experiments. It develops standards, architecture and interfaces essential to realizing the DoD/Army vision of creating a verified, validated and accredited synthetic "electronic battlefield" environment. The electronic battlefield is used to investigate and demonstrate new warfighting concepts including development of tactics, doctrine, training techniques, soldier support, systems and system upgrades. It directs and stimulates advances in those technologies required for real time interactive linking within and among constructive, virtual and live simulation.

Simulation Training and Instrumentation Command (STRICOM) located at Orlando, FL is responsible for Project AC90. Work is performed by the broadest range of the nation's industrial and academic communities. Contractors include: Natural Selection, La Jolla, CA; Acusoft, Orlando, FL; Pathfinder Systems, Lakewood, CO; SAIC, San Diego, CA; University of Central Florida, Institute for Simulation and Training, Orlando, FL; Veda Incorporated, Orlando, FL; Perceptronics, Inc., Woodland Hills, CA; Lockheed Martin, Orlando, FL.

The Army Research Office-Washington, Alexandria, VA is responsible for Project AC99. Work is performed by the broadest range of the nation's industrial and academic communities. Contractors include contractors: Center for Photonics Research, Boston, MA; Chain Reactions, Gold River, CA; FFE International, Alexandria, VA; Harris Corporation, Rochester NY; Hughes, Tucson, AZ; Lockheed Martin, Pomona, CA; Lockheed Martin, Dallas, TX; Lucent Technologies, McLeansville, NC, Boeing, Huntington Beach, CA; McDonnell Douglas, Huntsville, AL; Mobile Datacom, Clarksburg, MD; Monterey Bay, Columbia, MD; Morris Brown College, Atlanta, GA; Mystech Associates, Falls Church, VA; Northrop Grumman, Baltimore, MD; Research Triangle Institute, Research Triangle Park, NC; Rolands & Associates, Monterey, CA; Syracuse Research, Syracuse, NY.

The Army After Next Applied Research project funds early exploration of innovative concepts for the Army After Next (AAN). AAN is the Army's proposed plan to define the character of the Army in the 2025 timeframe. Concepts emerging from the AAN process will provide a basis for defining the future Army capabilities needed to ensure continuing technological overmatch of potential opponents and to address the full spectrum of mission requirements. This project will support early exploratory development of key enabling technologies for the AAN through enhanced industry participation in cost-shared Science and Technology Objectives (STOs) proposed by Army Laboratories and Centers.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A Modeling and Simulation Technology

Future efforts for these program elements (PE) will be performed by a broad range of contractors selected in response to the Broad Agency Announcement (BAA) process. These programs are fully coordinated with the other Army exploratory development programs, Defense Advanced Research Projects Agency (DARPA), Defense Modeling and Simulation Office, TRADOC and DoD Project Reliance agreements on conventional air/surface weaponry, with oversight provided by the Joint Directors of Laboratories. Work in these programs elements are related to and fully coordinated with efforts in PE 0604715A (Non-System Training Devices - Engineering Development). There is no duplication of effort within the Army or Department of Defense.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A Modeling and Simulation Technology PROJECT AC90

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AC90 Advanced Distributed Simulation	9053	9664	10078	10682	11036	11221	11455	Continuing	Continuing

A. Mission Description and Budget Item Justification: This program provides and demonstrates enabling technologies for advancing Distributed Interactive Simulation (DIS) in the synthetic environment and the representation of the battlefield needed to support the use of modeling and simulation as an acquisition tool and training in the era of reduced funding. Efforts in this project support the Battlefield Distributed Simulation-Developmental (BDS-D) program. BDS-D will provide virtual representation of a lethal combined arms environment with the warfighter-in-the-loop that closed-form analysis cannot provide. The environment permits new system concepts, tactics and doctrine and test requirements to be evaluated with a warfighter-in-the-loop in a combined arms battlefield throughout the acquisition life cycle at a reduced cost and time than the traditional approach. The research being conducted includes Semi-Automated Forces (SAF), simulation interface and linkage technologies, and complex data modeling and interchange.

FY 1997 Accomplishments:

- 781 Developed a prototype SAF architecture for assembling primitive behavioral elements into customized tactical behaviors; develop increased capability for spoken language interfaces to SAF through Voice I/O testbed.
- 1800 Demonstrated an initial capability to provide individual combatant mobility and interaction in the synthetic environment.
- 2500 Established an engineering technology (ET) test bed that uses existing virtual simulations and live systems (Bradley Fighting Vehicles) to prototype and assess ET architecture and common components. Conducted experiments and assess approaches to enable "direct-fire" or "line-of-sight" interactions between live and virtual systems. Assessed the ability to use a commercially produced image generator technology to determine the feasibility of displaying virtual targets on ground combat vehicle systems.
- 3972 Developed and enhanced the synthetic environment to support a division-sized battlefield. Develop and evaluate open object-oriented architecture, including methods for model definition and Verification Validation and Accreditation (VV&A) of networked simulations. Continued standards development/testing, expand terrain data base work, and evolve/refine data collection and analysis.

Total 9053

FY 1998 Planned Program:

- 791 Perform experimentation to assess scaleability limitations inherent in current and next generation architectures; expand non-rule based intelligent behavioral capability to take into account capabilities, constraints, and purpose.
- 1300 Provide and demonstrate the capability to fully immerse the live individual combatant in the synthetic environment, to include control of Semi-Automated Forces (SAF) through voice and gesture recognition. Develop an improved dismounted infantry SAF, to include Military Operations in Urban Terrain (MOUT) behaviors.
- 2330 Develop and prototype Embedded Simulation (ES) modular hardware and software common components. Prototype virtual-live interactive system. Link STRICOM ES test bed with TACOM VETRONICS Systems Integration Laboratory (VSIL) and CECOM Digital Integrated Lab (DIL).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A Modeling and Simulation Technology PROJECT AC90

FY 1998 Planned Program: (continued)

•	5000	Develop and enhance the synthetic environment to support a corps-sized battlefield. Develop and evaluate open object-oriented architecture, including methods for model definition and VV&A of networked simulations. Continue standards development/testing, expand terrain data base work, and evolve/refine data collection and analysis.
•	243	Small Business Innovation Research/Small Business Technology Transfer
Total	9664	

FY 1999 Planned Program:

•	849	Demonstrate an initial capability to implement variable fidelity levels in Computer Generated Forces (CGF).
•	2500	Tailor and integrate standard ES components to Future Scout and Cavalry System (FSCS) ATD program. With TRADOC, develop prototype training scenarios and databases.
•	3629	Develop and enhance the synthetic environment to support an Echelon Above Corps (EAC) sized battlefield. Develop and evaluate open object-oriented architecture, including methods for model definition and VV&A of networked simulations.
•	3100	Continue standards development/testing, expand terrain data base work, and evolve/refine data collection and analysis.
Total	10078	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9298	9995	10849
Appropriated Value	9298	9995	
Adjustments to Appropriated Value	-245	-331	
FY 1999 President's Budget	9053	9664	10078

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602308A Modeling and Simulation Technology

PROJECT: AC99

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AC99 Advanced Concepts & Technology	11054	10675	12453	13870	13391	13379	13125	Continuing	Continuing

A. Mission Description and Budget Item Justification: This project supports the Advanced Concepts and Technology (ACT) II Program. ACT II uses a yearly Broad Agency Announcement (BAA) to industry and academia, and provides a low overhead, timely mechanism for the demonstration of mature, commercial off-the-shelf (COTS) technologies, prototypes, software, and /or systems for assessment by the TRADOC Battle Labs. It evaluates new concepts through soldier in the loop, constructive and virtual simulations electronic battlefield demonstrations and field tests, and modeling and simulations in real time. Specific areas of interest include: battlespace management and battlefield synchronization, depth and attack operations, lethality, survivability and mobility; command, control, communications, and computers (to include interoperability); force sustainment; and doctrine and leader development. All projects support and complement the Army computer technical architecture tenets. The Act II goal is to advance a need from concept to demonstration to the soldier in one year.

FY 1997 Accomplishments:

- 11054 Conducted demonstrations and experiments in support of Battle Labs.
  This effort included the following activities:
  (1) Released BAA to solicit Battle Lab related concepts and technologies from the nation's industrial and academic communities.
  (2) Awarded 19 ACT II projects in ten states which will provide high payoff and innovative efforts for demonstration of warfighting capabilities.
  (3) Analyzed and evaluated the results of FY 1996 efforts; identified candidates for streamlined acquisitions or follow-on test and evaluation.
  (4) Program highlights include the 2.75 inch Precision Guided Rocket System (Texas Instruments, Dallas, TX), selected for accelerated acquisition, and Joint Intelligence Fusion (Mystech Associates, Falls Church, VA) which allows for joint intelligence database interoperability between the services.
  (5) Established the Air Maneuver Battle Lab at Ft. Rucker, AL and the Maneuver Support Battle Lab at Ft. Leonard Wood, MO to examine the latest concepts in technology, doctrine, tactics and organization to meet the immediate needs of the soldier.

Total 11054

FY 1998 Planned Program:

- 10407 Conduct demonstrations and experiments in support of Battle Labs.
  This effort includes the following activities:
  (1) Release BAA to solicit Battle Lab related concepts and technologies from the nation's industrial and academic communities.
  (2) Select, within resource constraints, high payoff and innovative efforts for demonstration of warfighting capabilities.
  (3) Analyze and evaluate the results of FY 1997 efforts; identify candidates for streamlined acquisitions.
  (4) Approve BAA topics for new ACT II projects to satisfy future Army and DoD needs not being addressed by existing programs.
- 268 Small Business Innovation Research/Small Business Technology Transfer

Total 10675

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602308A Modeling and Simulation Technology / PROJECT: AC99

FY 1999 Planned Program:

- 12453 Conduct demonstrations and experiments in support of Battle Labs.
- This effort includes the following activities:
  - (1) Release BAA to solicit Battle Lab related concepts and technologies from the nation's industrial and academic communities.
  - (2) Select, within resource constraints, high payoff and innovative efforts for demonstration of warfighting capabilities.
  - (3) Analyze and evaluate the results of FY 1998 efforts; identify candidates for streamlined acquisitions.
  - (4) Approve BAA topics for new ACT II projects to satisfy future Army and DoD needs not being addressed by existing programs.

Total 12453

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	11354	11064	13438
Appropriated Value	11354	11064	
Adjustments to Appropriated Value	-278	-389	
FY 1999 President's Budget	11076	10675	12453

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602308A Modeling and Simulation Technology

PROJECT: A636

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A636 Army After Next Applied Research	0	0	5450	7000	10000	12000	14000	Continuing	Continuing

A. Mission Description and Budget Item Justification: This project funds early exploration of innovative concepts for the Army After Next (AAN). AAN is the Army's proposed plan to define the character of the Army in the 2025 timeframe. Concepts emerging from the AAN process will provide a basis for defining the future Army capabilities needed to ensure continuing technological overmatch of potential opponents and to address the full spectrum of mission requirements. This project will support early exploratory development of key enabling technologies for the AAN through enhanced industry participation in cost-shared Science and Technology Objectives (STOs) proposed by Army Laboratories and Centers. The Labs and Centers will provide matching funds from their mission resources, while this AAN STO Enhancement funding will specifically be employed to support external efforts in industry. In addition to focusing additional resources on critical technologies for the AAN, these STOs will provide a transition path for the products of the 6.1 funded Strategic Research Objectives (SROs), which focus on high payoff research areas relevant to AAN technology thrusts. Fostering the development of key technologies that support a short list of TRADOC-approved enhancements will ensure their availability for application to the battlefield systems to be fielded for the AAN. This project will provide the Army the flexibility to explore emergent technologies for the AAN in a timeframe compatible with delivering mature capabilities as AAN systems are developed. Cost sharing with the Labs and Centers will provide a significant incentive for redirecting their resources toward AAN-related technologies, while increasing their ability to focus industry efforts on these issues. This project will be run similar to the Advanced Concepts and Technology II (ACT II) Program, with multiple efforts aimed at a variety of technologies addressing AAN capabilities requirements.

FY 1997 Accomplishments: Program not funded in FY 1997

FY 1998 Planned Program: Program not funded in FY 1998

FY 1999 Planned Program:

•	5450	Funding employed to match Army Laboratory/Center funding for AAN-focused Science and Technology Objectives to enhance industry participation.
Total	5450	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value			
Adjustments to Appropriated Value			
FY 1999 President's Budget	0	0	5450

Change Summary Explanation: Funding FY99: New project established to focus resources on critical technology enablers for the Army After Next.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

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

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	34272	60162	40107	35403	35639	36689	37617	Continuing	Continuing
DC05 Armor Exploratory Development	4881	6365	6700	6169	6248	6522	6679	Continuing	Continuing
DC83 DC83	828	0	0	0	0	0	0	0	828
DC84 DC84	0	1944	464	0	0	0	0	0	2408
AH39 Voice Instructional Device	2002	2907	0	0	0	0	0	0	4909
AH58 Joint Robotic Dev Prg on Ground Vehicle Surviv	0	4361	0	0	0	0	0	0	4361
AH72 ADAD on Bradley Stinger Fighting Vehicle	0	3877	0	0	0	0	0	0	3877
AH77 Advanced Automotive Technology	10052	19311	17084	17185	17274	17339	17418	Continuing	Continuing
AH82 Non-Ozone Depleting Substance Technology	2941	2351	1354	0	0	0	0	0	6646
AH91 Tank & Automotive Technology	13568	13231	14505	12049	12117	12828	13520	Continuing	Continuing
BH74 Simulation Laboratory	0	5815	0	0	0	0	0	0	5815

Mission Description and Budget Item Justification: This Program Element (PE) advances technologies for affordable and effective ground combat and tactical vehicles. Emphasis is placed on technologies needed for vehicles that are more mobile, affordable, versatile and highly survivable for the post Cold War era. New technologies are needed to achieve more deployable advanced armored vehicles that reflect the Army's need to lighten the force while retaining the ability to survive in diverse, worldwide environments and missions. The majority of the funds in this PE are contained in three projects, AH91, which supports a number of technical thrusts aimed at solving warfighting needs; DC05, which addresses armor technology; and AH77, which funds the National Automotive Center (NAC). The NAC leverages commercial industry's large investment in automotive technology research and development and pursues shared technology programs that are focused on benefiting military ground vehicles. Two NAC managed initiatives with special Congressional interest, Voice Instructional Device and Advanced Materials Technologies & Manufacturing Processes, are also funded in this PE. The NAC manages the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC) Small Business Innovation Research (SBIR) budget and executes selected SBIR. This PE also supports the Department of Defense (DoD) Next generation Fire Suppression Technology Program by evaluating non-

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602601A Combat Vehicle and Automotive Technology**

ozone depleting fire suppressant alternatives to Halon 1301 for combat vehicles. Work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Ground and Sea Vehicle Defense Technology Area Plan (DTAP). The PE is managed by the TARDEC, Warren, MI. This program 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. There is no unnecessary duplication of effort within the Army or DoD. The project is coordinated with the Marine Corps office within the Naval Surface Warfare Center and ground vehicle developers within the Departments of Energy, Commerce and Transportation, and the Defense Advanced Research Projects Agency (DARPA). Projects in this PE include non-system specific technology development efforts directed toward specific military needs, and therefore are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT DC05

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DC05 Armor Exploratory Development	4881	6365	6700	6169	6248	6522	6679	Continuing	Continuing

A. **Mission Description and Justification:** This project lays the technical foundation to solve critical armor deficiencies and improve the survivability of ground combat vehicles against increasingly lethal anti-armor weapons and mines. Supporting the ultimate objective of lighter, more deployable, more survivable vehicles, the emphasis is on armor technologies that will be compatible with current and emerging combat systems (e.g., Abrams, Bradley, Crusader). The project also develops low-burden solutions to the protection of tactical vehicles in war and operations other than war focusing on appliqué armor for small arms and land mine protection. Armors developed under this project have been applied to tactical vehicles, and this type of technology can be directly attributed to saving lives of U.S. Army soldiers in Bosnia. This project develops armor technologies to complement innovative non-armor survivability techniques such as those described in project AH91 in this PE. Within the broader field of armor development, this project focuses technology on problems unique to ground combat systems: protection of combat and tactical vehicles against such threats as kinetic energy projectiles, explosively formed penetrators, chemical energy warheads, and blast and fragments from land mines. This project draws upon products from Army programs (e.g., PE 0602618A (Ballistic Technology) projects AH80 and AH81) as well as innovative armors from industry, facilitating the transfer of armor products from those programs to Army systems applications. In addition to development of specific armor concepts, the project includes supporting work in armor materials, bringing together the collective expertise of the Department of Defense, the Department of Energy, and industrial and academic sources. Supporting work also includes development and refinement of armor performance models to assess armor configurations against different threats with sufficiently high fidelity to make their implementation in vehicles feasible and affordable. Other government agencies include: Jet Propulsion Lab, Pasadena, CA; National Institute of Standards and Technology (NIST), Gaithersburg, MD.

FY 1997 Accomplishments:

•	3471	- Developed second generation protection technology for ballistic and mine protection of medium trucks. - Developed advanced energetic armor technology in armor configurations for medium combat vehicles.
•	1410	- Developed advanced armor configurations compatible with signature management techniques for combat vehicles. - Developed analytical methods for design of ceramic armors with maximum energy dissipation for defeat of kinetic energy (KE) threats. - Developed and validated armor penetration mechanics model enhanced to include effects of energetic armors.
Total	4881	

FY 1998 Planned Program:

•	2173	- Develop hybrid reactive armor concept for light weight future combat vehicle systems. - Demonstrate light weight flank ballistic protective systems for scout class vehicles. - Demonstrate an advanced overhead protection technology integrating threat defeat with combat vehicle requirements for vision systems and vehicle hatches.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT DC05

FY 1998 Planned Program (Continued):

•	1900	- Develop medium caliber kinetic energy (KE) defeat system and structures for protection for medium and heavy class combat vehicles). - Develop improved smart armor KE threat defeat sensor to support technology selection for future combat systems.
•	1100	- Develop and validate analytical methods for design of ceramic armors with maximum energy dissipation for defeat of KE threats. - Validate armor penetration mechanics model augmented to include energetic armor effects to shorten design cycle and reduce test costs.
•	1050	- Conduct component demonstrations on a tactical wheeled vehicle to include advanced mine protection.
•	142	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	6365	

FY 1999 Planned Program:

•	1876	- Develop lightweight alternative non-energetic reactive armor materials for future passive armors in medium and heavy class combat vehicles. - Demonstrate combat vehicle armors incorporating advanced tandem Anti-Tank Guided Missile (ATGM) defeat mechanisms. - Develop novel hypervelocity penetrator defeat mechanism to support future combat systems.
•	1876	- Develop low back pressure air intake/exhaust grille system with medium caliber protection to improve protection of fielded and developmental combat systems. - Validate analytical methods for design of ceramic armor design through use of analytical design models. - Demonstrate 25% reduction in typical test cost for armor design through use of analytical design models.
•	2948	- Develop integrated smart armor sensor package for KE threat defeat and demonstrate frontal armor system with 35% weight savings over baseline system. - Complete and test survivability appliqués for tactical vehicles.
Total	6700	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5853	6572	7148
Appropriated Value	5982	6572	
Adjustments to Appropriated Value	-1101	-207	
FY 1999 President's Budget	4881	6365	6700

Change Summary Explanation: Program adjustment of -1101 in FY97 to higher priority Army programs.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602601A Combat Vehicle and Automotive Technology / PROJECT: AH39

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH39 Voice Instructional Device	2002	2907	0	0	0	0	0	0	4909

A. Mission Description and Justification: This Congressionally directed program is managed by the National Automotive Center and funds the design, development and testing of a Voice Instructional Device (VID) for use with fuel tankers, the Palletized Loading System and M1022A1 Dolly Wheeled Hydraulic System. The VID provides audible instructions to its operator, for diagnostics and maintenance. VID is an audio device that can be used by maintenance personnel to perform inspection or repair procedures. This program will be completed in FY98, therefore, the Army has not budgeted any funding beyond FY98.

FY 1997 Accomplishments:

•	2002	- Conducted a technology analysis and completed a technical plan to demonstrate feasibility of utilizing voice pattern recognition technology.
		- Designed, developed and demonstrated prototype of voice pattern recognition diagnostic computer to be completed in FY1998.
Total	2002	

FY 1998 Planned Program:

•	2834	- Follow-up the FY 97-funded concept validation effort with updated prototype VID sets and selected field demonstrations.
•	73	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	2907	

FY 1999 Planned Program: Project not funded in FY99

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2056	0	0
Appropriated Value	2100	3000	
Adjustments to Appropriated Value	-98	-93	
FY 1999 President's Budget	2002	2907	0

Change Summary Explanation: Funding: FY1998 – Project is Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

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

PROJECT: AH58

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH58 Joint Robotic Dev Prg on Ground Vehicle Surviv	0	4361	0	0	0	0	0	0	4361

A. Mission Description and Budget Item Justification This project develops and demonstrates Non-Developmental Item (NDI) components for robotic and semi-robotic military vehicles which are not specific to any single system. High priority NDI components are (1) "smart" running gear (e.g., integral in-hub electric drive, tire inflation control, active shock absorption, etc., and sensors for motor torque, wheel velocity, etc.),and (2) semi-autonomous navigation (e.g., machine perception hardware and software for terrain characterization, obstacle detection and crossing or avoidance, path selection, and remote operator interface). The NDI components will be scaleable for multi-wheeled vehicles (4, 6 or 8 wheel configurations) up to 15,000 lb. These components are for use in lightweight advanced vehicle projects, specifically the Army Research Laboratory DEMO III program, the DARPA Tactical Mobile Robots program, the DARPA/Marine Reconnaissance, Surveillance and Target Acquisition Vehicle (RST-V), and Army After Next vehicles. This project integrates vehicle survivability, mobility, intra-vehicular digital electronics, and integration of diverse vehicle technologies developed by the Army, other DoD laboratories and industry. The project initially focuses on two critical areas of deficient performance in robotic & semi-robotic vehicles: mobility and navigation. Improved survivability is a natural by-product of removing the crew from the vehicle (crew survivability) which greatly removes the need for armor, and reduces vehicle size to present a smaller target. Work on this project is consistent with and fills a gap in the Joint Service Unmanned Ground Vehicle Master Plan. The project will develop a Systems Integration Laboratory (SIL) to assess the compatibility of robotic/semi-autonomous vehicle locomotion and navigation sub-systems, to assess net vehicle performance, to design interfaces, and to optimize/harmonize the performance and characteristics of the subsystems. This is a one year effort , therefore, the Army has not budgeted any outyear funding.

FY 1997 Accomplishments: Project not funded in FY 97.

FY 1998 Planned Program:

•	2231	- Develop a modular "smart" running gear as an NDI component and demonstrate smart running gear unit scaled for a 2,500 lb. Vehicle.
•		- Test and evaluate multiwheel central command , control and coordination.
•		- Optimize modular electric motor power, size and efficiency.
•		- Develop alternative power efficient distribution systems.
•	2021	- Final demonstration and simulation of full scale components.
•		- Design a Systems Integration Laboratory (SIL) architecture.
•		- Develop instrumentation for a reconfigureable remote vehicle operator station for modular robotic technology platforms.
•		- Support Demo III technology.
•	109	- Small Business Innovative Research/Small Business Technology Transfer Program
Total	4361	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH58

FY 1999 Planned Program: Project not funded in FY 99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value	0	4500	
Adjustments to Appropriated Value		-139	
FY 1999 President's Budget	0	4361	0

Change Summary Explanation: Funding: FY1998 – Project is Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

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

PROJECT: AH72

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH72 ADAD on Bradley Stinger Fighting Vehicle	0	3877	0	0	0	0	0	0	3877

A. Mission Description and Budget Item Justification: This Congressional directive adds funding for investigation into and demonstration of one or more air defense alerting devices applicable to Bradley Stinger air defense vehicles, Avenger, Linebacker and LAV-AD.

Acquisition Strategy: Through a competitive BAA (Broad Agency Announcement), near term solutions will be solicited for passive alert devices applicable to vehicular mounted Stinger air defense systems. Performance modeling will be accomplished by the Government to assess absolute and relative performance between candidates. Laboratory and field testing by the Government, supported by the contractor, will be accomplished with possible culminating exercises at Roving Sands 99 user trials. This is a one year effort , therefore, the Army has not budgeted any outyear funding.

FY 1997 Accomplishments: Project not funded in FY 97.

FY 1998 Planned Program:

•	2000	- Contract awards for Air Defense Alerting Device (ADAD) systems.
•	890	- Government analysis and laboratory testing, management support.
•	889	- Field testing at Government range.
•	98	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	3877	

FY 1999 Planned Program: Project not funded in FY 99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value	0	4000	
Adjustments to Appropriated Value		-123	
FY 1999 President's Budget	0	3877	0

Change Summary Explanation: Funding: FY1998 – Project is Congressional add.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH77

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH77 Advanced Automotive Technology	10052	19311	17084	17185	17274	17339	17418	Continuing	Continuing

A. **Mission Description and Justification:** This project funds the National Automotive Center (NAC), which leverages commercial industry's large investment in automotive technology research and development and initiates shared technology programs that are focused on benefiting military ground vehicle systems. The NAC, located at the Tank-Automotive and Armaments Command (TACOM), is part of the Tank-Automotive Research, Development and Engineering Center (TARDEC). The NAC serves as the catalyst linking industry, academia and government agencies for the development and exchange of automotive technologies. The NAC executes collaborative research and development (R&D) contracts, cooperative agreements, and other initiatives to leverage commercial industry's investment in well-defined, high return-on-investment areas tied to key Army science and technology objectives for advanced land combat. The NAC focuses collaborative R&D contracts on key military automotive technology thrust areas to include: mobility, electronics, propulsion, logistics, safety and environmental protection with the goal of (a) improving the performance and endurance of ground vehicle fleets, and (b) reducing ground vehicle design, manufacturing, production, and operating and support costs. Two-way industry/government technology transfer is pursued under Cooperative Research and Development Agreements (CRADAs). The NAC also leverages DoD Dual-Use Application Program (DUAP) resources. The activities of the NAC are supported by other government agencies via a linkage created under Memoranda of Agreement, and oversight is provided by a Senior Advisory Board which includes representation from appropriate program executive offices and program managers, the User, the Army staff, the U.S. Marine Corps and OSD. These linkages permit the NAC to consolidate the collective expertise of federal government departments such as Energy, Transportation and Commerce and other DoD agencies. The NAC performs basic research in PE 0601104A, project BH73 (NAC) in addition to two other efforts funded in this PE, VID (Project AH39) and Advanced Materials Technologies & Manufacturing Processes (Project AH91). The NAC also manages the TARDEC Small Business Innovation Research (SBIR) budget, and executes selected SBIR projects. The Army has agreed to support the NAC at approximately $17M per year and is in the process of a below threshold reprogramming to bring the FY98 core program up to $16.4M . This reprogramming is not reflected in the FY98 program shown below. The outyear funding has been adjusted to this amount. Major contractors include: Environmental Institute of Michigan, Ann Arbor, MI; Science Applications International Corporation, Warren, MI; Radian Inc., Alexandria, VA; Picotronix, Ann Arbor, MI; University of Michigan, Ann Arbor, MI; VSE, Alexandria, VA; Oakland University, Rochester, MI; TASC, Reading, MA; Ford, Dearborn, MI; Chrysler, Auburn Heights, MI; General Motors, Warren, MI (Cooperative Agreement); Optimetrics, Ann Arbor, MI; Wayne State University, Detroit, MI; Pinnacle Research, Los Gatos, CA; Southwest Research, San Antonio, TX; Failure Analysis, Redmond, WA; Barrnes & Reinicke, Troy, MI; ICRC Energy, Oakton, VA; University of Alaska, Fairbanks, AK; Cummins, Columbus, ID, VSE Corp., Alexandria, VA; University of Texas, Austin, TX; General Dynamics Land Systems, Sterling Heights, MI; Baum, Romstedt Technology Research Corp. (BRTRC Inc.), Fairfax, VA.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH77

FY 1997 Accomplishments:

- 3711 - Designed and developed advanced commercial automotive technologies for military ground vehicles. Technologies include: Adaptive cruise control; Anti-lock braking; active suspension; protective coatings; composite trailer decking; virtual product development enhancements; Driver/vehicle interface; Micro-auxiliary power units; Integrated seat design; Tire monitoring; Ceramic coatings for engine components; Air filtration; Ultrasonic array; Nickel metal hydride battery; and Thin film thermal coatings. Work will improve vehicle safety, performance, fuel efficiency, and provide an operations and support (O&S) cost reduction.
- 3791 - Integrated Society of Automotive Engineers (SAE) 1939 databus with powertrain electronic controls, added exhaust braking, drive-by-wire, Infrared (IR) night vision, and a smart dash to improve inter-system communication and demonstrate new technologies on military 5 ton truck.
  - Completed engine selection and design activities for advancing state-of-the-art technology of high output diesel engines. Work is directed toward improvement of military propulsion systems.
  - Completed preliminary design and development of portable blend/filtration system for waste engine oil reutilization for military ground vehicles. Waste engine oil is an environmental issue.
- 2550 - Preliminary design completed for metal matrix composite double pin track, missile seeker support structure and diesel pistons.
  - Constructed a base-line automotive product development framework to support simulation-based acquisition of military systems.

Total 10052

FY 1998 Planned Program:

- 6013 - Develop and demonstrate advanced commercial automotive technologies to include: Adaptive cruise control; Anti-lock braking; active suspension; protective coatings; composite trailer decking; virtual product development enhancements; Driver/vehicle interface; Micro-auxiliary power units; Integrated seat design; Tire monitoring; and ceramic coatings for engine components. This work will improve military vehicle safety, performance, fuel efficiency, and provide an operations and support (O&S) cost reduction.
- - Provide $2M in FY98 funds in the Metal Matrix Composites program to match the $2M in funding provided in Title III funding
- 2885 - Design and develop automotive technologies under Dual-Use Application Program (DUAP). Planned projects include: Next-generation light truck; Smart diagnostics and repair; Heavy truck powerpack enhancements; Active braking; Low-cost infrared imaging sensors; Fuel-fired heating, ventilation, air conditioning; Advanced fuel injection; Recycled polymer & synthetic component materials processing; Alloy engine mono-block; Lightweight diesel engine; Optimized motor and controller; Soft-switching inverters; Enhanced crash protection. . This work will improve military vehicle safety, performance, fuel efficiency, and provide an operations and support (O&S) cost reduction.
- 1000 - Congressional directed add to complete effort to increase rated horsepower of a MACK E9 diesel engine by 50%, from 500 HP to 750 HP, while controlling emissions. After completion, integrate the engine into a Pallitized Loading System (PLS) truck for in vehicle demonstrations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH77

FY 1998 Planned Program (Continued):

•	4000	- Congressional directed add to investigate integration of advanced commercial technologies into the remanufacture of the 6.2 liter HMMWV diesel engine to reduce dependence on obsolete commercial components, increase use of off-the-shelf current state-of-the-art commercial parts and technologies to improve fuel economy, noise reduction and exhaust emissions.
•	2500	Congressional directed add for a Government/University effort to assess and develop promising alternative vehicle propulsion technologies such as natural gas, fuel cell power sources, electric drive systems and other propulsion technologies for Military applications.
•	1133	- Complete preliminary demonstration of state-of-the-art high output military vehicle diesel engine technologies that will improve fuel efficiency and performance. - Demonstrate a portable blend/filtration system for waste engine oil reutilization for military ground vehicles. Waste engine oil is an environmental issue. - Integrate and demonstrate flat panel display, navigation system, and interactive diagnostic computer into smart truck demonstrator.
•	1322	- Integrate and demonstrate flat panel display, navigation system, and interactive diagnostic computer into "smart truck" demonstrator. This work will improve the crew's operation and maintenance performance. - Complete planning for the integration of key advanced commercial automotive technologies (engine, brakes, air conditioning, diagnostics, crash protection) into the light and heavy wheeled vehicle demonstrators. This work will improve military vehicle performance, safety, and readiness.
•	458	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	19311	

FY 1999 Planned Program:

•	13084	- Develop and demonstrate automotive technologies under the Dual-Use Application Program (DUAP) Technologies include: Next-generation light truck; Smart diagnostics and repair; Heavy truck powerpack enhancements; Active braking; Low-cost infrared imaging sensors; Fuel-fired heating, ventilation, air conditioning; Advanced fuel injection; Recycled polymer & synthetic component materials processing; Alloy engine mono-block; Lightweight diesel engine; Optimized motor and controller; Soft-switching inverters; Enhanced crash protection. New technology efforts will concentrate on fuel efficiency, powerpack performance enhancements, hybrid propulsion, intelligent transportation, robotics, diagnostics/prognostics, advanced lightweight materials and vehicle mobility enhancements. This work will improve military vehicle safety, performance, fuel efficiency, and provide an operations and support (O&S) cost reduction.
•	4000	- Integrate key commercial automotive technologies (engine, brakes, air conditioning, diagnostics, crash protection) into the light and heavy wheeled demonstrators and engine, armor, air conditioning, diagnostics technologies into the tracked vehicle demonstrator. This work will improve military vehicle performance, safety, and readiness. - Integrate commercial computer aided design (CAD) components within the automotive based product development software framework (APDF) APDF is designed to support Simulation-Based Acquisition of military systems.
Total	17084	

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

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

PROJECT: AH77

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	10318	8440	8445
Appropriated Value	10318	19940	
Adjustments to Appropriated Value	-266	-629	
FY 1999 President's Budget	10052	19311	17084

Change Summary Explanation: Funding: FY1998 – Increase represents several Congressional adds.
FY1999 – Funding increased to maintain stable funding for the NAC.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

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

PROJECT: AH82

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH82 Non-Ozone Depleting Substance Technology	2941	2351	1354	0	0	0	0	0	6646

A. **Mission Description and Justification:** This project demonstrates environmentally and toxicologically acceptable replacements for Halon 1301 in fire suppression systems in crew occupied compartments of ground combat vehicles. Due to the ozone depleting potential of Halon 1301, the Clean Air Act of 1990 and DoD Directive 6050.9 require that alternate extinguishing agents be identified to maintain current crew and vehicle survivability and supportability. Testing will be performed to meet Tier 1-3 Army Surgeon General and Environmental Protection Agency requirements. Funds in this project identify and evaluate non-ozone depleting substances for application to military vehicles. Investments to date have been successful in identifying two agents suitable for ground vehicle engine compartments. Work continues to find a suitable agent for crew compartments. This project also supports Army activities under the DoD Next Generation Fire Suppression Technology Program to identify materials more suitable than currently available alternatives for vehicle crew compartments. Alternative agents are purchased from DuPont Inc., Deepwater, NJ and Great Lakes Chemical, Lafayette, IN.

FY 1997 Accomplishments:

•	2941	- Conducted performance testing on alternative agents, FM-200 and FE-13.
		- Completed tier 2 (longer term (14-90 Day) multiple exposure) subchronic toxicity studies of alternative agents.
		- Conducted tier 3 (long term (1 year) multiple exposure) chronic toxicity studies, as required, based on tier 2 results.
Total	2941	

FY 1998 Planned Program:

•	872	- Continue performance testing of additional alternative agents.
•	900	- Participate in DoD Next Generation Fire Suppression Technology Program
•	520	- Continue tier 3 (long term; up to three years, multiple exposure) chronic toxicology studies, as required.
		- Develop system design guidelines for alternative agents.
		- As a result of preliminary tier 2 studies, conduct toxicology studies of break-down products in alternate agents.
•	59	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	2351	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH82

FY 1999 Planned Program:

•	1000	- Continue support of DoD Next Generation Fire Suppression Technology Program.
•	354	- Complete system design guidelines.
		- Complete long-term toxicology studies.
		- Complete breakdown product studies.
Total	1354	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3025	2426	1354
Appropriated Value	3090	2426	
Adjustments to Appropriated Value	-149	-75	
FY 1999 President's Budget	2941	2351	1354

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

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

PROJECT: AH91

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH91 Tank & Automotive Technology	13568	13231	14505	12049	12117	12828	13520	Continuing	Continuing

A. Mission Description and Justification: This project provides innovative vehicle concepts and component technologies leading to product improvements to fielded equipment and to the development of advanced systems that will enable the Army to maintain superiority to fight and survive against diverse threats. Conceptual designs, virtual prototyping, and performance analyses and battlefield wargaming of ground vehicle systems identify promising emerging technologies in support of approved and emerging U.S. Army Training and Doctrine Command (TRADOC) requirements. They also quantify benefits, burdens and trade-offs related to ground vehicle applications. The project includes eight areas: (1) vehicle concepts such as the Future Scout and Cavalry System (FSCS), the Future Combat System (FCS), the Future Infantry Vehicle (FIV), and Army After Next (AAN) systems; (2) mobility; (3) integrated survivability; (4) vehicle electronics (VETRONICS) and digitization; (5) advanced vehicle structures; (6) simulation/analysis (7) military fuels and lubricants; and (8) water purification technology. Technology initiatives are being pursued to address advanced mobility, survivability and lethality requirements of lighter, digitized, more deployable vehicles. Activities are closely coordinated through the Army Training and Doctrine Command's Mounted and Dismounted Battlespace Battle Labs; Program Executive Office for Ground Combat and Support Systems; and the Army Research Laboratory (ARL). This coordination increases opportunities for transition of ARL corporate research into ground vehicles. Tank and automotive virtual prototyping provides seamless sharing of databases/engineering models, allowing more rapid and efficient integration, assessment and transfer of DoD and commercial vehicle technologies. Vehicle electronics will be based on adapting commercial electronic standards and architectures for combat vehicle battlefield unique requirements. The survivability technologies, which include non-armor approaches such as signature reduction, countermeasures, and damage reduction, complement, but do not duplicate, work performed under the armor exploratory development project (DC05) in this PE. For FY 1997-1998 only, it funds a Congressional special interest initiative among the NAC and Focus: HOPE to investigate advance materials manufacturing processes development to modify or retrofit diesel engine components for application to ground vehicles. Other government agencies include: Defense Advanced Research Projects Agency, Arlington, VA; Oakridge National Laboratory, Oakridge, TN; Red River Army Depot, Texarkana, TX. Major contractors include: Cadillac Gage Textron, New Orleans LA; Soucy International, Drummondville, Quebec; Pentastar Huntsville, AL; Michigan Technological University, Houghton MI; United Defense Limited Partnership, San Jose, CA; University of Texas, Arlington TX; Oakland University, Rochester Hills, MI; Gonzales Engineering, Troy, MI; Boeing Corporation, St. Louis, MO; University of Dayton Research Center, Dayton, OH; Monterey Technologies Inc., Monterey, CA; DCS Corp, Alexandria, VA.; Texas Instruments, Dallas, TX; Southwest Research Institute, San Antonio, TX; Separation Systems Inc., San Diego, CA, Scientific Systems, Boston, MA; University of California, Berkley, CA.

FY 1997 Accomplishments:

- 3233 - Developed preliminary Future Combat System (FCS), Future Infantry Vehicle (FIV) and Army After Next (AAN) concepts and analysis in support of TRADOC Integrated Concept Teams (ICTs); provided concepts and analysis leading to a FIV Mission Need Statement; developed Future Sout and Cavalry System (FSCS) concepts to focus system requirements, technology goals and provide basis for cost-effectiveness analysis.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH91

FY 1997 Accomplishments: (continued)

- Completed detailed design of baseline virtual prototyping architecture; demonstrated system/component level configuration management enabling distributed/concurrent ground vehicle technology development; demonstrated remote access of DoD virtual prototype models at selected locations; implemented Janus model at TARDEC to perform operational effectiveness analysis. Completed Virtual Proving Ground demo with TECOM-ATC.

• 3614 - Conducted North Atlantic Treaty Organization mobility modeling of Future Scout Cavalry System mobility requirements.

- Developed active suspension algorithms using preview sensor data; developed band track for increased road wheel unit loading; demonstrated electric suspension in the laboratory for hybrid electric High Mobility Multipurpose Wheeled Vehicle.
- Defined concept future combat system engine for heavy combat vehicle application; completed cycle simulation studies on high power density diesel concept.
- Completed correlation program of chromatographic analytical procedure(s) for predicting fuel performance properties from compositional measurements; developed software package for data integration and transition chromatographic analytical procedure(s) and model to petroleum quality analysis system; completed literature/market survey on energy enhancement technologies for ground fuel applications; completed laboratory characterization of experimental additives and blending ingredients.
- Optimized operating property requirements of selected water purification technologies and conducted bench scale analysis of leading candidates which will meet or exceed the performance of reverse osmosis membranes.

• 4747 - Developed two retrofittable wide angle optical viewing system concepts incorporating agile laser protection; completed concept development using holographic diffuser.

- An initial survivability evaluation was performed using optimization tools to assess the benefits of reduced signature for a scout class vehicle; completed testing of integrated low observable (LO) and ballistic skirts; designed and fabricated an integrated LO and ballistic laser warning receiver concept.
- Developed electronic architecture models for ground vehicle domain.

• 1974 - Completed initial design activities for an advanced materials manufacturing process development to modify/retrofit diesel engine components for application to ground combat vehicles, through the NAC via a collaborative automotive technology contract with Focus: HOPE.

Total 13568

FY 1998 Planned Program:

• 4725 - Develop vehicle concepts and perform technology survey and assessment in support of the Future Infantry Vehicle (FIV) ICT and Army After Next (AAN).

- Perform subsystem integration assessments for advanced technology for the Future Combat System (FCS) and develop refined concepts based on emerging AAN requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH91

FY 1998 Planned Program (Continued):

- Conduct an evaluation and refinement of the virtual prototyping architecture, verifying the ability to reduce development time, cost and testing requirements when used in place of traditional development methods. Initiate immersive ergonomic interactive solid models with rapid feedback in multiple databases.

•	4692	- Integrate roll control to semiactive suspension for a scout class vehicle to increase vehicle speed, and platform stability. - Test band track system at increased roadwheel unit loading; develop band track components (drive & tensioner system) for scout vehicle applications in the 30 ton weight class and investigate mine resistant track technology. - Complete contracted study to define technology for heavy combat vehicle diesel engine and propulsion system and propose methods for propulsion system volume reduction; complete single cylinder high temperature head material tests; complete multi-cylinder high temperature synthetic lubricant test; complete single cylinder ceramic coated piston test. - Evaluate Silicon Carbide switches for ground vehicle application. - Complete demonstration of an innovative water purification technology to improve flow rate, shelf life, increased temperature and pH range and chlorine tolerance.
•	3250	- Define optimum survivability suite for scout class vehicle. - Continue development of agile laser protected wide angle vision system by demonstrating the feasibility of a fiber bundle periscope, completing optical system design using holographic diffuser, and performing laboratory analysis of laser limiting materials provided by U.S. Army Natick Research, Development and Engineering Center. - Demonstrate and validate 3D audio and voice recognition into FSCS crew station. - Test integrated signature ballistic air intake grille system and integrated LO and ballistic skirts; develop warning receiver component designs with reduced signature.
•	526	- Complete the NAC managed Focus: HOPE advance material manufacturing process effort; demonstrate design and development of the machine cell required to support production of diesel engine components for Army ground vehicles.
•	38	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	13231	

FY 1999 Planned Program:

•	5245	- Perform detailed concept studies, tech assessments and analysis for the Future Infantry Vehicle (FIV) in support of the development of the FIV Operational Requirements Document and in preparation of the FIV technology demonstrator. - Perform technology assessments and subsystem integration studies for the Future Combat System and AAN alternatives such as Assault, Fire Support, and robotic versions.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH91

FY 1999 Planned Program (Continued):

- Complete evaluation and refinement of the virtual prototyping architecture and immersive environments technology, verifying the ability to reduce development time, cost and testing requirements when used in place of traditional development methods.

•	5809	- Develop electric actuator for active suspension units for heavy all electric combat vehicle; evaluate semiactive suspension for improved ride and platform stability for heavy combat vehicle class; develop increased durability nitrile rubber track and mine resistant track technology. Conduct multi-cylinder engine dynamometer endurance testing on candidate energy enhancement materials; conduct engine emissions testing on candidate energy enhancement materials; conduct engine-fuel-lubricant compatibility evaluations with candidate energy enhancement materials. - Leveraging with international cooperative research and development funds, design and fabricate high power density single cylinder technology screening engine.
•	3451	- Demonstrate retrofittable wide angle optical viewing system design which can incorporate laser limiting materials. - Demonstrate integrated signature-ballistic side armor system for light and medium weight future vehicle systems with detectability and areal density reductions that would be applicable to the FSCS ATD. - Demonstrate voice recognition and 3D audio in mobile crew station testbed, and demonstrate off road driving using indirect vision at 50% direct vision rate.
Total	14505	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	13059	13667	14403
Appropriated Value	13384	13667	
Adjustments to Appropriated Value	+184	-436	
FY 1999 President's Budget	13568	13231	14505

Change Summary Explanation: Program adjustment of -1493 in FY98 and -1770 in FY99 to higher priority Army programs.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

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

PROJECT: BH74

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH74 Simulation Laboratory	0	5815	0	0	0	0	0	0	5815

A. Mission Description and Budget Item Justification: This Congressional directive adds funding for the completion of a modernization program of the Physical Simulation Laboratory at the U.S. Army Tank-Automotive Research, Development and Engineering Center. This effort integrates the virtual proving ground into the laboratory environment for engineering development and Synthetic Theater of War (STOW) exercises. This capability will enable motion bases to be networked to the simulation community, allowing high fidelity interactive experiments for the evaluation of engineering related issues and soldier/machine interfaces. Other elements of the work effort will result in (1) upgrading hydraulic power supply and its cooling loop (cooling tower) which are necessary to provide the required oil pressure and flow to the motion bases, (2) improvements to existing tactical vehicle durability simulators, and (3) a military vehicle mass and inertia measurement device. This final effort will result in improved hardware/soldier-in-the-loop simulation using motion bases, an upgraded and more reliable hydraulic power supply, and more accurate tactical vehicle dynamics models. This is a one year effort , therefore, the Army has not budgeted any outyear funding.

FY 1997 Planned Program: Project not funded in FY97.

FY 1998 Planned Program:

•	5669	- Install and integrate real-time motion base simulation technology.
		- Conduct demonstrations of weapon and soldier in the loop simulations.
	146	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	5815	

FY 1999 Planned Program: Project not funded in FY99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value	0	6000	
Adjustments to Appropriated Value		-185	
FY 1999 President's Budget	0	5815	0

Change Summary Explanation: Funding: FY1998 – Project is Congressional add.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602618A Ballistics Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	39248	40042	31115	34900	38352	39263	40592	Continuing	Continuing
AH37 Liquid Propellant Technology	7149	3877	0	0	0	0	0	0	11026
AH75 Electric Gun Technology	7632	11660	7640	9000	9000	9000	7239	Continuing	Continuing
AH80 Ballistics Technology	20173	20350	22167	23067	26169	26957	29957	Continuing	Continuing
AH81 Armor/Anti-Armor Technology	4294	4155	1308	2833	3183	3306	3396	0	Continuing

Mission Description and Budget Item Justification: This program element (PE) provides ballistic technologies required for armaments and armor to allow US dominance in future conflicts across a full spectrum of threats in a global context. Project AH37 is directed toward solving remaining technology challenges identified under previous attempts to weaponize liquid propellant (LP) technology. It capitalizes on the large Army investment in LP technology. Project AH75 focuses on pulsed power 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 and electrothermal chemical (ETC) technology that will greatly increase anti-armor capabilities. Project AH80 is focused on applied research in ballistics technology to enhance the lethality and survivability of future weapons. Focus areas included advanced solid propellants, launch and flight dynamics, weapons concepts for light forces, warheads and projectiles, armor and munition-target interactions. Project AH81 taps the innovation of industry and pursues the most promising and affordable approaches to developing armor/anti-armor technologies. Work in this program element has been coordinated with the other military services through the Weapons Technology Area Plan to prevent duplication of effort and to maximize the return on investment. One result of this process is the Army's leveraging of Navy and Defense Special Weapons Agency investments for ETC technology demonstrations. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602618A Ballistics Technology

PROJECT: AH37

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH37 Liquid Propellant Technology	7149	3877	0	0	0	0	0	0	11026

A. Mission Description and Justification: This project focuses on maturation of liquid propellant (LP) technology with the intent to evaluate LP as a means of achieving increased lethality and/or survivability for future weapons systems applications. Technology challenges including pressure oscillations, material compatibility, and reliability/durability of the propellant in a battlefield environment will be addressed and advantages of an LP weapon will be explored. The LP technology program is managed by the Army Research Laboratory - Aberdeen Proving Ground, MD with contractual efforts at General Dynamics Defense Systems (GDDS) - Pittsfield, MA and Burlington, VT; Wright-Malta Corp. - Malta, NY; Princeton Combustion Research Laboratory - Monmouth Junction, NJ; Institute for Defense Analysis (IDA) - Alexandria, VA; and Penn State University - University Park, PA.

FY 1997 Accomplishments:

•	7149	- Developed techniques for pressure oscillations mitigation and verified experimentally in large caliber LP gun.
		- Developed promising additive packages (chelating agents) for hydroxyl ammonium nitrate (HAN)-based LPs to improve material compatibility
		- Identified higher energy HAN-based propellant with potential for increasing muzzle energy of an LP gun.
		- Completed initial design and testing of a small caliber, high performance LP gun using improved ballistic models.
Total	7149	

FY 1998 Planned Program:

•	3779	- Identify and test concepts for reliable ignition of liquid propellant.
		- Complete material compatibility testing for specific gun hardware.
		- Perform small caliber liquid propellant gun firings to establish design of a high performance, regenerative liquid propellant gun.
		- Evaluate Army user needs, technology pay-off for liquid propellant guns, and identify windows of opportunity.
•	98	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	3877	

FY 1999 Planned Program: Project not funded in FY 1999

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602618A Ballistics Technology	PROJECT: AH37

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7343	0	0
Appropriated Value	7343	4000	
Adjustments to Appropriated Value	-194	-123	
FY 1999 President's Budget	7149	3877	0

Change Summary Explanation: Funding: 1998 funds (+4000) added by Congress to complete maturation of liquid propellant technology.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602618A Ballistics Technology

PROJECT: AH75

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH75 Electric Gun Technology	7632	11660	7640	9000	9000	9000	7239	Continuing	Continuing

A. Mission Description and Justification: This project provides oversight and accountability for the Army electric armaments technology program, which is managed by the Army Research Laboratory at Aberdeen Proving Ground, MD. Future armored combat vehicles will require more lethal, yet compact main armament systems capable of defeating protection levels greatly in excess of currently experienced values. Electric armaments offer the potential to field a leap-ahead capability by providing hypervelocity and/or hyperenergy launch greatly above the ability of the conventional cannon. Electric 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 challenges associated with developing electric armaments primarily for application in direct-fire ground vehicles, in particular with developing pulse power for electromagnetic (EM) launch and advanced propellant performance for electrothermal chemical (ETC) weapon systems. Once these challenges are overcome, electric guns will be considered candidates for main armament systems on future combat vehicles. This project funds a contractual effort to develop an efficient pulsed power system for electromagnetic (EM) launch. The goal is to demonstrate pulse power technology (rotating machines) with energy density of three Joules per gram (J/g) and to identify a clear potential for growth to ten J/g. Efforts in EM pulsed power systems are conducted by SAIC - Minneapolis, MN; CEM - Austin, TX; CAES - Cumberland, MD; and R-Cubed - Salt Lake City, UT. In addition, this project supports the development of electrothermal chemical (ETC) technology which is a joint effort with the Defense Special Weapons Agency (DSWA) with contractual efforts by SAIC - San Diego, CA; UDLP - Minneapolis, MN; Thiokol - Northeast, MD; and Olin - St. Marks, FL. The goal of the ETC effort is to demonstrate 140mm lethality from a 120mm cannon.

FY 1997 Accomplishments:

- 7632 - Completed fabrication and assembly of subscale composite rotating machine (compulsator); initiated a series of performance tests to validate fabrication technology and machine design; successfully demonstrated performance as predicted to rotational speeds of 7000 revolutions per minute (rpm) on the way to 12,000 rpm full speed goal, corresponding to an energy density of a 1 Joule/gram (J/g) class pulse power machine.
  - Initiated design concepts for a next generation machine (the Exit Criteria Machine or ECM) which will demonstrate ability to achieve 3 J/g energy density.
  - Completed subscale and full scale testing of several ETC-ignition and propulsion concepts; successfully demonstrated improvements in precision ignition control and repeatability.

Total 7632

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602618A Ballistics Technology / PROJECT: AH75

FY 1998 Planned Program:

•	11367	- Test subscale compulsator into dynamic load representative of an EM launcher to establish exit criteria machine technology.
		- Test subscale compulsator for EM gun concept at full design limits.
		- Design Exit Criteria Compulsator Machine (ECM) EM launch pulsed power system.
		- Assess the feasibility of multiple ETC concepts and demonstrate 14 megajoule (MJ) muzzle energy from a 120mm, M256 cannon.
		- Design and build EM launcher for Exit Criteria Machine.
		- Design and validate EM launch packages for Exit Criteria Tests.
		- Test prototype advanced switches on subscale machine.
•	293	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	11660	

FY 1999 Planned Program:

•	7640	- Begin fabrication of ECM pulsed power system for EM gun concept.
		- Test pulsed power switch system on Subscale Machine (SSM).
		- Prove ETC propelling charge design and begin controlled step-up of muzzle energy toward 16-17 MJ.
Total	7640	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7839	8032	10159
Appropriated Value	7839	12032	
Adjustments to Appropriated Value	-207	-372	
FY 1999 President's Budget	7632	11660	7640

Change Summary Explanation: Funding: FY 1998 funds (+4000) added by Congress for electric railgun technology.
Funding: FY99 funds reprogrammed (-2519) for high priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602618A Ballistics Technology

PROJECT: AH80

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH80 Ballistics Technology	20173	20350	22167	23067	26169	26957	29957	Continuing	Continuing

A. Mission Description and Justification: This project produces key technologies required for armaments and armor to allow U.S. dominance in future conflicts across a full spectrum of threats. The program focuses on lethality technologies for more lethal and more deployable weapons and on survivability technologies to lighten and protect the force. These ballistic technologies will support advances in vehicle survivability, direct fire armament capabilities, indirect fire support and weapons effectiveness. This project continues to support extensive experimental programs to advance the state-of-the-art in ballistics technologies. 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, Picatinny Arsenal, NJ; the Tank and Automotive Research, Development and Engineering Center, Warren, MI; and the Missile Research, Development and Engineering Center, Huntsville, AL.

FY 1997 Accomplishments:

•	15195	- Successfully exercised Global Positioning System auto-registration fire control technique to enhance artillery projectile accuracy. - Designed long-standoff shaped charge concept for possible use against active protection systems - Evaluated advanced armor systems such as sensitized explosive reactive armor and non depleted uranium for protection capability against advanced threats. - Completed research module to provide lower cost azimuth determination which when coupled with Global Positioning System will improve battlefield target acquisition and situation awareness. - Demonstrated laser igniter for artillery munition propellant which permits high rates of fire while improving safety, reliability and durability. - Experimentally validated modeling capability for resin transfer molding of thick composites which reduces costs for retooling and system acquisition time.
•	3790	- Developed engineering based methods to compute ballistic damage response and performance of combat system components, including main rotor blades, drive trains, and electro-optics to improve survivability/lethality analysis of Army aviation systems.
•	1188	- Demonstrated integration of the multi-user prototype synthetic environment with computer generated individual combatants. Developed mission planning and rehearsal tools simulating the battlefield to quickly adjust mission plans to changing battlefield situations.
Total	20173	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602618A Ballistics Technology
PROJECT: AH80	

FY 1998 Planned Program:

•	14182	- Advance technologies such as recoil mitigation and range correction for munitions which will provide enhanced capabilities for light forces in operations across the threat spectrum - Apply advanced guidance technology to artillery projectiles, missiles and fire control concepts to provide improved weapon accuracy and associated relief from logistic burden. - Enhance direct fire lethality by introducing novel propulsion concepts and advanced warhead designs including multi-stage shaped charge and kinetic energy precursor technology. - Investigate advanced basal and appliqué armor technology which will provide new approaches to armoring lighter weight vehicles.
•	4141	- Implement blast damage algorithm for component damage from small warheads to optimize lethality/survivability of smart indirect fire munitions /ground systems.
•	2027	- Implement physical models of vulnerability and weapons effects in real time for interactive simulations.
Total	20350	

FY 1999 Planned Program:

•	15884	- Determine the effects of advanced propulsion technology on gun range and accuracy; investigate advances in direct fire propulsion and lethal mechanisms. - Optimize guidance and flight technologies to extend range and improve accuracy of indirect fire weaponry. - Develop technology which will provide new operational capabilities to soldiers in low intensity conflicts and operations across the threat spectrum. - Enhance the armor technology base to address the lethality of advanced threats and increase crew protection in lightweight vehicles. Develop enabling technologies for Counter Kinetic Energy (KE) Active Protection System (APS) which extends the engagement envelope for the defeat of tank-fired KE rounds beyond the outer skin of the vehicle. This effort is fully integrated into the Tank-Automotive Research, Development, and Engineering Center (TARDEC) Full Spectrum Active Protection program and is cooperatively managed.
•	6283	- Implement vulnerability/lethality ballistics methodologies in a server configuration incorporating engineering technologies into higher level models to improve survivability/lethality analysis capability. - Provide engineering based predictions of the subsystem capabilities of air and ground combat platforms after multiple impact combinations of direct and/or indirect fire threats.
Total	22167	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	20328	20998	22642
Appropriated Value	20328	20998	
Adjustments to Appropriated Value	-155	-648	
FY 1999 President's Budget	20173	20350	22167

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602618A Ballistics Technology

PROJECT: AH81

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH81 Armor/Anti-Armor Technology	4294	4155	1308	2833	3183	3306	3396	0	Continuing

A. Mission Description and Justification: The objective of this project is to provide significantly increased levels of protection and survivability to existing and future combat systems, and to provide significantly increased lethality and effectiveness to existing and future anti-armor munitions by seeking novel and innovative solutions from industry. All of the funds in this project are used to fund contractual work to tap innovative ideas of industry. This project began as a joint program among the U.S. Army, Defense Advanced Research Projects Agency (DARPA), and the U.S. Marine Corps to enhance the national capability in armor/anti-armor (A3) technologies, and has been funded only by the Army since FY 1994. Under the general heading of armor, this project funds development of technologies needed for highly mass efficient ballistic armors and for active protection systems (APS). APS represents a revolutionary combat vehicle protection approach that uses materials projected into the path of a munition to destroy, degrade, disrupt or prematurely initiate it before it hits its intended target. Anti-armor efforts develop technology to supports several initiatives (1) a high priority Army program to enhance U.S. 120mm kinetic energy (KE) tank ammunition, especially against explosive reactive armor (ERA), which is available in the world arms market and is quite effective; (2) novel penetrators to improve munition effectiveness, and (3) an initiative to substantially extend the battlespace of the tank by developing technology needed for an extended range tank munition. Major contractors include: Dow Chemical Co., Midland, Miland Science Applications International Corp., Albuquerque, NM.

FY 1997 Accomplishments:

•	2585	- Completed KE precursor concept development for ERA defeat and selected final configuration.
•	1709	- Supported demonstration of integrated survivability approaches to overhead threats.
		- Completed development of warhead for APS defeat. (1Q97-4Q97)
Total	4294	

FY 1998 Planned Program:

•	2435	- Complete KE precursor final design and transition to PE 0603004A, Proj D232, for cartridge integration.
		- Conduct exploration of novel penetrator designs to defeat advanced armor systems.
•	825	- Demonstrate top attack armor concepts employing electromagnetic defeat mechanisms and lightweight materials.
•	800	- Demonstrate light armor protection panels for scout-class vehicles.
•	95	- Small Business Innovation Research/Small Business Technology Transfer Programs
Total	4155	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602618A Ballistics Technology / PROJECT: AH81

FY 1999 Planned Program:

•	1308	- Select and demonstrate novel penetrator designs for full scale testing.
		- Design critical componentry for tank extended range munitions.
Total	1308	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4403	4287	4797
Appropriated Value	4403	4287	
Adjustments to Appropriated Value	-109	-132	
FY 1999 President's Budget	4294	4155	1308

Change Summary Explanation: Funding: FY 1999: funds reprogrammed (-3489) to other high priority requirements.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602622A Chemical, Smoke and Equipment Defeating Technology

PROJECT: A552

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A552 Smoke/Novel Effects Munitions	2193	3577	5116	4090	4132	4188	4261	Continuing	Continuing

A. Mission Description and Budget Item Justification: This program element provides applied research for technologies to increase survivability with enhanced smoke and obscurant capabilities, and solve critical light force needs to defeat enemy targets (i.e., non-lethal and flame/incendiary devices). Project A552 provides applied research of several capabilities to counter enemy weapon systems and to provide a capability to degrade enemy capability. Improved multispectral smokes/obscurants will be 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, all of which can operate anywhere from the visible through the microwave portion of the electromagnetic spectrum. These systems will be designed to be safe and environmentally acceptable. Flame and incendiary payloads will be developed to defeat a variety of targets ranging from personnel to bunkers and light armored vehicles. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. Efforts under this program element transition and provide risk reduction for demonstration and validation and engineering and manufacturing development programs. Efforts in this program element include non-system specific development efforts aimed at specific military needs and are therefore correctly placed in Budget Activity 2.

FY 1997 Accomplishments:

•	2193	- Evaluated degradable and environmentally safe millimeter wave (MMW) screening obscurant candidates and conduct field trials; conduct packaging and dissemination studies. - Conducted a technology demonstration with a modular Obscuration Reinforcing System (ORS) attached to an M-1A1 Abrams tank. The demonstration included stationary and mobile, infrared and MMW screening trials. Results indicate that MMW capability may be improved by incorporating the results of this demonstration into future tanks and upgrades to current tanks. - Conducted technical watch level of effort on flame, incendiary, antimateriel, riot control and non-lethal technologies.
Total	2193	

FY 1998 Planned Program:

•	3519	- Evaluate degradable and environmentally safe MMW screening obscurant candidates and conduct field trials; conduct packaging and dissemination studies; continue to investigate affordability issues. - Evaluate rapid obscuration concepts for combat vehicles. - Integrate millimeter wave module with the M56 smoke generator and its associated carrier; incorporate mission and operational cost reduction measures.
•	58	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	3577	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602622A Chemical, Smoke and Equipment Defeating Technology
	PROJECT A552

FY 1999 Planned Program:

•	2400	- Complete the design and adaptation of the MMW module on the M56 and M58 Smoke Generators; implement cost and maintenance reduction measures; conduct field tests. - Integrate vehicle smoke and obscurant acquisition and hit avoidance measures and concepts into an integrated defense system for armored vehicles. Investigate and test propellant for a rapid dissemination obscurant technique for a 40mm MMW screening munition.
•	2348	- Investigate candidate infrared (IR) materials for projectiles and vehicle grenades; evaluate delivery mechanisms. - Investigate materials for direct fire multispectral smoke munition. - Investigate improved dissemination and smoke generation techniques for IR materials.
•	368	- Conduct investigations in flame, incendiary, anti-materiel, and riot control smoke technologies.
Total	5116	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2259	4739	6691
Appropriated Value	2343	3739	
Adjustments to Appropriated Value	-150	-162	
FY 1999 President's Budget	2193	3577	5116

Change Summary Explanation: Funding: FY98 – Congressional reductions (-1162); FY99 – Funds reprogrammed to higher priority requirements (-1575).

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602623A Joint Service Small Arms Program

PROJECT: AH21

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH21 Joint Service Small Arms Program	4388	9000	5229	5239	5453	5582	5734	Continuing	Continuing

A. Mission Description and Budget Item Justification: The objective of this Program Element (PE) is to develop key individual and crew served weapons technologies that will enhance the fighting capabilities and survivability of dismounted battlefield personnel of the Services. This PE funds efforts as follows: component technology for an Objective Crew-Served Weapon (OCSW) to replace selected M2 machine guns and MK19 grenade machine guns; bursting munitions technology to provide a 300% to 500% increase in hit probability, the ability to defeat defilade or non-visible targets, and means to extend the effective range of the Objective Individual Combat Weapon (OICW) to 1000 meters and the OCSW to 2000 meters; an objective sniper weapon technology to increase accuracy and effective range to 2000 meters for the next sniper weapon; technology advancement/enhancement efforts to 1) assure that the Objective Family of Small Arms, the next generation of weapons systems, continues to overmatch the evolving threat; and 2) address the follow-on needs of the Army After Next; technology to provide alternative, non-toxic components for small caliber ammunition, to dramatically reduce future environmental contamination during training and enable the Services to comply with applicable statutes; other fighting technology alternatives (FTA) promoting significant generic advances in function or form of small arms via a spectrum of applications from product improvements through all new weapon concepts (advanced materials and structures for gun systems, guided bullets, and explosively launched projectiles); and non-conventional target effects (NCTE) technologies for small arms-size directed energy systems (lasers/acoustics/microwaves), increased hit/incapacitation/suppression capabilities with controllable target effects (lethal to less-than-lethal). All Joint Service Small Arms Program (JSSAP) efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP), and approved Joint Service Science and Technology Objectives (JSSTO), plus Mission Needs Statements and Operational Requirements Documents of the Services. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Work in this PE is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), PE 0603607A (Joint Service Small Arms Program), and will transition to JSSAP efforts conducted in PE 0604802A (Weapons and Munitions-Engineering Development) and PE 0604601A (Objective Crew Served Weapon-Engineering Development). Additional transition paths have been established in coordination with Product Manager (PM) Small Arms, USMC Program Manager (PM) Ground Weapons and US SOCOM. This project includes non-system specific development efforts aimed at specific military needs and therefore is appropriate to Budget Activity 2.

FY 1997Accomplishments:

- 3199 - Integrated Objective Crew-Served Weapon (OCSW) sub-system components into initial demonstrator design, and demonstrated initial firing prototype weapon.
  - Completed test plan for sniper baseline performance experiment and quality functional deployment process for an objective sniper weapon.
- 1189 - Fabricated feasibility demonstration hardware for small arms composite barrel and novel mechanism for fighting technology alternatives (FTA)
  - Conducted initial technology assessment of lasers and acoustics for non-conventional target effects (NCTE)
  - Identified technologies for enhancement of Objective Family of Small Arms, focusing on individual and crew weapons.
  - Downselected to best initial technology concepts for non-toxic ammunition and performed concept verification.

Total 4388

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602623A Joint Service Small Arms Program / PROJECT: AH21

FY 1998 Planned Program:

•	5772	- Complete integration of OCSW weapon and mount components into prototype weapon system. - Conduct first OCSW system prototype firing demonstration. - Conduct design analysis for: integration of OICW fire control technology to OCSW to meet 2000 meter requirement; and OCSW refinement phase.
•	796	- Complete sniper baseline performance experiment and explore new concepts/technologies to achieve future sniper requirements.
•	920	- Explore various new concepts/technologies and explore the role and requirements for "small arms" in Army After Next (AAN).
•	430	- Complete FTA feasibility demonstration phase and document results - Complete and document a technology assessment of lasers and acoustics for NCTE
•	917	- Update simulator capability for OICW training during ATD phase. - Modify test range facility for OICW safety/technical testing.
•	215	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	9000	

FY 1999 Planned Program:

•	2729	- Integrate OICW fire control technology into the OCSW prototype system design. - Conduct design refinements on OCSW weapon, ground mount, fuze and ammunition elements.
•	742	- Evaluate leading edge concepts/technologies to address future sniper requirements and establish achievable lethality and tactical performance estimates for conceptual sub-systems.
•	653	- Evaluate leading edge concepts/technologies that address AAN requirements.
•	1105	- Conduct OICW safety certification and technical testing.
Total	5229	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4497	4786	5204
Appropriated Value	4593	9286	
Adjustments to Appropriated Value	-205	-286	
FY 1999 President's Budget	4388	9000	5229

Change Summary Explanation: Funding: FY 1998 Congressional increase of 4500 for Objective Crew Served Weapon.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	20993	29905	29489	33112	34768	35436	36193	Continuing	Continuing
AH18 Artillery & Combat Support Technology	8385	10708	11652	12793	13272	13553	13859	Continuing	Continuing
AH19 Close Combat Weaponry	4812	6546	8691	9201	9981	10120	10296	Continuing	Continuing
AH28 Munitions Technology	7796	7806	9146	11118	11515	11763	12038	Continuing	Continuing
J03 Plastic Cased Ammunition	0	4845	0	0	0	0	0	0	4845

Mission Description and Budget Item Justification: The objective of this Program Element (PE) is to perform applied research of advanced direct and indirect fire weapons (except small arms) and munitions. The PE funds several efforts, including the following: advanced weapon concepts and analysis supporting the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) to increase anti-armor capabilities and increase survivability for Early Entry Forces; the Direct Fire Lethality Initiative which develops technologies to provide tank main armament upgrade opportunities for fielded and future ground combat systems. The PE funds efforts to develop extended range munitions and alternative defeat mechanisms of advanced armor systems for Army After Next. The PE also funds modeling and analytic codes for thermal analysis and high impetus low flame temperature propellants to reduce wear on gun tubes (which degrades accuracy); high energy explosive technologies that increase projectile and warhead lethality; advanced armament fire control, and decision aids and software architecture; advanced acoustic sensor technology to enhance performance of smart munitions; and technology advances in acoustic sensors and anti-armor area denial systems. This PE also includes work on thermal management of high performance, high rate of fire, large caliber guns, and advanced air-to-air guns in enhanced rotary wing aircraft (e.g., Apache and Comanche) armaments, as well as ways to make artillery systems more flexible and deployable through range extension and weight reduction technologies. The work in this PE is consistent with Army Vision 2010, Army After Next, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armaments Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ. Work in this PE is related to, and fully coordinated with, efforts in PE 0602618A (Ballistics Technology), PE 0602623A (Joint Service Small Arms Program), and transitions to work performed in PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603607A (Joint Service Small Arms Program) and PE 0603802A (Weapons and Munitions Advanced Development). These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology

PROJECT: AH18

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH18 Artillery & Combat Support Technology	8385	10708	11652	12793	13272	13553	13859	Continuing	Continuing

A. Mission Description and Justification: This project focuses on the exploratory development of technology for cannon artillery, mortar weapon, fire control and combat support systems in support of next generation, Army Vision 2010, and Army After Next (AAN) systems. Also being pursued is technology for improving combat vehicle lethality and fire control while reducing life cycle costs with innovative applications of smart materials, advanced actuators, gearless electric drives, and advanced digital stabilization. Decision aid and software technology is being developed to increase armament battlefield survivability for self-propelled howitzers, along with technologies for improving the effectiveness and affordability of next generation smart munitions, such as Sense and Destroy Armor (SADARM) Block II. Low Cost Competent Munition (LCCM) concepts integrating Global Positioning System (GPS) technology into fuzing are being developed for artillery projectiles. The resulting screw-on module and ground receiver will significantly increase a projectile's overall delivery accuracy and also be readily applicable to the artillery's existing ammunition stockpile. Meteorological extraction algorithms are also being developed to further improve artillery projectile tracking accuracy. Technology for artillery projectile rotating and obturating bands is being pursued to address an impending shortcoming when firing from high performance cannons. Recoil management technologies are being developed to create a more lethal, yet lightweight Direct Support artillery weapon. The application of light-weight, high-strength composites to mortar projectiles is being pursued to extend range and, ultimately, enhance target effectiveness. This project also supports a pulsed-power technology assessment of electric gun applications to support more energetic, lethal and longer range projectiles, and the development and evaluation of advanced area denial concepts as an alternative to anti-personnel mining techniques. This project also funds technology to develop advanced acoustic sensors in support of the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD). Acoustic sensors provide non-line of sight target queuing that is critical in an early entry scenario. Technologies for reducing artillery target location error and providing real time targeting and battle damage assessment data to fire directions centers will also be developed and will support AAN information dominance strategies. Such technologies will support mobility and deployability strategies envisioned for the AAN.

FY 1997 Accomplishments:

- 2058 - Conducted cannon/projectile compatibility Phase I test firing and conducted post-mortem performance evaluation; modified obturator design and fine tuned material characteristics to support future high performance cannon-projectile wear requirements.
  - Designed gearless azimuth gun drive and smart barrel actuator design, to improve aiming accuracy of combat vehicles; fabricated hybrid 120mm M256 gun tube for smart barrel actuator tests.
  - Defined operational concepts and conducted a feasibility and trade-off analysis for applying re-usable decision aids software modules to enhance the digitization of armament systems on the future battlefield; integrated baseline software architecture description tool into a software test bed and demonstrated the ability to cost effectively support software code development, integration and reuse for weapon systems; generated baseline reference architecture for artillery ballistics fire control software.
- 4212 - Completed GPS translator assembly and test firings for auto-registration Low Cost Competent Munition (LCCM) to achieve more accurate artillery fire; completed projectile impact prediction algorithms.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology / PROJECT: AH18

FY 1997 Accomplishments: (continued)

- Completed preliminary artillery projectile tracking system (PTS) meteorological extraction algorithms to enable accurate predicted-fire engagements of subsequent fire missions.
- Continued support of contractor and Army Research Laboratory efforts in electric armaments planning, management and execution; conducted initial assessment of electro-magnetic (EM) armament options for Future Combat System (FCS).
- Supported Prairie Warrior warfighting experiment and simulations between ARDEC and Field Artillery Center, Ft. Sill, examining potential first round effects on target concepts to improve artillery effectiveness; supported Precision Guided Mortar Munition (PGMM) early user experiment at Ft Hunter-Liggett, CA with link to Distributed Interactive Simulation (DIS) node at ARDEC.

• 2115
- Demonstrated advanced noise cancellation techniques for vehicle mounted acoustic system; collected target acoustic signature data to develop/enhance commander's tactical decision aids in support of integrated acoustic system (RFPI ACTD residual hardware).
- Conducted simulation and modeling effort using DIS to assess performance of anti-personnel landmine (APL) alternative concepts; conducted personnel detection sensor survey for applicability to APL and area denial systems.
- Defined power, data rate and producibility requirements to increase footprint and detection range of a low cost 2nd generation, laser radar (LADAR) sensor.
- Refined rocket motor design for the 120mm Extended Range Mortar Munition, including rocket nozzle and propellant grain designs.

Total 8385

FY 1998 Planned Program:

• 4686
- Integrate hardware onto Paladin howitzer as part of an auto-registration accuracy improvement program; support related Navy Extended Range Guided Munition (ERGM) program; investigate GPS fuze integration and anti-jam technologies with the Army Research Labs.
- Analyze Sense and Destroy Armor (SADARM) Block II requirements for the next generation of smart artillery munitions; finalize sensor concepts and fabricate prototype hardware for sensor concept evaluation.
- Demonstrate Meteorological (MET) extraction techniques for Crusader artillery system; define baseline fire support targeting sensor system requirements and complete critical subsystem designs (sensor, GPS receiver/ guidance, airframe/ control and data link/ ground station) to achieve real time targeting and battle damage assessment for artillery in support of AAN strategies.
- Evaluate a deployment version of the area denial concept as an alternative to conventional mining techniques; test alternate sensor technologies for personnel detection in realistic environments and lethal and non-lethal defeat mechanisms.

• 3167
- Fabricate gearless azimuth drive and smart barrel actuators for improved accuracy combat vehicle gun systems; design low cost, more accurate optical fiber based muzzle reference system; mount optical fiber on 120mm gun.
- Develop baseline executable reference architecture software specification/ model for weapon systems; demonstrate application of a formal Reference Architecture specification for rapid component generation, integration and reuse; generation of this capability will provide long term benefits in support of AAN information dominance strategies.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602624A Weapons and Munitions Technology
PROJECT AH18	

FY 1998 Planned Program: (continued)

- Conduct final gun testing of high performance rotating band and obturator designs under worse case conditions (worn-tubes, maximum muzzle velocity); evaluate design performance.
- Continue support of RFPI ACTD acoustic sensor effort; verify accuracy of acoustic sensor performance and propagation models; demonstrate 1) a preliminary tactical decision aid tool, 2) target acquisition & tracking capabilities of the Integrated Acoustic Sensor for RFPI and 3) acoustic propagation prediction capability using RFPI environmental sensors.

• 2855
- Integrate knowledge base and rule development of decision aids utilizing digitized battlefield plans and procedures; integrate route planning and site selection decision aid modules into the distributed interactive simulation (DIS) environment for the Division Task Force XXI Advanced Warfighting Experiment (AWE).
- Perform interior ballistics modeling for ultra-lightweight direct support artillery weapon; create virtual prototype and model of 6750 lb. soft recoil test bed; develop an Army data base of electro-rheological fluids; development will support AAN mobility and deployability strategies.
- Complete extended range mortar munition rocket motor, fuzing and payload deployment designs; complete interior and exterior ballistic analyses.
- Conduct simulations in support of Battle Lab AWEs and ARDEC RFPI programs (e.g., Precision Guided Mortar Munition (PGMM), and the extended range mortar); conduct electric gun technology maturation assessment for program re-transition decision; review/update Future Combat System (FCS) main armament system pulsed power technology alternatives.

Total 10708

FY 1999 Planned Program:

• 3800
- Fabricate hardware for tower/ Captive Flight Test (CFT) data gathering for improved sensor for SADARM Block II; fabricate prototype sensor hardware for gun-hardening experiments; conduct preliminary tower CFT.
- Fabricate a cannon for ultra lightweight 155mm direct support artillery weapon and modify soft recoil test bed; develop concepts for 5700 lb. electro-rheological fluid-controlled soft recoil weapon in support of AAN mobility strategies.
- Gather area denial intrusion sensor data in various terrain and weather conditions; develop computer algorithms; conduct simulation to evaluate operational effectiveness.

• 3440
- Continue fabrication and integration of gearless azimuth gun drive into M1A1 testbed; design gearless elevation drive; complete fabrication and integrate smart barrel actuators on 120mm gun.; transition M1A1 technology to advanced development in support of the Direct Fire Lethality ATD.
- Develop & demonstrate a network accessible reference architecture data repository of reusable fire mission components; develop and demonstrate a baseline reusable voice natural language interface component for fire missions; develop process tools to support a "software component factory" approach to affordable embedded software development; this effort supports AAN information dominance strategies.
- Refine acoustics tactical decision aid components for environmental characterization, propagation prediction and artificial intelligence rule-based acoustic sensor deployment planner.
- Fabricate test hardware and lightweight rocket motor for extended range mortar munition; conduct interior ballistics tests.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology / PROJECT: AH18

FY 1999 Planned Program: (continued)

- 4412 - Complete capture of armament decision aid knowledge base; complete hardware, software and DIS integration efforts; test and verify operation of new decision aid components; conduct man-in-the-loop testing.
  - Conduct simulations in support of Battle Lab AWEs and ARDEC's RFPI, Joint Precision Strike Demonstration-Theater Precision Strike Operations (JPSD-TPSO), and Military Operations in Urban Terrain (MOUT) programs (e.g., fire support targeting sensor, lightweight mortar, area denial).
  - Transition lightweight mortar concepts from Army Research Labs; develop key components for lightweight mortar system.
  - Conduct high-G tests on the artillery-delivered fire support targeting sensor; complete packaging analysis and GPS receiver software algorithm development.

Total 11652

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9273	11427	12390
Appropriated Value	9273	11067	
Adjustments to Appropriated Value	-888	-359	
FY 1999 President's Budget	8385	10708	11652

Change Summary Explanation: Funding: FY 1997: Funds reprogrammed (-888) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology

PROJECT: AH19

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH19 Close Combat Weaponry	4812	6546	8691	9201	9981	10120	10296	Continuing	Continuing

A. **Mission Description and Justification:** The objective of this project is to exploit and advance new technologies which will demonstrate significant improvements in direct fire weapon performance for ground and air combat vehicles. Principal efforts support the Direct Fire Lethality Program. Included are technologies for the tank projectile precursor defeat of explosive reactive armor (ERA), composites for sabots and gun structures, and trajectory correction mechanisms. In addition, this project develops technologies in the areas of weapon stabilization, projectile design and fabrication, means to increase gun life by reducing barrel wear, thermal management of high rate launch mechanisms and munition auto-loaders, feeders and storage mechanisms. The project also develops extended range munitions and alternative defeat mechanisms of advanced armor systems for Army After Next. This project provides opportunities for longer range, more accurate and more lethal cannon systems for armored vehicle upgrades (e.g., Abrams, Bradley Fighting Vehicle System (BFVS), Future Combat System, Future Scout Cavalry Vehicle) and for future systems. The approach will be to develop both the hardware and analytical tools necessary to assess system performance, identify problem areas and to develop solutions. Through FY 1997, this project also supported the DoD Non Lethal Munitions program.

FY 1997 Accomplishments:

- 2982 - Completed full scale 120mm kinetic energy (KE) precursor penetrator tests; transitioned to cartridge integration phase (PE 0603004A/Proj D232).
  - Reconfigured propellant grain igniter with energetic grain coating to enhance burning.
  - Completed study of eight extended range munitions candidates.
- 295 - Completed ammunition transfer mechanism and high density stowage system.
  - Completed technical assessment/market survey for the Future Scout Cavalry System/Future Infantry Vehicle (FSCS/FIV) armament
- 1535 - Designed, fabricated and tested high performance non-lethal acoustic source.
  - Proof-of-Principle completed for non-lethal vehicle immobilizing system.
  - Developed lab test cells for sputter plated refractory metal coatings inside tubular gun sections for increased wear life.

Total 4812

FY 1998 Planned Program:

- 4052 - Conduct performance simulations of novel penetrator capabilities against advanced armors for development of advanced armor defeat mechanisms applicable for both near term and Army After Next (AAN).
  - Perform 120mm KE projectile dispersion test for enhanced accuracy.
- 800 - Evaluate and downselect extended range munitions designs.
- 625 - Complete assessment of bursting munitions and KE penetrator technologies for enhanced lethality for future scout and aviation platform applications.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology / PROJECT: AH19

FY 1998 Planned Program: (continued)

•	1000	- Evaluate results of coating adhesion, morphology and thickness distribution of 25mm gun tubes for increased wear life.
•	69	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	6546	

FY 1999 Planned Program:

•	6916	- Demonstrate KE radial thruster technology capability to measure and counter flight disturbances to enhance accuracy up to 70%.
		- Conduct analytical evaluation of extended range munition capabilities.
		- Demonstrate novel penetration defeat of future threat complex armors.
		- Develop lightweight, high performance armament systems technology for Army After Next applications.
•	775	- Fabricate and test bursting munitions for the Future Scout Cavalry System (FSCS).
•	1000	- Complete adhesive test of sputter coated 25mm gun barrels.
Total	8691	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4933	6974	9384
Appropriated Value	4933	6754	
Adjustments to Appropriated Value	-121	-208	
FY 1999 President's Budget	4812	6546	8691

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology

PROJECT: AH28

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH28 Munitions Technology	7796	7806	9146	11118	11515	11763	12038	Continuing	Continuing

A. **Mission Description and Justification:** This project supports advanced technologies in gun propellants, explosives, warheads, insensitive munitions (IM) and materials for armor penetrators in support of next generation and Army After Next systems. Advances in warhead technology will provide improved explosively formed penetrators (EFP), shaped charges (SC) and heavy metal alloy penetrators and liners to defeat as well as protect current and future systems. High energy/density explosives are needed to increase lethality. New, improved energetic materials have numerous transition opportunities for weapons system upgrades. The IM efforts conducted in this project will increase the survivability of tanks, artillery, helicopters and infantry fighting vehicles, as well as safety in manufacturing plants, storage depots, and air and sea transport.

FY 1997 Accomplishments:

•	2492	- Conducted warhead testing with advanced Trinitroazetadine (TNAZ) formulations with increased energy to enhance warhead lethality. - Demonstrated polynitrocubane synthesis with 7 nitro-groups on the cubane which is a breakthrough towards the synthesis of the target molecule, octanitrocubane, for increased energy propellants. - Transitioned TNAZ for pilot plant processing.
•	2686	- Demonstrated a high efficiency lightweight concrete defeating warhead.
•	721	- Conducted 1/4 scale testing of tungsten composite penetrators (a more environmentally benign replacement for depleted uranium in penetrators)
•	1897	- Scaled up pilot plant processing technology of high energy gun propellant to enable testing in FY98.
Total	7796	

FY 1998 Planned Program:

•	2780	- Scale up polynitrocubane explosive and plan study for anti-armor warhead loading.
•	2870	- Demonstrate selective warhead design to defeat heavy armored targets (15-20% increase in performance over state-of-the-art warheads) or lightly armored targets (four fold increase in lethal area over current shaped charges).
•	820	- Characterize high density material/alloys for advanced EFP and SC warheads to enhance the lethality of Army After Next systems.
•	1300	- Demonstrate high energy high performance gun propellant in live firings (impetus values 10-20% over JA2 and muzzle velocities 5-10% over M829A2).
•	36	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	7806	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology / PROJECT: AH28

FY 1999 Planned Program:

•	3100	- Conduct static warhead test using polynitrocubane explosive to show an increase in energy performance for next generation and Army After Next systems of up to 25%.
•	2646	- Build on warhead designs demonstrated in FY 1998 to develop advanced lightweight/compact warhead concepts to defeat current and future advanced armor.
•	600	- Downselect materials/processes for advanced EFP and SC warheads.
•	1800	- Conduct studies on the processibility of thermoplastic elastomers and the effect of binder/plasticizer type and ratio on energetic materials to provide higher energy, safer gun propellant.
•	1000	- Design multiple explosively formed penetrator warhead for active protection against chemical energy and kinetic energy threats.
Total	9146	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	8040	8316	8571
Appropriated Value	8040	8055	
Adjustments to Appropriated Value	-244	-249	
FY 1999 President's Budget	7796	7806	9146

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology

PROJECT: J03

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
J03 Plastic Cased Ammunition	0	4845	0	0	0	0	0	0	4845

A. Mission Description and Budget Item Justification: This project is the result of a Congressional plus-up for the development and certification of small caliber plastic cased ammunition. The effort will quantify cost and weight savings associated with the use of small caliber plastic cased ammunition, particularly 5.56mm and conduct fielding certification testing. The effort will solicit quantities of plastic cased ammunition from the commercial sector, and after initial screening will produce large quantities for engineering and safety qualification testing. A complete life cycle cost analysis to include one time and recurring production costs, as well as logistical benefits from the lighter weight ammunition, will be documented. This effort will assess the state of the art in small caliber plastic cased ammunition and document economic and logistical benefits as well as performance tradeoffs. The effort will develop the basis on which future plastic cased efforts can be determined. Concurrent with the assessment of potential in existing weapon systems, the effort will assess the potential in a future small arms system where weight savings is critical, the Objective Crew Served Weapon (OCSW).

FY 1997 Accomplishments: Program not funded in FY 1997

FY 1998 Planned Program:

•	1423	- Procure initial samples and subsequent large quantities of ammunition from multiple sources.
•	1400	- Test ammunition samples from multiple sources.
•	800	- Analyze life cycle cost.
•	1100	- Complete evaluation of plastic cased ammunition and assess potential application for the OCSW.
•	122	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	4845	

FY 1999 Planned Program: Program not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		5000	
Adjustments to Appropriated Value		-155	
FY 1999 President's Budget	0	4845	0

Change Summary Explanation: Funding: FY 1998: Congressional increase of 5000 for Plastic Cased Ammunition.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	23756	24464	22329	23680	26506	26840	27253	Continuing	Continuing
AH11 Battery/Individual Power Technologies	5618	5639	3415	2404	2488	2537	2593	Continuing	Continuing
AH94 Electronics and Electronic Devices	18138	17372	18914	21276	24018	24303	24660	Continuing	Continuing
AJ04 Thermophotovoltaic Generator	0	1453	0	0	0	0	0	0	1453

Mission Description and Budget Item Justification: This program consists of research in the physical sciences essential to all land combat systems that contain electronics, chemical/biological sensors, photonics, magnetic materials, ferroelectrics, microwave and millimeter-wave components, batteries, and fuel cells. Supported systems include the Future Soldier System (FSS), autonomous missile systems, advanced land combat vehicles, smart anti-tank munitions, electric weapons, secure jam-resistant communication, automatic target recognition (ATR), foliage-penetrating radar, combat identification, and digitizing of the battlefield. The work under this program element provides enabling capability 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 develop small, low-cost, lightweight, high-energy sources of power for communications, target acquisition, miniaturized displays and microclimate cooling for Future Soldier System. Under Defense Reliance agreements, this program supports the in-house exploratory development effort at a single Army site which serves as both the center for display technology development and the center for frequency control and timing for the Army, Navy, Air Force, Ballistic Missile Defense Organization, and Defense Nuclear Agency. It supports all of the science and technology thrust areas that employ electronic and portable power-source technology. This PE includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices

PROJECT: AH11

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH11 Battery/Individual Power Technologies	5618	5639	3415	2404	2488	2537	2593	Continuing	Continuing

A. Mission Description and Justification: This project provides exploratory development in the application of the physical sciences of electrochemistry, electronics, and process science, as they apply to improving existing systems and enabling newer, more advanced battery, fuel cell, and electromechanical (including engines and permanent magnetic alternators) technologies. The goal is to develop small, low-cost, environmentally compatible, light weight, high energy density sources of power for communications, target acquisition, miniaturized displays, combat service support applications, and future soldier systems. Technology developments support thrusts aimed at reduced acquisition costs, reduced operations and support costs, and Army modernization. Mobile electric power and fuel cell technology efforts conducted under PE 0602786A/Project AH20 in prior years is restructured to this project beginning in FY 1997. Battery technology conducted under Project AH94 is restructured to this project in FY 1997.

FY 1997 Accomplishments:

•	845	- Completed design and development of rechargeable lithium ion BA-2590 battery and charger, based on small commercially available cells. - Demonstrated prototype capacitor-battery hybrid power source for low cost Simulated Area Weapons Effects (SAWE)/Multi Integrated Laser Engagement System (MILES) training missions. - Demonstrated gas fueled portable thermophoto-voltaic power source system.
•	138	- Completed the fabrication/testing of a lightweight, portable, electronically controlled, signature suppressed 3 kW, 120 VAC generator set capable of starting and operating on multiple fuels. Generator Set is comprised of novel a permanent magnet alternator, power electronic conditioner/controls, and a commercially available state of the art engine. Demonstrated 3 kW power system.
•	885	- Reduced size and weight of fuel cells, improved thermal management and hydrogen generation techniques.
•	705	- Performed feasibility assessment tasks to demonstrate silent, portable fuel cell systems as a smart battery recharger/power source which can be used by dismounted soldier.
•	945	- Built, tested and demonstrated prototype zinc-air (AA size) military cells.
•	750	- Built and tested rechargeable alkaline zinc batteries in standard BA-5590 military battery.
•	600	- Completed investigation of effects of no lead added on performance of alkaline cells.
•	750	- Completed development of safe, non metallic lithium rechargeable D cell for optimum performance BA-2590 training battery.
Total	5618	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices / PROJECT: AH11

FY 1998 Planned Program:

•	940	- Complete development of standard family of lithium manganese dioxide batteries as a more cost effective alternative to the present non-rechargeable lithium sulfur dioxide system for combat missions. - Complete development of safe, optimized-performance standard family of rechargeable lithium ion batteries as a lighter weight, lower operations and support cost alternative to the present nickel cadmium and nickel metal hydride batteries.
•	332	- Demonstrate the 3 kW STO Unit to the user community. Initiate procurement/fabrication of advanced power components and subsystems rated at 5 and 10 kW. Initiate testing of state of the art alternators and power electronics and commercially available engines as they become available. Effort will lead to the modernization and upgrade of existing power systems.
•	946	- Design, construct, test and demonstrate improved lightweight 50 and 150 watt fuel cell systems with 600 watt-hour capacity.
•	460	- Develop Lithium-Ion coin cell for memory-hold power applications.
•	930	- Demonstrate low cost reusable Alkaline Manganese Battery for low power training applications.
•	500	- Investigate/develop high rate of discharge, large size (fat D cell size), non-metallic rechargeable lithium ion cells optimized for safety and performance, for use in BBX-590 military batteries.
•	1390	- Develop zinc-air system suitable for field recharging of batteries.
•	141	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	5639	

FY 1999 Planned Program:

•	1244	- Complete development of an ultra high energy density, low operations and support cost, rechargeable lithium ion and non rechargeable zinc-air battery system.
•		- Continue design, application, engineering and testing of hybrid power sources to provide smaller, lighter and more cost effective man-portable power systems for Command, Control, Communications, Computers, Intelligence and Electronic Warfare (C4IEW) equipment.
•	528	- Initiate design of a 350 pound portable, electronically controlled 5000 Watt engine driven generator set capable of operating on multiple fuels for tactically mobile use based on commercially available engines and state of the art alternator and power electronic technologies.
	643	- Design liquid fueled 50 to 150 watt fuel cell with 2000 watt-hour per kilogram of fuel.
•	1000	- Develop high energy, high power density, signature-suppressed, advanced power systems for battlefield recharging and tactical power generation.
Total	3415	

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices

PROJECT: AH11

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5946	2218	2415
Appropriated Value	5946	5818	
Adjustments to Appropriated Value	-328	-179	
FY 1999 President's Budget	5618	5639	3415

Change Summary Explanation: Funding: FY 1998 Congressional add (+3600) for various battery programs.
Funding: FY 1999 (+1000) due to decision to increase investment in critical area.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices

PROJECT: AH94

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH94 Electronics and Electronic Devices	18138	17372	18914	21276	24018	24303	24660	Continuing	Continuing

A. Mission Description and Justification: This project provides exploratory development in the application of the physical sciences of physics, electrochemistry, biotechnology, electronics, and process science, as they apply to improving existing systems and enabling newer, more advanced systems. Technology developments support thrusts aimed at reduced acquisition cost, reduced operations and support costs, Army modernization, Advanced Technology Demonstrations (ATDs) and Advanced Technology Transition Demonstrations, described in the Army Science and Technology Master Plan.

FY 1997 Accomplishments:

- 10031 - Improved integrated computer-aided design technologies and applied to electronic components to achieve a 4x reduction in time and cost to develop/upgrade high performance devices, components, sensors and process modules for Army land combat systems.
  - Continued effort to design and fabricate advanced microwave (MW)/millimeter wave (MMW)/quasi-optical components to improve line-of-sight space and terrestrial communication and fire control applications.
  -Designed and prototyped sub-MMW /terahertz components to enable communication devices to operate at frequencies where detection, interference, and countermeasures are inhibited.
  - Developed and characterized new piezoelectric materials and novel resonators and microresonators for low noise oscillators and high-accuracy clock applications.
  - Developed high-accuracy, low-noise, low-power quartz and atomic clocks and resonant sensors for uncooled infrared, chemical and acceleration sensing.
- 3882 - Designed, fabricated, and transitioned improved miniature sensors/actuators for mine detection and missile seekers.
  -Developed hand-held optoelectronic biosensors to provide new and critically needed capabilities in biological/chemical warfare agent detection for the warfighter.
  - Applied improved fabrication processes based on phosphor physics and luminescence properties to emerging display technologies and demonstrated ruggedized, high resolution, low power, flatpanel displays for command post situations, personnel communications, and training applications.
  - Jointly evaluated with Air Force high temperature super conducting (HTSC) antenna feed for Military Strategic Tactical Relay System (MILSTAR); demonstrated and integrated MMW devices into moving target indicator (MTI) radar.
- 4225 - Prototyped lithium cells utilizing highly energetic oxyhalide and transitioned metal oxide cathode materials; demonstrated proof-of-principle thermophotovoltaic power source for quiet mobile electric power field generators.
  - Continued investigation of nonlinear optical processes; investigated additional materials; extended modeling of nonlinear processes; optimized mid-infrared (IR) optical parametric oscillator (OPO).
  - Developed a prototype to validate scalability of processors and architectures from combat platforms to mobile command nodes. Transitioned technology to Battlespace Command and Control (C2) ATD.

Total 18138

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602705A Electronics and Electronic Devices
	PROJECT AH94

FY 1998 Planned Program:

•	4993	-Fabricate and evaluate ferroelectric thin-film millimeter wave scanning antenna and advanced ferroelectric lenses to demonstrate electronic scanning. -Demonstrate MW/MMW/terahertz devices for communications/navigation/surveillance systems. -Develop predictive physics-based and circuit-based modeling and simulation tools for circuits, leveraging high performance computing assets.
•	5911	-Design and fabricate optoelectronic devices for secure, spread spectrum communications systems and high efficiency power switches for use in foliage/ground penetrating ultra-wide band radar applications. -Complete material property studies and optimize process technology for lead zirconate titanate (PZT) thin-films for use in microactuators and microsensor devices. -Develop high luminous efficacy phosphors and devices, circuitry and drivers for various display technologies, and perform characterization of these displays.
•	3117	-Execute DoD-mandated program to maintain industrial base in oscillator and clock technology. -Develop low-noise, acceleration-insensitive oscillator technology for air-borne navigation and communication systems such as Joint Surveillance and Target Acquisition Radar System (JSTARS). -Develop low-power, high-accuracy clock technology to support direct P-code acquisition of global positioning system (GPS) as well as a high-shock version for GPS guided munitions.
•	1406	-Continue efforts to improve technology for lightweight hydrogen and methanol fueled backpack fuel cell. -Investigate new cathodic electrocatalysts for man-portable methanol fuel cells and prototype rechargeable Li cells with solid electrolyte to develop low-cost, high-energy density power sources. -Improve the design and construction of reserve battery technology and demonstrate the feasibility of a 90 second operating lifetime.
•	677	-Investigate techniques to parallelize (allow multiple simultaneous processing) algorithms for transformation and rendering the battlespace information that is part of the battle scene which will be compatible with the next generation of tactical parallel and scalable processing architectures.
•	1220	-Fabricate mercury cadmium telluride detector array on silicon substrate. -Demonstrate 8 micron laser source by OPO and characterize parameters relevant for remote chemical detection. -Demonstrate two-color detector structures with wavelength choices for several different applications
•	1366	-Enzyme-based chem-bio detection technology program.
•	182	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	18872	

FY 1999 Planned Program:

•	4619	-Design and fabricate high frequency electronic components including antennas, ferroelectric materials/devices, transmit/receive modules, and MW/MMW devices to improve soldier situational awareness by enhancing the senses through communications, radar, electronic warfare (EW), surveillance, and target acquisition systems. -Develop scalable software to predict performance, cost, and other parameters of electronic components without producing hardware.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices / PROJECT: AH94

FY 1999 Planned Program: (continued)

-Demonstrate simulation models for power semiconductors and electromagnetic solvers for high frequency circuit design to reduce procurement time and costs of high frequency electronic components.

- 4126 -Execute DoD-mandated program to support industrial base for research on low-noise, acceleration-insensitive oscillator technology and low-power, high-accuracy, high-shock clocks for communication/navigation systems.
- 6575 -Advance the state-of-the-art of GaAs quantum well technology to support manufacturable, low-cost, high-performance devices for missile seeker applications.
  -Continue to improve optoelectronic device design, fabrication, and characterization processes for high speed communications and target acquisition/surveillance.
  -Leverage Defense Advanced Research Projects Agency (DARPA) programs to continue advanced displays research on phosphors, interface circuitry, and manufacturing processes to eventually achieve luminous efficacy of 80 lumens/Watt.
- 1619 -Research and develop electrode and electrolyte materials to enable advanced energy storage devices and electrochemical capacitors for portable communications systems.
  -Continue to improve reserve technology for smaller, longer-lived, higher power-density devices capable of surviving high-spin, high "g" environments for smart mines and fuses.
- 690 -Demonstrate a parallelized battlespace visualization suite of algorithms on a next generation tactical processing architecture which provides a more timely rendering of the battlespace scene.
- 1285 -Demonstrate high quality electro-optic devices monolithically integrated with silicon electronic devices.
  -Determine the feasibility of using lasers or near infrared modulators as optical readouts for integration at the focal plane.
  -Demonstrate long range performance for frequency modulated eyesafe laser radar (LADAR).

Total 18914

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	18405	17974	19959
Appropriated Value	18405	19474	
Adjustments to Appropriated Value	-267	-2102	
FY 1999 President's Budget	18138	17372	18914

Change Summary Explanation: Funding: FY 1998: Congressional adjustment/undistributed Congressional reduction (-602) and reprogramming of Chem/Bio Detector technology funding (-1500) to OSD Chem/Bio Program.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices

PROJECT: AJ04

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AJ04 Thermophotovoltaic Generator	0	1453	0	0	0	0	0	0	1453

A. Mission Description and Budget Item Justification This Congressional special interest project conducts applied research to enable newer, more advanced thermophotovoltaic (TPV) technologies. Prototypes of TPV power sources (with power output from a few watts to a few hundred watts) will be developed and engineered as portable battery chargers operating on logistic fuels.

FY 1997 Accomplishments: Project not funded in FY 1997

FY 1998 Planned Program:

- 1417 - Complete demonstration of thermophotovoltaic power source configuration and power output level for portable battery charger.
- 36 - Small Business Innovation Research/Small Business Technology Transfer Programs.

Total 1453

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
Previous President's Budget	0	0	0
Appropriated Value		1500	
Adjustments to Appropriated Value		-47	
Current Budget Submit/President's Budget	0	1453	0

Change Summary Explanation: Funding: FY 1998: Congressional increase (+1500) to support development of TPV technology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602709A Night Vision Technology	PROJECT DH95

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DH95 Night Vision and Electro-Optic Technology	16935	16712	19157	18796	19368	19638	19969	Continuing	Continuing

A. Mission Description Item Justification: This project develops core night vision and electronic sensor technologies for Army weapons systems. Advanced focal plane arrays, both infrared and multispectral, are being developed that will see farther, provide advanced signal processing, and improve performance on the dirty battlefield. Lightweight, high resolution common module optics and sensor technologies for future head-mounted vision systems are being developed for future aviators, infantry, armored vehicle crewmen, and field maintenance personnel. Multiwavelength, multifunction laser sources will provide affordable, high performance technology options for Army tactical laser rangefinding, designating, obstacle avoidance, laser radar, and missile countermeasures. Aided/automatic target recognition technologies will enable dramatic reductions in the time to acquire targets, detect land mines, and collect intelligence data while also reducing the warfighter's cognitive workload. Hardware-in-the-loop multispectral sensor simulations are being developed that will allow end-to-end predictive modeling, hardware design, and evaluation of new technologies in a virtual environment, while allowing warfighters to test these capabilities, develop tactics and techniques, and train in parallel with the hardware development process. This program element supports Force XXI Land Warrior, upgrades for Force XXI weapons systems, Army after next future systems, as well as the rapid force projection initiative and rapid terrain visualization advanced concept technology demonstrations (ACTDs). Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri Service Reliance Agreements on Sensors and Electronic Devices. Work in this program element is related to and fully coordinated with PE 0602712A (Countermine Technology), PE0602270A (Electronic Warfare Technology), and PE 0603710A (Night Vision Advanced Technology). This program is managed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program is dedicated to conducting applied research and tests of general technologies to meet specific military needs and is correctly placed in Budget Activity 2.

FY 1997 Accomplishments:

- 5379
  - Evaluated advanced staring long wave infrared focal plane arrays (IRFPAs) (256 X 256 elements) in test systems.
  - Fabricated two-color 128 x 128 elements IRFPAs with mid wave infrared and long wave spectral sensitivity .
  - Developed buffer layer growth techniques that improves thermal and structural interfaces between detector and silicon read out structure and allows increase reliability of current IRFPAs and fabrication of a new generation of very large high performance focal planes.
  - Demonstrated novel device growth and processing techniques in the prototype microfactory environment that enhanced detector material quality.
  - Multiple designs completed for digital optical interconnects from focal plane.
- 2822
  - Developed a high-resolution far infrared scene generation capability that incorporates calibrated thermal target signatures, real-time database visualization, and solar loading model for terrain and roads.
  - Developed real time 1st and 2nd generation thermal imager sensor effects package that allows accurate modeling of zoom, polarity and gain, level.
  - Integrated high resolution infrared target signatures with multi-sensor scene simulation;
  - Conducted hardware in the loop testing/evaluation of infrared tracker and hunter sensor suite using multi-sensor scene simulator.
  - Image Intensifier sensor simulation completed and verified, validated and accredited .

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602709A Night Vision Technology
	PROJECT DH95

FY 1997 Accomplishments (Continued):

•	1185	– Developed low cost laser obstacle avoidance device to aid vehicle drivers in obstacle avoidance.
		– Conducted laboratory demonstration of nonlinear optical conversion modules to generate tunable laser radiation from the ultra-violet to far-infrared from a single pump laser source.
•	2925	– Extended forward looking infrared (FLIR) aided target recognizer (ATR) evaluation methodology to synthetic aperture radar (SAR) sensors.
		– Evaluated and tested tactical endurance synthetic aperture radar ATR against varying target sets in multiple mission scenarios.
		– Completed open architecture ATR processor assessment for M1A2.
•	3124	– Completed development of wide field of view (FOV) sensor readout electronics.
		– Completed evaluation of lightweight optical materials and hybrid optics designs; completed development of modular display drive electronics.
•	1500	– Continued development of evaluation methodologies for aided mine detection algorithms.
Total	16935	

FY 1998 Planned Program:

•	4781	– Evaluate the practicality and affordability of monolithic growth techniques for large single spectrum staring focal plane arrays.
		– Develop validated staring imager performance models for transition to support design and evaluation of high sensitivity integrated detector/dewars.
		– Demonstrate smart on-chip read-out circuit functions such as spatial and temporal filtering that can provide significant improvements in target to clutter contrast.
		– Evaluate multi-color focal plane array technologies with hyperspectral filtering for application to overhead battlefield surveillance and intelligence assets.
•	3196	– Evaluate and characterize uncooled focal plane array materials technologies that are sensitive from the visible through near infrared spectral region and that can exploit the night time illumination effects of naturally occurring "sky-glow" radiation that is not visible with current image intensifier technology.
		– Establish sensitivity, resolution, and read-out circuit requirements for an uncooled, solid state near infrared imaging focal plane array to replace current generation image intensifier tubes.
•	1420	– Develop laboratory variable repetition rate laser pump module and combine with nonlinear conversion modules as needed for different applications such as target designation, eyesafe rangefinding, and laser radar.
•	4049	– Integrate advanced infrared and millimeter wave radar ATR evaluation capability for multi-sensor reconnaissance, search and target acquisition applications.
		– Incorporate low power consumption, miniaturized high performance components into ATR processing hardware for compact sensor applications.
•	3154	– Continue development and integration of real-time multi-spectral effects (visible, near infrared, mid infrared) into synthetic scene generation capability for insertion into prototyping and wargame simulations.
		– Continue development of mine signature simulations for infrared and ground penetrating radar sensors and evaluation of aided mine detection algorithms in support of land mine center of excellence.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602709A Night Vision Technology
	PROJECT: DH95

FY 1998 Accomplishments (Continued):

•	112	– Small Business Innovative Research/Small Business Technology Transfer
Total	16712	

FY 1999 Planned Program:

•	4750	– Develop design architecture for partitioning smart integrated circuit functions between on- and off-focal plane processing hardware.
		– Evaluate throughput requirements, heat dissipation requirements, and circuit fabrication requirements for varying on-focal plane read-out circuit configurations with a goal of increasing read-out capacity by an order of magnitude.
		– Develop monolithic read-out integrated circuit for an infrared focal plane array that incorporates analog to digital conversion and multi-band fusion processing functions.
•	2554	– Complete common source laser brassboard and demonstrate multiple applications in different wavelength bands.
		– Evaluate diode pumped laser source technology and investigate new high peak power laser diode structures for a micro eyesafe laser to reduce the size, weight, and power consumption of manportable laser devices.
•	4138	– Conduct ATR evaluations of multispectral and large format staring infrared sensors in increasingly complex dynamic operational scenarios,
		– Integrate off focal plane ATR processing with smart focal plane array.
•	3715	– Demonstrate a real-time multi-spectral synthetic scene rendering (visible, near infrared, mid infrared, and far infrared) capability in a wargame simulation.
		– Continue to develop mine signature simulations that accurately represent multiple sensor spectrums and evaluate aided mine detection algorithms in support of land mine center of excellence.
•	4000	– Develop uncooled focal plane array device technology for a low cost solid state near infrared camera that will provide an order of magnitude increase in sensitivity to present image intensifier tubes.
		– Develop electronics and image processing components necessary to integrate brassboard solid state, near infrared camera for multispectral imaging in ultra violet, visible, and near infrared spectrums.
Total	19157	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	16636	17304	19213
Appropriated Value	16636	17304	
Adjustments to Appropriated Value	+299	-592	
FY 1999 President's Budget	16935	16712	19157

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602712A Countermine Applied Research

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	7052	10272	10715	10485	10574	10781	11020	Continuing	Continuing
AH24 Countermine Technology	5757	9157	8301	8324	8088	8243	8422	Continuing	Continuing
AH35 Camouflage Technology	0	774	2058	2161	2486	2538	2598	Continuing	Continuing
AC61 AC61	1295	341	356	0	0	0	0	0	1992

Mission Description and Budget Item Justification: This program element provides countermine and advanced signature management technologies. The specific countermine efforts include remote detection of minefields, and detection and neutralization of individual mines from moving vehicles and manportable systems. Advanced robotics technologies will be emphasized to minimize threats to weapons systems and personnel. Breaching and neutralization techniques will be developed for both conventional and electronically activated mines that can act at a distance. A Center of Excellence for land mine detection will coordinate and standardize development of mine signature simulations, provide a catalogue of mine signatures, and support evaluation of mine detection algorithms. Advanced signature management techniques will provide mobile and semi-mobile assets (e.g. Abrams, Theater Missile Defense) with low cost, low burden survivability enhancements addressing detection avoidance and hit avoidance in global battlefield conditions. The Army has focused its resources and is expediting these programs in coordination with the US Marine Corps. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on conventional air/surface weapons and ground vehicles. Work in this program element is related to and fully coordinated with PE0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermine and Barrier Development), and PE0603710A (Night Vision Advanced Technology). This program is managed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program is dedicated to conducting applied research and tests of general technologies to meet specific military needs and is therefore correctly placed in Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602712A Countermine Applied Research

PROJECT: AH24

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH24 Countermine Technology	5757	9157	8301	8324	8088	8243	8422	Continuing	Continuing

A. **Mission Description and Justification:** Countermine research will focus on remote detection of minefields, and detection and neutralization of individual mines from moving vehicles and manportable systems. Advanced robotics technologies will be developed to minimize threats to weapons systems and personnel. Breaching and neutralization techniques will be developed for both conventional and electronically activated mines that can act at a distance. A Center of Excellence for land mine detection will coordinate and standardize development of mine signature simulations, provide a catalogue of mine signatures, and support evaluation of mine detection algorithms. Advanced signature management techniques will provide mobile and semi-mobile assets (e.g., Abrams, Theater Missile Defense) with low cost, low burden survivability enhancements addressing detection avoidance and hit avoidance in global battlefield conditions. Efforts for camouflage technologies are restructured to Project AH35 of this PE beginning in FY 1998.

FY 1997 Accomplishments:

- 648 – Demonstrated passive deception/low observable technologies for suppression of mobile and semi-mobile assets' multispectral signatures, reduced detection ranges by 50 percent in woodland, desert, arctic and urban battlefield environments.
- 3904 – Developed operational concept for use of mine hunter killer with ground standoff mine detection system.
  – Performed investigations of direct fire neutralization of buried mines at known locations.
  – Defined initial systems architecture and fire control approach.
- 1205 – Developed and evaluated sensor fidelity enhancements to forward looking radar and determined technical performance parameters required to achieve increased probability of detection with a significant reduction in false alarm rate.

Total 5757

FY 1998 Planned Program:

- 697 – Investigate a variety of new component and focal plane array (FPA) technologies, such as 3-5 micron staring FPAs, multi/hyperspectral, passive polarization, active sources and electronic stabilization to support a lightweight, airborne stand-off mine detection capability.
- 5430 – Evaluate advanced infrared (IR), ultra-wide band synthetic aperture radar, acoustic, induction eddy current decay, passive microwave, magnetoresistive, microbial/bioluminescent detection technologies to significantly improve detection capability and extend standoff detection ranges against antipersonnel and antitank mines.
- 2000 – Complete design of an explosive neutralizer as part of the mine hunter/killer.
- 800 – Continue development of mine signature simulations, build database of mine signatures, and establish methodology for evaluation of detection algorithms in support of land mine detection Center of Excellence.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602712A Countermine Applied Research
	PROJECT: AH24

FY 1998 Planned Program: (continued)

•	230	– Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	9157	

FY 1999 Planned Program:

•	1500	– Complete design and performance trade-off analysis and evaluation of alternative multispectral imaging sensor technologies for a lightweight airborne minefield detection capability.
		– Develop and test critical component modules for the lightweight, airborne mine detection sensor.
•	4817	– Investigate acoustic and seismic technologies as an additional means of enhancing the ability to remotely detect mines from moving vehicles at speeds of 5-20 km/hr.
•	1500	– Complete development and evaluation of advanced stand-off mine detection sensor technologies and transition to the mine hunter/killer .
•	484	– Continue development of mine signature simulations, cataloguing of mine signatures, and assessments of mine detection algorithms in support of land mine detection center of excellence.
Total	8301	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	6041	9448	8301
Appropriated Value	6041	9448	
Adjustments to Appropriated Value	-284	-291	
FY 1999 President's Budget	5757	9157	8301

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602712A Countermine Applied Research

PROJECT: AH35

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH35 Camouflage Technology	0	774	2058	2161	2486	2538	2598	Continuing	Continuing

A. Mission Description and Justification: Develop signature management and deception technologies that deny acquisition of friendly force assets from threat sensors. Demonstrations will be supported by signature characterization, modeling and simulation conducted under the Integrated Sensor Modeling and Simulation effort. These signature management and deception systems provide mobile and semi-mobile assets with low cost, low operational burden survivability upgrades addressing detection avoidance in global battlefield conditions. This project is a restructure from project AH24.

FY 1997 Accomplishments: Funded in Project H24 of this PE.

FY 1998 Planned Program:

•	755	– Complete feasibility studies for advanced camouflage and deception technologies.
		– Develop and demonstrate passive IR coatings for signature suppression of vehicles.
•	19	– Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	774	

FY 1999 Planned Program:

•	2058	– Develop reactive IR suppressive coatings.
		– Develop appliqués/structures to reduce vehicle and solar loading signatures over an extended period of a diurnal cycle and in varying backgrounds.
		– Develop electronically projected, multispectral decoy to replicate the signature of a combat vehicle.
Total	2058	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	799	2058
Appropriated Value	0	799	
Adjustments to Appropriated Value		-25	
FY 1999 President's Budget	0	774	2058

Change Summary Explanation: Funding: FY 1998 - This project is a restructure of funds beginning in FY 1998 to segregate camouflage and countermine research activities.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602716A Human Factors Engineering Technology

COST *(In Thousands)*	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	15781	16723	13369	14193	14396	14869	15432	Continuing	Continuing
AH34 Rural Health Technology	2145	2907	0	0	0	0	0	0	5522
AH70 Human Factors Engineering Systems Development	13636	13816	13369	14193	14396	14869	15432	Continuing	Continuing

Mission Description and Budget Item Justification: The objectives of this program are, first, to maximize the effectiveness of soldiers in concert with their materiel so that they may survive and prevail on the battlefield. 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. Secondly, this program focuses on improving health care in remote areas through research and technology development in distance learning, and on the development, field testing, and empirical validation of methods for improving the coordinated functioning of civilian and military emergency medical teams. The work in this latter effort complements related Army programs in soldier performance, training and evaluation methodologies, and will provide direct research benefits to the Army's medical community, including combat casualty care on the battlefield and in other remote areas of operation. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. All work under this PE is part of the Human Systems Tri-Service Reliance panel. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602716A Human Factors Engineering Technology

PROJECT: AH34

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH34 Rural Health Technology	2145	2907	0	0	0	0	0	0	5522

A. **Mission Description and Justification:** The Congressionally-directed Medical Teams program provides for the continued development, field testing, and empirical validation of methods for improving the coordinated functioning of emergency medical teams (both military and civilian). This multi-year project, initially supported by Congress in FY96, extends previous Army research on the effective training and evaluation of military aviation crews and systematically applies it to the collection of hospital and pre-hospital personnel who must perform as an effective team during the initial "golden hour" of shock/trauma or acute patient care. Additionally, this project provides both the civilian and military medical communities with a rigorous framework for objectively demonstrating and assessing the "value-added" of selected telemedicine and medical decision management technologies.

FY 1997 Accomplishments:

•	2145	-Completed development of prototype team training and evaluation packages for emergency medicine (Madigan Army Medical Center, Tacoma, WA; and Rhode Island Hospital). -Identified the following military and civilian hospital sites for field validation of training and evaluation packages; Naval Medical Center, Portsmouth, NH; 60th Medical Defense Group, Travis AFB, CA; West Virginia University Medical Center, University of Florida Medical Center, Methodist Hospital, IN; Connemaugh Memorial Medical Center, Johnstown, PA; and Eisenhower Army Medical Center, Fort Gordon, GA.. -Conducted comparative investigations of teleconsulting versus on-site decision aids for field intubation of trauma patients (University of Maryland Shock Trauma Center). -Conducted initial examination of patient simulator technology for "value added" to emergency medical team performance. -Investigated the feasibility of incorporating various design features for forward resuscitative surgical capabilities in both military and civilian setting.
Total	2145	

FY 1998 Planned Program:

•	2834	-Evaluate the prototype hospital training and evaluation system at each of the cooperating hospitals. -Conduct an extended team testbed at Madison Army Medical Center. -Conduct a test of an advanced intra-team communication system at Madison Army Medical Center and Rhode Island Hospital.
•	73	-Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	2907	

FY 1999 Planned Program: Project not funded in FY 1999

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602716A Human Factors Engineering Technology PROJECT AH34

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2203	0	0
Appropriated Value	2203	3000	
Adjustments to Appropriated Value	-58	-93	
FY 1999 President's Budget	2145	2907	0

Change Summary Explanation: Funding: FY 1998 funding (+3000) added by Congress to continue development of medical teams technology.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602716A Human Factors Engineering Technology

PROJECT: AH70

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH70 Human Factors Engineering Systems Development	13636	13816	13369	14193	14396	14869	15432	Continuing	Continuing

A. Mission Description and Justification: This program focuses on maximizing the effectiveness of the soldier in concert with his materiel, in order to survive and prevail on the battlefield. 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.

FY 1997 Accomplishments:

- 4513 - Within the knowledge-based logistics planning shell (KBLPS) tool framework, developed mechanisms for constructing, automatically updating and interactively presenting multi-media staff briefings, incorporating large quantities of complex information for Joint Logistics Advanced Concept Technology Demonstration (ACTD).
  - Developed forklift enhancement data on International Standard Organization (ISO) container unstuffing to validate operator interface improvements for Office of Science and Technology.
  - Investigated control and operator sensing strategies and configurations for teleoperated manipulator devices doing military tasks. Completed development and evaluation of the automated field material handling workcell concept.
  - Continued efforts to collect performance data on sensor human feedback interface devices and exoskeleton control devices with emphasis on lightening the soldier's load, focusing primarily on fatigue reduction.
  - Incorporated auditory performance parameters into metrics to enhance soldier survivability for the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC).
  - Conducted simulations in a distributed interactive simulation (DIS) environment for decision making by a dispersed force for the Field Artillery and Intelligence and Electronic Warfare (IEW) School.
- 3332 - Demonstrated and distributed human figure performance model (JACK) Army wide.
  - Completed Improved Performance Research Integration Tool (IMPRINT), version 2.0 accreditation review report and continue efforts to develop trade-off tools to evaluate soldier and unit performance and life cycle cost implications of choices in concept and system designs.
  - Continued efforts to develop and deliver a virtual reality (VR) capability for the individual soldier fighting system in a DIS environment through the use of VR and synthetic environment technologies, e.g., high resolution visual displays, computer image generators, 3-D audio, etc. Transition to STRICOM.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602716A Human Factors Engineering Technology
	PROJECT AH70

FY 1997 Accomplishments (continued):

- 5791 - Evaluated and validated soldier-system analysis tools in an operational environment and evaluated new system concepts, e.g., battle command vehicle for the Armor School.
  - Provided HFE support to U.S. Materiel Command (AMC), AMC Research, Development and Engineering Center (RDEC) installations, Training and Doctrine Command (TRADOC), battle labs and laboratories.
  - Developed a draft Army standard set of soldier-information system performance metrics for Maneuver Control System (MCS) and used in Prairie Warrior and Division 97 Advanced Warfighting Experiments (AWE)..

Total 13636

FY 1998 Planned Program:

- 4791 -Enhance and extend collaborative planning tools to logistics planning, preparation and execution at all echelons. Transition to Combined Army's Support Command (CASCOM).
  -Continue to investigate control and operator sensing strategies and configurations for teleoperated manipulator devices performing military tasks. Develop operator workload models for unmanned ground vehicles. Transition tools and guidelines to the Program Manager for Unmanned Ground Vehicles (PM UGV) and U.S. Army Aviation and Missile Command (AMCOM).
  -Publish findings on sensor human feedback devices and exoskeleton control devices. Transition data and guidelines to Natick RDEC, Soldier Systems Command (SSCOM), and the Infantry School.
  -Continue to verify and validate the auditory detection model. Conduct a study to assess the impact of multi-directional auditory displays on crew performance in armored vehicles for TARDEC.
  -Conduct cognitive analysis of command, control, communications, computers and intelligence (C4I) systems and develop models to assess system effects on decision making and the ways soldiers visualize military operations for the Battle Command Battlelab.
- 3991 -Continue to develop unique features and refinements to the human figure performance model (Jack) with emphasis on improving run-time, user interface and fidelity and decreasing the time and cost to use critical features.
  -Complete Improved Performance Research Integration Tool (IMPRINT),version 3, which incorporates embedded analysis wizard, advanced workload analysis capability, and updated resident databases for use in soldier-system front end analyses.
  -Refine the virtual reality capability for the individual soldier fighting systems in a DIS environment; Integrate the sensor suit (which records the movements of humans engaged in strenuous exercise) and a low to medium resolution version of the soldier icon (JACK); Initiate collection of baseline data for live and virtual studies. Transition data and design guidelines to Simulation, Training and Instrumentation Command (STRICOM).
- 4997 -Continue to develop soldier-system analysis and tradeoff tools and workload models for assessing soldier and unit performance and the life cycle cost implications of choices in concept and system designs.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602716A Human Factors Engineering Technology
	PROJECT AH70

FY 1998 Planned Program (continued):

-Provide HFE support to AMC, AMC RDECs, TRADOC activities, battle labs, and other laboratories.
-Develop an integrated set of soldier-information system performance based design standards and demonstrate in Division 98.

•	37	-Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	13816	

FY 1999 Planned Program:

•	4469	-Demonstrate collaborative logistics planning tools in advanced warfighting experiments and related Force XXI activities. -Expand the study investigating the impact of multi-directional auditory displays to helicopter pilot performance and dismounted soldier performance for the Aviation School. -Develop a human performance measurement strategy to assess new command and control concepts in the distributed interactive simulation (DIS) environment. Transition techniques and methods to NRDEC, Dismounted Battlespace Battle Lab. -Develop performance-based specifications for prioritizing the Army's investment in advanced 2-D and 3-D visualization concepts across the battle staff's task domain, and in new media technologies that support collaborative planning and problem solving by a geographically dispersed staff. Develop a cognitive task analysis model to examine the impact of new media technologies on battlefield command and control.
•	4200	-Verify and validate the human figure performance model (Jack), link with physics based model, and begin to incorporate data collected in 3-D. -Add training requirements analysis capability and enhanced performance degradation modeling to Improved Performance Research Integration Tool (IMPRINT) Version 3. - Collect performance data using the virtual reality capability for the individual soldier fighting systems in a DIS environment, compare results of live and virtual studies, and update and validate the databases with actual research data. Transition data and guidelines to STRICOM.
•	4700	-Develop an integrated soldier-system analysis and design tool supporting materiel design, doctrine writing and training architecture development. Continue enhanced human factors engineering field evaluation methods with soldier in the loop operational test data to upgrade existing capabilities to assess new technologies and systems. -Provide HFE support to AMC, AMC RDECs, TRADOC activities, battle labs, and other laboratories.
Total	13369	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	13765	14256	15626
Appropriated Value	13765	14256	
Adjustments to Appropriated Value	-129	-440	
FY 1999 President's Budget	13636	13816	13369

Change Summary Explanation: Funding: FY 1999 funds (-2257) reprogrammed to other high priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

	COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	50019	56131	13842	14617	15706	16115	16781	Continuing	Continuing
D048	Industrial Operations Pollution Control Technology	1867	2363	2385	2621	2766	2858	2960	Continuing	Continuing
A821	Bioremediation Education Science and Technology (BEST) Centers	0	3877	0	0	0	0	0	0	3877
A822	Facility Environmental Mangement and Monitoring System	1906	4845	0	0	0	0	0	0	6751
A823	Hawaii Small Business Development Center	5158	5233	0	0	0	0	0	0	10391
A826	Unexploded Ordnance Remediation	3813	0	0	0	0	0	0	0	3813
A829	National Defense Center for Enivornmental Excellence (NDCEE) Technology	12556	5106	0	0	0	0	0	0	17662
A835	Military Medical Environmental Criteria	3186	3313	3155	3312	3804	3899	4112	Continuing	Continuing
A876	Plasma Energy Pyrolysis System	7149	5815	0	0	0	0	0	0	12964
A877	Western Environmental Technology Office Environmental Support	4765	6784	0	0	0	0	0	0	11549
A895	Pollution Prevention Technology	0	0	613	685	721	754	781	0	Continuing
A896	Base Facility Environmental Quality	7138	2973	4343	4383	4640	4702	4879	0	Continuing
A908	Commercialization of Technology to Reduce Defense Costs Initiative	0	4845	0	0	0	0	0	0	4845
A917	Computer Based Land Management	0	3877	0	0	0	0	0	0	3877
AF25	Military Environmental Restoration Technology	2481	3223	3346	3616	3775	3902	4049	Continuing	Continuing

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AF26 Agricultural-Based Bioremediation	0	3877	0	0	0	0	0	0	3877

Mission Description and Budget Item Justification: This Program Element (PE) provides technology that allows the Army to comply with regulations mandated by all Federal, State and local environmental/health laws and to reduce the cost of this compliance. Examples of key laws include the Superfund Amendments and Reauthorization Act of 1986 and the Defense Environmental Restoration Act (the DoD equivalent of this law), in addition to the Resource Conservation and Recovery Act of 1984, as amended. This PE provides the Army with a capability 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. The current DoD estimate for the total Army cost of completing this cleanup program is eight to ten billion dollars. This PE also provides 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 PE develops pollution control technology which assists installations to comply with environmental regulations at less cost. The PE also provides technology to mitigate noise impacts and maneuver area damage resulting from Army training activities. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Defense Reliance Agreements on civil engineering and environmental quality with oversight provided by the Joint Engineers and Armed Services Biomedical Research Evaluation and Management. These projects include non-system specific development efforts directed at specific military needs and are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology	PROJECT: D048

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D048 Industrial Operations Pollution Control Technology	1867	2363	2385	2621	2766	2858	2960	Continuing	Continuing

A. Mission Description and Justification: This project provides pollution control technologies required to reduce the cost of treating hazardous toxic effluent from the operation of Army industrial installations, which include ammunition plants, depots and arsenals, and to satisfy increasingly stringent wastewater discharge standards under the Clean Water Act and relevant state regulations. Federal facilities are now subject to fines and facility shutdowns for violation of federal, state, and local air and wastewater discharge regulations. This new technology is essential to control and reduce generation of hazardous waste, to satisfy hazardous waste reduction goals and to avoid future hazardous waste disposal costs and liabilities to the Army. This project will provide compliance tools to control toxic air pollutants regulated under the Clean Air Act amendments. Efforts will focus on new energetic materials which will enter the Army inventory within the next decade to assure that ammunition plants will remain compliant. Changes in solid, liquid, and gaseous emissions resulting from pollution prevention efforts will require technology changes to existing treatment systems to compensate. The primary developing agency is the U.S. Army Construction Engineering Research Laboratories, Champaign, IL.

FY 1997 Accomplishments:

•	1867	- Developed preliminary guidance on pyrolytic behavior of energetic materials. - Developed guidelines for treatment and use of munitions wastes. - Developed biofilter technology for treatment of volatile organic compounds (VOC) from industrial operations.
Total	1867	

FY 1998 Planned Program:

•	2352	- Initiate development of adaptive tuning control algorithms for industrial wastewater treatment plant automation. - Develop biofilter technology for treatment of VOCs from industrial operations. - Develop improved biological treatment technologies for energetic wastewater employing sulfate reduction environments. - Develop engineered gelatin technology for stabilization of industrial waste streams contaminated with heavy metals.
•	11	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	2363	

FY 1999 Planned Program:

•	2385	- Develop technology for electrochemical reduction of energetic compounds in water. - Develop technology and guidelines for minimizing hazardous air pollutant emissions from industrial operations supporting Army installations. - Initiate development of technology and guidelines for using focused high energy acoustic beams to destroy energetic contaminated industrial wastes. - Develop thermal plasma techniques for the pyrolytic destruction of organic energetic wastes and the vitrification of heavy metal-bearing wastes.
Total	2385	

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: D048

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5945	2439	2501
Appropriated Value	5945	2439	
Adjustments to Appropriated Value	-4078	-76	
FY 1999 President's Budget	1867	2363	2385

Change Summary Explanation: Funding: FY97: Funds (-3960) reprogrammed to the Navy. Funds were incorrectly appropriated to the Army; remainder was for Small Business innovative research (-100) and for higher priority requirements (-18).

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A821

COST (In Thousands)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A821 Bioremediation Education Science and Technology (BEST) Centers	0	3877	0	0	0	0	0	0	3877

A. Mission Description and Justification Bioremediation Education, Science and Technology Centers (BEST) have been developed to address research needs of bioremediation through a partnership between a major university, a national laboratory, and a science consortium located at a historically black college or university (HBCU). This partnership brings together the education and research talents of all three of those institutions to advance this field of research. The goals for the Centers established under this program are to become a national resource for multidisciplinary research and education in bioremediation sciences. In FY93, the Department of the Army was appropriated funds to establish Bioremediation Education Science and Technology (BEST) Centers. The U.S. Army Corps of Engineers (USACE) was assigned as the Army's executive agent for administering the BEST Program. The U.S. Army Engineer Waterways Experiment Station (WES) administers the BEST Program for the USACE. WES, through a Broad Agency Announcement (BAA) process, awarded a three-year cooperative agreement for operation of a BEST Center to: The Regents of the University of California, Lawrence Berkeley Laboratory (LBL), Office of Sponsored Research Administration, 1 Cyclotron Road, Mail Stop 90/1070, Berkeley, CA 94270. The LBL was awarded the BAA for establishment of a BEST Center under Cooperative agreement number, DACA39-95-2-0005. The BEST Center consists of the University of California Lawrence Berkeley Laboratory (LBL); Jackson State University (JSU), Jackson, MS; and the Ana G. Mendez University System (AGMUS), San Juan, Puerto Rico.

FY 1997 Accomplishments: Project not funded in FY 1997

FY 1998 Planned Program:

- 3779 - Establish additional centers/programs to complement and/or supplement the three existing centers/programs.
- 98 - Small Business Innovative Research/Small Business Technology Transfer Programs

Total 3877

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
Previous President's Budget	0	0	0
Appropriated Value	0	4000	
Adjustments to Appropriated Value	0	-123	
FY1999 President's Budget	0	3877	0

Change Summary Explanation: Funding: FY1998 - Project is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A822

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A822 Facility Environmental Mangement and Monitoring System	1906	4845	0	0	0	0	0	0	6751

A. **Mission Description and Justification:** - This Congressionally mandated Pollution Prevention Project is managed by the Army to develop and implement the two-phased acquisition of a testbed demonstrator at Tobyhanna Army Depot (TYAD) for an automated control and real-time monitoring management of environmental emissions, pollutants, environmental management initiatives such as reduction opportunity assessments, ISO 14000 (international environmental standard evolved from ISO 9000 quality standards) gap analyses and environmental cost analysis. Completed Phase I in FY 1995 with identification and analysis of TYAD facility environmental management needs, conceptualization of the Facility Environmental Management and Monitoring System (FEMMS), prototype module designs, and implementation of FEMMS in coordination with National Defense Center for Environmental Excellence (NDCEE). Phase II was completed in 1st quarter FY96 with the selection of baseline FEMMS module designs.

FY 1997 Accomplishments:

•	1906	- Continued expanding consideration of pollutants and wastes at TYAD being monitored by FEMMS. - Continued to develop additional FEMMS modules to address future environmental requirements..
Total	1906	

FY 1998 Planned Program: Based on technology demonstrated at Tobyhanna Army Depot (TYAD) under the FEMMS, the technology will be transferred to the Radford Army Ammunition Plant as the basis for Radford Environmental Development and Management Program (REDMAP). This Congressionally mandated Pollution Prevention Project is managed by the Army to institute the Radford Environmental Development and Management Program (REDMAP) at the Radford Army Ammunition Plant, Virginia for the development of an integrated environmental and pollution prevention management and control system. In addition, since all DOD facilities are required to implement Executive Order 12856 by 1999 (so that federal facilities comply with the mandated Pollution Prevention Act (PPA) of 1990 and E.O. 12856 of August 3, 1993), these funds will focus on issues related to implementation of E.O. 12856 at Radford Army Ammunition Plant.

•	4723	- Implement selected Pollution Prevention technologies: Source reduction of dinitrotoluene (DNT) in Radford manufacturing processes, reduction of spent acids in DNT manufacture, elimination of DNT in wastewater discharges, elimination of lead in MK 90 rocket propellant, elimination of non contact cooling water discharge to waste treatment plant, upgrade of granular activated carbon units, and reduction of nitrocellulose fines. - Implement environmental management projects: Air monitoring systems, bioplant upstream computer monitoring systems, sensor upgrades for catalytic reduction system, solid waste tracking system upgrade.
•	122	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	4845	

FY 1999 Planned Program: Project not funded in FY 1999

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology / PROJECT: A822

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1958	0	0
Appropriated Value	1958	5000	
Adjustments to Appropriated Value	-52	-155	
FY 1999 President's Budget	1906	4845	0

Change Summary Explanation: Funding: FY1998 - Project is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A823

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A823 Hawaii Small Business Development Center	5158	5233	0	0	0	0	0	0	10391

A. Mission Description and Justification: This Congressionally-mandated project is a continuation of an effort begun and funded in FY 93 under project A830. The project has technology policy goals favoring activities that meet dual-use and employment-creating criteria. The former refers to commercializing products that are used by Armed Services personnel as well as the civilian population. The latter is offered as a contribution to U.S. economic revitalization. The approach involves private-public partnerships to carry out activities leading to the commercialization of these products. These include but are not limited to pharmaceuticals, industrial products, and food products derived from the agricultural resources of transitioning sugar plantations in Hawaii. Advisory personnel from federal agencies (primarily the Departments of Defense and Agriculture) and state agencies participate at the work group and oversight committee levels.

FY 1997 Accomplishments:

•	5158	- Continued development of agricultural-industrial products having potential for dual-use and commercialization, focusing on native Hawaiian agricultural crops with potential application for medicine/food/bioremediation use in the military.
Total	5158	

FY 1998 Planned Program:

•	5102	- Continued development of agricultural-industrial products having potential for dual-use and commercialization, focusing on native Hawaiian agricultural crops with potential application for medicine/food/bioremediation use in the military.
•	131	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	5233	

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5287	0	0
Appropriated Value	5287	5400	
Adjustments to Appropriated Value	-129	-167	
FY 1999 President's Budget	5158	5233	0

Change Summary Explanation: Funding: FY98 - Project is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A826

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A826 Unexploded Ordnance Remediation	3813	0	0	0	0	0	0	0	3813

A. Mission Description and Justification: This project is of Congressional special interest. The purpose of the project is to conduct a demonstration of technology to detect and remediate unexploded ordnance (UXO) using the Jefferson Proving Ground (JPG) as the test site. The primary thrust of this effort is to expedite site cleanup, reduce the cost of cleanup of contaminated soil, groundwater, and structures and to ensure that human health and the environment are protected. Research will be conducted in detection, discrimination, identification, characterization, and monitoring of UXO. Emphasis will be placed on the development of near real-time sensing and in situ remediation.

FY 1997 Accomplishments:

•	3813	- Developing geophysical methods for the identification and discrimination of UXO. - Developing methods for geophysical background feature site characterization related to UXO identification and discrimination. - Refining sensor/data fusion and analysis techniques to reduce nuisance and false alarms.
Total	3813	

FY 1998 Planned Program: Project to be completed in FY 1998 using carry-over FY 1997 funds.

FY 1999 Planned Program: No funded program in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3916	0	0
Appropriated Value	3916	0	
Adjustments to Appropriated Value	-103	0	
FY 1999 President's Budget	3813	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A829

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A829 National Defense Center for Enivornmental Excellence (NDCEE) Technology	12556	5106	0	0	0	0	0	0	17662

A. **Mission Description and Justification:** This Congressionally mandated project is managed by the Army on behalf of the Office of the Deputy Undersecretary of Defense for Environmental Security (DUSD-ES). The mission of the NDCEE is four-fold: (1) Demonstrate and export new environmentally-acceptable technology to the industrial base; (2) train the industrial base on the use of the new technology; (3) perform research and development, where necessary, to mature a new technology prior to demonstrating and exporting the new technology to the industrial base and (4) assist DoD in technology transfer. The NDCEE, which is located in Johnstown, Pennsylvania, has the goal of resolving the environmental technology and management requirements of the DoD community and commercial industrial base. The primary in-house development agency is the U.S. Army Materiel Command's Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ. The NDCEE has positioned itself as a critical resource for the Deputy Undersecretary of Defense for Environmental Security for environmental management and technology validation and integration. Major programs support by the center include the Joint Group on Acquisition Pollution Prevention, Toxics Reduction Investment & Management (TRIM), environmental cost accounting standards development and the DoD fuel cell program.

FY 1997 Accomplishments:

- 8170 - Expanded and upgraded environmental technology facility (supercritical cleaning system, automatic plating, thermoplastic coatings, wet/dry blast booth, high velocity oxygen fuel spray, central water polishing unit); perform industrial base integration and environmental analyses.
  - Continued execution of Congressionally-directed efforts: industrial health risk assessments and NitRem removal process demonstration.
  - Demonstrated and transitioned: non-halogenated metal parts cleaning, electrodeposited coatings, powder coating demonstration, non-chrome conversion coatings, waterjet paint stripping, paint handling and spraying equipment, flashjet stripping, ion beam processing, material and process substitution program, cadmium plating alternatives, and supercritical carbon dioxide as a replacement for solvents in paint.
- 4386 - Demonstrated and transitioned: new materials to help sustain the manufacturing base by exploiting waste products as a resource; simulations to speed the implementation process of new technologies into manufacturing processes; techniques to help designers decide on materials and processes for environmentally safe manufacturing; and techniques for teardown, disassembly, and reuse to eliminate open burning and open detonation as a means of disposal.

Total 12556

FY 1998 Planned Program:

- 4981 - Maintain environmental technology facility (pretreatment line, power washers, flashjet, honeycomb cleaner, carbon dioxide turbine wheel stripper, mobile treatment units, ion beam implanter, supercritical painting system, advanced immersion system, media booths, alternative plating line); perform industrial base integration and environmental analyses.
  - Continue to execute Congressionally-directed efforts: industrial health risk assessments and NitRem removal process demonstration.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology / PROJECT: A829

FY 1998 Planned Program: (continued)

- Demonstrate and transition: non-chrome conversion coatings, waterjet paint stripping, paint handling and spraying equipment, ion beam processing, cadmium replacements, and supercritical carbon dioxide as a replacement for solvents in paint.

•	125	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	5106	

FY 1999 Planned Program: Project transitioned to PE78045A "Army Industrial Preparedness Manufacturing Technology".

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	12895	5269	0
Appropriated Value	12895	5269	
Adjustments to Appropriated Value	-339	-163	
FY 1999 President's Budget	12556	5106	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A835

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A835 Military Medical Environmental Criteria	3186	3313	3155	3312	3804	3899	4112	Continuing	Continuing

A. Mission Description and Justification: This project evaluates human health and environmental effects resulting from exposure to explosives, propellants, and smokes produced in Army industrial and field operations or disposed of through past activities. The end results of this research are determinations of acceptable residual concentration levels that will protect human health and the environment from adverse effects. The products of this research are US Environmental Protection Agency approved health advisories and criteria documents to be used in risk assessment procedures. These criteria are used by the Army during negotiations with regulatory officials to set scientifically and economically rational safe cleanup and discharge levels at Army installations. The primary developing laboratories are the US Army Biomedical Research and Development Laboratory (USABRDL), Ft. Detrick, MD, the Center for Health Promotion and Preventive Medicine (CHPPM), Edgewood, MD, and the Waterways Experiment Station (WES), Vicksburg, MS.

FY 1997 Accomplishments:

•	2015	- Developed munitions biomarkers and bioeffects and conduct toxicological evaluation of munitions and degradation products (CHPPM). - Developed toxicity predictions using structure activity relationships (CHPPM). - Continued work to perform cross-species extrapolation of non-mammalian bioassays (USABRDL/CHPPM), apply sentinel biomonitoring systems (USABRDL), and apply methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
•	1171	- Continued to develop fate and transport of military-unique compounds and microbial biomarkers (WES). - Continued to identify biomarkers to monitor bioattenuation of military-unique compounds (WES). - Continued to develop exposure models and decision-making framework for ecological risk assessment (WES).
Total	3186	

FY 1998 Planned Program:

•	3230	- Develop munitions biomarkers and bioeffects and conduct toxicological evaluation of munitions and degradation products (CHPPM). - Develop toxicity predictions using structure activity relationships (CHPPM). - Perform cross-species extrapolation of non-mammalian bioassays (USABRDL/CHPPM), apply sentinel biomonitoring systems (USABRDL), and apply methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL). - Develop fate and transport of military-unique compounds and microbial biomarkers (WES). - Identify biomarkers to monitor bioattenuation and effects of military-unique compounds (WES). - Develop exposure and effects models and decision-making framework for ecological risk assessment (WES).
•	83	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	3313	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology / PROJECT: A835

FY 1999 Planned Program:

•	3155	- Develop munitions biomarkers and bioeffects and conduct toxicological evaluation of munitions and degradation products (CHPPM). - Develop toxicity predictions using structure activity relationships (CHPPM). - Perform cross-species extrapolation of non-mammalian bioassays (USABRDL/CHPPM), apply sentinel biomonitoring systems (USABRDL), and apply methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL). - Develop fate and transport of military-unique compounds and microbial biomarkers (WES). - Identify biomarkers to monitor bioattenuation and effects of military-unique compounds (WES). - Develop exposure and effects models and decision-making framework for ecological risk assessment (WES).
Total	3155	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3103	3418	3308
Appropriated Value	3103	3418	
Adjustments to Appropriated Value	+83	-105	
FY 1999 President's Budget	3186	3313	3155

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A876

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A876 Plasma Energy Pyrolysis System	7149	5815	0	0	0	0	0	0	12964

A. Mission Description and Budget Item Justification: This project provides a compliance and pollution control technology required to reduce the cost of treatment and disposal of hazardous and toxic site waste streams resulting from production or deactivation of military items or components. Plasma arc technology application enables the military to reduce the need for landfills and their future liability-related issues in a one step, safe, and economic process. The project will deliver an effective compliance technology to control and dispose of recalcitrant hazardous and toxic wastes regulated under Resource Conservation and Recovery Act amendments, in addition to satisfying the increasingly stringent emission standards of the Clean Air Act relevant to open burning/open detonation practices within the military. A plasma arc processing unit can reduce the significant costs associated with the many steps involved in other conventional hazardous waste treatment technologies, such as: sample characterization lead time, health and safety exposure risks to workers, and increased risks to the general public from accidents involving the excavated and transported wastes. The development and field demonstration of plasma arc technology will provide the user community with a much-needed tool for military hazardous waste processing and disposal on a flexible basis. In particular, developing a mobile unit's specifications, design, and blueprints will enable the Army, working with the Air Force, to converge on a mobile unit configuration and cut the time for field implementation.

FY 1997 Accomplishments:

•	7149	- Developed plans and permits for field demonstrations. - Developed and characterized waste matrix guidelines. - Field demonstration.
Total	7149	

FY 1998 Planned Program:

•	5669	- Develop plans and permits for mobile system for field demonstration. - Design and procured mobile unit for field applications. - Field demonstration.
•	146	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	5815	

FY 1999 Planned Program: No funded program in FY 1999.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology / PROJECT: A876

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7343	0	0
Appropriated Value	7343	6000	
Adjustments to Appropriated Value	-194	-185	
FY 1999 President's Budget	7149	5815	0

Change Summary Explanation: Funding: FY1998 - Project is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A877

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A877 Western Environmental Technology Office Environmental Support	4765	6784	0	0	0	0	0	0	11549

A. Mission Description and Justification: This Congressionally-directed effort with the Western Environmental Technology Office (WETO) provides for the transfer of environmental compliance technologies required to reduce the cost for treating hazardous and toxic pollutants from Army industrial operations which include Army ammunition plants, depots, and arsenals, and to help satisfy increasingly stringent environmental regulations on DoD and the Department of Energy (DOE). Those environmental requirements include wastewater discharge standards under the Clean Water Act and relevant State regulations, hazardous air pollutant emission standards under the Clean Air Act Amendments (CAAA), requirements under Federal Facilities Compliance Act and Resource Conservation and Recovery Act and other regulations. The U.S. Army Construction Engineering Research Laboratories (CERL) works closely with the Industrial Operations Command (IOC) to transfer environmental compliance and pollution prevention technologies to IOC installations. This project will support the transfer of environmental technologies to IOC installations. This enables the Army to reduce environmental compliance costs and future environmental liability costs. The technology transfer projects under this project should result in model industrial operations with environmental compliance which will help accelerate technology transfer to similar industrial operations within DoD. The primary technology transfer agency is the U.S. Army Construction Engineering Research Laboratories, Champaign, IL. WETO is a privatized former component of DOE (as of September 1996). WETO will evaluate and demonstrate technologies to help DOE meet a requirement to clean up its sites.

FY 1997 Accomplishments:

•	4765	- Continued engineering design and evaluation of technologies to remove and detoxify metals and energetics in wastewater. - Continued design and construction of hazardous air pollutant control technology. - Continued construction and evaluation of technologies to treat oily waste and solvents.
Total	4765	

FY 1998 Planned Program:

•	6614	- Continuing engineering design and evaluation of technologies to remove and detoxify metals and energetics in wastewater. - Continuing design and construction of hazardous air pollutant control technology. - Continuing construction and evaluation of technologies to treat oily waste and solvents.
•	170	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	6784	

FY 1999 Planned Program: No funded program in FY 1999.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A877

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4895	0	0
Appropriated Value	4895	7000	
Adjustments to Appropriated Value	-130	-216	
FY 1999 President's Budget	4765	6784	0

Change Summary Explanation: Funding: FY1998 - Project is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A895

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A895 Pollution Prevention Technology	0	0	613	685	721	754	781	0	Continuing

A. Mission Description and Justification: The objective of this project is to develop pollution prevention technologies that directly support Army training, maintenance, and industrial support/manufacturing. Investment in pollution prevention technologies enhances Army Warfighting by maintaining readiness as well as ensuring uninterrupted training. The goal of this project is to increase the availability of Army systems and to reduce life cycle costs by 15-30% through the elimination or reduction in the usage of hazardous/toxic substances in the design, manufacture, maintenance, and disposal of Army materiel. This project funds four specific tasks: (1) the continued development of new primer compositions for small caliber ammunition known as Metastable Interstitial Composites (MICs). This task is part of the integrated Green Bullet initiative and is the technology to eliminate lead salt compounds used in today's military small arms primers; (2) the elimination of electrodeposition of hazardous chromium from chromic acid to bore surfaces of medium caliber gun barrels through the use of Cylindrical Magnetron Sputtering technology and the employment of new coating materials. This task is part of the integrated Green Gun Barrel Initiative; (3) the development of a new, non-toxic, low volatile organic compounds (VOC), wash primer for use as a metal surface pretreatment for both ferrous and non-ferrous surfaces to eliminate the high cost of installing and operating mandated air quality compliance systems at the application facilities; (4) the development of novel in-process surface/solvent diagnostics technology for metal cleaning operations to minimize solvent usage where use of organic solvents cannot currently be eliminated. Having automated diagnostics for both the metal surface cleanliness and the solvent contaminant level will assure the minimization of hazardous waste generation for metal plating and coating processes. The project addresses high priority Army environmental quality technology user requirements and supports compliance with pollution reduction goals set forth in Presidential Executive Order 12856. This project is managed for the Army Materiel Command by the Industrial Ecology Center located at the U.S. Army Armaments Research, Development, and Engineering Center, Picatinny Arsenal, NJ. Work in this project is related to, and fully coordinated with efforts in PE/project 0601102A/BH67, "Environmental Research-Army Materiel Command" and DoD PE 0603716D, "Strategic Environmental Research and Development Program."

FY 1997 Accomplishments: Project not funded in FY 1997.

FY 1998 Planned Program: Project not funded in FY 1998.

FY 1999 Planned Program:

•	613	- Establish critical manufacturing/processing baseline and test, evaluation and process control parameters for MIC synthesis - Complete fabrication of test apparatus and apply new bore coatings to test specimens using a cylindrical magnetron sputtering (CMS) approach. - Identify and obtain candidate water born and high solid polymer wash primers for adhesion, salt spray, appearance, and application testing. - Measure spectra versus concentration for representative contaminant and develop algorithms for quantification from observed spectral features
Total	613	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology / PROJECT: A895

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	0	0	0
Appropriated Value			
Adjustments to Appropriated Value			
FY 1999 President's Budget	0	0	613

Change Summary Explanation: Funding: FY1999 – Project developed to highlight efforts in this area.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A896

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A896 Base Facility Environmental Quality	7138	2973	4343	4383	4640	4702	4879	0	Continuing

A. **Mission Description and Justification:** This project provides the Army with the technical capability to protect and improve the biological and physical characteristics of fixed installation training and testing areas needed to sustain readiness while also conserving protected natural and cultural resources, including threatened and endangered species. Technology developed within this project will enable training and testing land users to match usage events and schedules to the capabilities of specific land areas, and will also provide advanced methods to restore lands damaged in readiness exercises. Efforts under this project will also enable the Army to prevent pollution in facilities base operations, and to comply with the myriad Federal, state, and host country environmental regulations dealing with hazardous and non-hazardous water, wastewater, air emission, solid waste (including sediment discharge) and noise. An additional effort is the development of environmental monitoring and modeling capabilities to support environmentally sustainable installation lands and facilities. The primary developing agency is the U.S. Army Construction Engineering Research Laboratories, Champaign, IL.

FY 1997 Accomplishments:

•	3344	- Developed Phase I plant succession model for training land carrying capacity.
		- Developed TES Army wide status reporting system.
		- Initiated development of pollution prevention procedures for solvents, cleaners, and oil-water separation.
•	3794	- Developing a Congressionally-mandated agriculture-based bioremediation capability (to be executed by Army Environmental Center).
Total	7138	

FY 1998 Planned Program:

•	2973	- Develop cause/effect relationships between training activities and impacts on threatened and endangered species.
		- Complete addition of weather statistics and terrain effects on improved noise propagation models.
		- Identify and characterize the mechanisms that cause volatile organic carbon emissions from solvent and petroleum product usage.
Total	2973	

FY 1999 Planned Program:

•	4343	- Develop validated risk assessment models to determine the effects of Army activities on habitat disturbance.
		- Provide knowledge, approach, and tools to match training land use and land capacity in selected ecoregions.
		- Develop decision support methodologies for assessment and mitigation of maneuver training impacts on threatened and endangered species.
		- Complete guidance for identifying pollution prevention alternatives for Army applications.
Total	4343	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE
	February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	0602720A Environmental Quality Technology	A896

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7257	3067	4553
Appropriated Value	7257	3067	
Adjustments to Appropriated Value	-119	-94	
FY 1999 President's Budget	7138	2973	4343

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A908

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A908 Commercialization of Technology to Reduce Defense Costs Initiative	0	4845	0	0	0	0	0	0	4845

A. Mission Description and Justification The objective of this technology commercialization program is to significantly lower U.S. Defense Department procurement costs through integration of the technology commercialization process from the laboratory workbench to end users. Advanced methodologies will be utilized for identification, optimization, and commercialization of developed at Federal Defense and non-defense laboratories. A partnership has been formed with the Federal Laboratory Consortium (FLC), and UNISPHERE Institute (UNISPHERE) to assist in implementation of this program. This partnership will support DoD by identifying, developing, testing, evaluating, and transitioning state-of-the-art methods and technologies to improve quality, efficiency, and compliance and promote reduction of Defense procurement costs. Commercialization plans will be prepared for technologies having sufficient market potential after successful matching. These plans shall include a management plan and time table for closing business deals, finance plan outlining resources required to bring the technologies to market, and demand side targets pinpointing specific buyers and/or end users of the technology. A systematic and thorough assessment and verification of technologies will be conducted through extensive multilevel testing and demonstration.

FY 1997 Accomplishments: Project not funded in FY 1997

FY 1998 Planned Program:

•	4723	- Identification of Critical Technologies in which small and mid-sized firms have a strong innovative capacity. FLC Regional Coordinators and others will assist in identification of government funded technologies which are deemed to have commercial application. - Development of Technology Transition Protocol (TTP): A comprehensive (TTP) for each technology selected will identify engineering and performance and test requirements to validate technologies. - Technology Assessments: - Demonstration-Validation-Optimization: Existing Centers of Excellence and laboratories will be used to verify and optimize technologies. - Market Assessments/Proactive Matching: surveys of relevant markets in which lab technologies and products will be conducted to determine if cost effective market entry is possible. A strategy will be developed to mach identified technologies and targeted lab and/or firms with lab licensed technology.
•	122	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	4845	

FY 1999 Planned Program: Project not funded in FY 1999

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE
	February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	0602720A Environmental Quality Technology	A908

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	0	0	0
Appropriated Value	0	5000	
Adjustments to Appropriated Value		-155	
FY1999 President's Budget	0	4845	0

Change Summary Explanation: Funding: FY1998 - Project is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A917

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A917 Computer Based Land Management	0	3877	0	0	0	0	0	0	3877

A. Mission Description and Justification These funds would be used to improve DoD land managers' ability to characterize and monitor broad scale changes occurring across training and testing lands by utilizing and exploiting remote sensing and field survey technologies. Major improvements could be made in data acquisition, data display and visualization, and integration of these data into dynamic landscape models. Threatened and endangered species management capabilities on military lands have been focused on development of knowledge bases, particularly in understanding the impacts of specific military activities on species whose presence is currently impacting the use of military lands. Accurate, effective, and predictive methodologies and models for land condition assessment are needed that correlate and predict the relationship between military use and the patterns and nature of impacts associated with each type of use under varying climatic and landscape conditions. The proposed funding would be focused to develop these methodologies and models that, parenthetically, the private sector has not pursued.

FY 1997 Accomplishments: Project not funded in FY 1997

FY 1998 Planned Program:

•	3779	- Development of a computer-based land management model (LMM) to reduce time and costs of training area recovery
•	98	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	3877	

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	0	0	0
Appropriated Value	0	4000	
Adjustments to Appropriated Value		-123	
FY 1999 President's Budget	0	3877	0

Change Summary Explanation: Funding: FY1998: Project is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: AF25

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AF25 Military Environmental Restoration Technology	2481	3223	3346	3616	3775	3902	4049	Continuing	Continuing

A. **Mission Description and Justification:** This project provides cost effective technologies required to clean up 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. 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; 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. 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 primary developing agency is the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

FY 1997 Accomplishments:

•	2481	- Developed improved laboratory analytical methods for identifying organic contaminants in soils. - Demonstrated thermal desorption sampler for volatile organic compounds and solvent detection. - Completed design criteria and assessment of in-situ and ex-situ chemical processes for remediation of explosives/organics-contaminated soils. - Demonstrated physical separation technology for remediation of heavy metals-contaminated soils and test methods to predict mobility of metals.
Total	2481	

FY 1998 Planned Program:

•	3148	- Develop advanced groundater sampler/biosensor system as part of the SCAPS and initiate evaluation of electromagnetic induction technologies for unexploded ordnance (UXO) detection. - Develop Groundwater Modeling System (GMS) Version 2, housing a remedial module with fate/transport packages for explosives and metals. - Develop improved chemical analytical techniques for detecting and quantifying special organic compounds in complex media. - Provide technical data package of advanced concepts for in-situ biological treatment of explosives-contaminated media. - Develop chemical extraction technologies for heavy metals-contaminated soils.
•	75	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	3223	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE
	February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	0602720A Environmental Quality Technology	AF25

FY 1999 Planned Program:

•	3346	- Develop an enhanced instrumentation package for the SCAPS and continue development of UXO detection technologies and of on-site data visualization and analysis capabilities. - Incorporate in-situ bioremediation and electrokinetics design modules into the GMS version 2 model. - Continue development of advanced biological ex-situ (bioreactors) and in-situ treatment of contaminated soils and physical/chemical methods for groundwater.
Total	3346	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2579	3326	3507
Appropriated Value	2579	3326	
Adjustments to Appropriated Value	-98	-103	
FY 1999 President's Budget	2481	3223	3346

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: AF26

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AF26 Agricultural-Based Bioremediation	0	3877	0	0	0	0	0	0	3877

A. Mission Description and Justification: FY1997 Agriculture Based Bioremediation work has the Army Environmental Center (AEC) and the Construction Engineering Research Laboratory (CERL) demonstrating technologies to restore contaminated military and civilian sites especially those located in fragile Pacific island ecosystems. CERL provides research and development support and distribute the funding. AEC provides overall program management. Demonstrating bioremediation technologies that are agriculturally based will enhance the Army's ability to restore contaminated sites with fewer dollars and in a way that is widely accepted by the stakeholder community. Using fewer dollars for restoration purposes will allow those dollars to be directed to the readiness stance of the overall military. Stakeholder acceptance, both regulatory and public, is enhanced by employing "green technology." These green technologies, by being efficient and less costly, meet an ever growing requirement to produce clean sites with fewer dollars. Focusing on fragile Pacific island ecosystems could enable the Army to gain regulatory acceptance by the Environmental Protection Agency's Region IX, a major force behind gaining acceptance throughout the remaining regions.

FY 1997 Accomplishments: Project not funded in FY 1997

FY 1998 Planned Program:

•	3779	- Additional data will be collected to base scientific and technical assessments upon.
•	98	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	3877	

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	0	0	0
Appropriated Value		4000	
Adjustments to Appropriated Value		-123	
FY1999 President's Budget	0	3877	0

Change Summary Explanation: Funding: FY1998 - Project is a Congressional add.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602782A Command, Control, Communications Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	13893	16197	19746	18176	18934	19412	19924	Continuing	Continuing
AH92 Communications Technology	7583	8847	12911	9924	10338	10599	10879	Continuing	Continuing
A779 Command/Control (C2) and Platform Electronics Technology	6310	7350	6835	8252	8596	8813	9045	Continuing	Continuing

Mission Description and Budget Item Justification: The communications technology project (AH92) conducts research of those advanced communications technologies required to provide a worldwide communications capability. The objective of the command/control (C2) and platform electronics technology project (A779) is to expand scientific knowledge for demonstration of state-of-the-art technologies, including command/control and electronic systems/subsystems, performance reliability, maintainability, safety, survivability, and man-machine interface for all Army air and ground platforms, including soldier systems and equipment. Investigation of an infrastructure that will allow timely distribution, display and use of C2 data on Army platforms will lead to greater battlefield functional capabilities, survivability and total integration into the digitized battlefield. These technologies will provide field commanders with the capability to communicate to and from virtually any place on earth. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. Work in this program element is related to and fully coordinated with efforts in PE 0603006A (Command, Control and Communications Advanced Technology), PE 0602783A (Computer and Software Technology) and PE 0603734A (Military Engineering Advanced Technology). It includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. Work in this program element is performed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Monmouth, NJ.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602782A Command, Control, Communications Technology

PROJECT: AH92

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH92 Communications Technology	7583	8847	12911	9924	10338	10599	10879	Continuing	Continuing

A. **Mission Description and Justification:** The applied research efforts in this project focus on developing and leveraging/adapting commercial communications technologies required to meet the information needs of the Force XXI battlefield. Several of the efforts also provide supporting technology for the digital battlefield communications advanced technology demonstration and the battlefield information transmission strategy . Key technologies being addressed include: the adaptation and implementation of asynchronous transfer mode switching technology in a hostile mobile environment, the adaptation and interface with commercial personal communications technology, development of realistic models for emerging communications systems in dynamic field environments, the development and application of several tactical antenna technologies, the development of photonic controls for phased array antennas, and the development of solutions to address problems associated with implementation of mobile internet protocol spread across different networks. These efforts also directly support the information systems and defense technology objectives outlined in the Defense Technology Area Plan and the advanced battlespace information systems study.

FY 1997 Planned Program:

- 2901 – Fabrication and characterization of Optical Phased Locked Loop (OPLL) laser completed. Fabrication of OPLL module underway.
  – Developed software for modeling high capacity communication transmission systems in a dynamic, on-the-move battlefield environment.
- 909 – Developed enhanced personal communications services (PCS) wireless private branch exchange (PBX) technology to reduce base station requirements in support of digital battlefield communications.
  – Initiated development of a next generation PCS capability for the dismounted soldier by adapting commercial cellular code division multiple access and wideband code division multiple access technology, leveraging DARPA small unit operations technology developments, and global mobile information systems developments.
- 3473 – Implemented multi-channel hierarchical video routing between asynchronous transfer mode (ATM) and internet protocol (IP) multicast networks to permit interactive video teleconferencing, allow remote updates to battlefield situation displays, and provide graceful performance degradation in the event of a lost data channel.
  – Implemented and integrated broadcast ATM protocol with a radio access point.
  – Completed development of conformal, structurally embedded reconfigurable antenna technology (SERAT) to reduce size, weight, and electromagnetic signature of aircraft/vehicle communications antennas.
  – Completed design and fabrication of very high frequency/ultra-high frequency multiband antenna for multimode, multiband radios.
  – Demonstrated optically activated antenna switch to improve frequency switching efficiency.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology
	PROJECT AH92

FY 1997 Planned Program (Continued):

– Continued development of range extension and testing in conjunction with digital battlefield communications radio access point and high capacity trunk radio programs.

•	300	– Continued evaluation of information protection technologies focusing on protection and detection of network attacks to the tactical internet command and control infrastructure.
Total	7583	

FY 1998 Planned Program:

•	4350	– Solve address problems of mobile IP hosts and dynamic networks spread across different IP nets and ATM in hostile environments. – Investigate mobile ATM and resource allocation to support operations of mixed ATM/IP/narrow integrated services digital networks in dynamic hostile environments. – Evaluate commercial network management software tools. – Test and evaluate a SERAT conformal antenna mounted on a ground vehicle. – Evaluate fixed station multiband very high frequency/ultra-high frequency antennas – Continue development of super high frequency on the move antenna positioner/tracker and develop element topology for structure tuned very high frequency antenna.
•	3338	– Prototype integrated photonic control sub-system for single/multi-panel optically controlled phased array communications antennas. – Evaluate very high frequency single channel ground and airborne radio system (SINCGARS)/mobile subscriber receiver/transmitter multiplexer prototype in rapid force projection initiative (RFPI) light digital tactical operations center (TOC) exercise. – Expand the communications system performance models to include the emerging multicast and multimedia communications technologies and systems.
•	659	– Continue development of next generation PCS capability for the dismounted soldier and evaluate prototype technology in a lab testbed environment. – Experiment and assess commercial PCS technology in a tactical environment and investigate military back haul capability.
	500	– Continue technology development for tactical internet command and control protection with focus on providing network access protection tools.
Total	8847	

FY 1999 Planned Program:

•	3576	– Continue development of solutions to address problems of dyanmic and mobile IP hosts and spread across different IP and ATM networks in hostile communications environments. – Continue to develop mobile ATM and resource allocation for mixed network operations in a dynamic, hostile communications environment. – Integrate rule-based engine with network management prototype and conduct operational testing.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology
	PROJECT AH92

FY 1999 Planned Program: (continued)

– Apply SERAT technology to ground environments, and experiment with structure-tuned antenna technology. Evaluate/demonstrate a self steering capability for super high frequency on-the-move satellite communications antennas.

- 3560 – Complete development of the integrated photonic control system for single/multi-panel phased arrays, and integrate/demonstrate on a single panel phased array antenna.
  – Investigate evaluate ultra high frequency digital multiplexer and wideband power amplifier technologies to reduce interference from co-located radios, reduce noise induced bit errors, and improve radio range performance.
  – Continue efforts to expand the communications system performance models and provide virtual communications systems models that support man-in-the-loop evaluations.
- 2275 – Continue experimentation of commercial PCS technology for dismounted soldiers and enhance commercial PCS waveforms to protect against communication threats. Test secure handsets in a tactical environment.
- 3500 – Continue development of protection techniques for the tactical internet expanding the effort to address intrusion detection and host level protection.

Total 12911

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7863	9254	9925
Appropriated Value	7863	9254	
Adjustments to Appropriated Value	-280	-407	
FY 1999 President's Budget	7583	8847	12911

Change Summary Explanation: Funding: FY 1999 Funding increase to support development of protection techniques for the Army's Tactical Internet

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602782A Command, Control, Communications Technology

PROJECT: A779

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A779 Command/Control (C2) and Platform Electronics Technology	6310	7350	6835	8252	8596	8813	9045	Continuing	Continuing

A. **Mission Description and Justification:** The objective of this project is the exploration of new concepts and techniques in command/control and platform electronics integration to achieve new and enhanced military functional capabilities. Emphasis is on mission planning, rehearsal, execution and monitoring, precision navigation and landing, command and control, and integration with the evolving digital battlefield. New enabling technologies which support the current thrusts are also explored, such as advanced controls and displays, voice interactive technology, 3D visualization, decision aids and tactical planning aids, data transfer, distributed data bases, advanced open system architectures, visionics technology and integration concepts which contribute to digitization of the battlefield and provide command and control on the move. The project serves as a direct technology feed to the following advanced warfighting experiments, Advanced Technology Demonstrations (ATD) , Advanced Concept Technology Demonstrations (ACTD) and Defense Technology Objectives (DTO): Task Force XXI (TF XXI) and Division (DIV) XXI advanced warfighting experiments, Battlespace Command and Control (BC2) ATD, Rapid Terrain Visualization ACTD, Battlefield Awareness and Data Dissemination ACTD, Joint Countermine ACTD, Navigation Warfare ACTD, Consistent Battlespace Understanding DTO; Forecasting, Planning, and Resource Allocation DTO; and Integrated Force Management DTO.

FY 1997 Accomplishments:

- 2310 – Developed technology that enables digital terrain models and video recording technology to be incorporated into a precision navigation system. Enhanced data reduction facilities for hosting on an NT Windows platform.
  – Assessed state of the art anti-jam protection technologies (advanced antenna technology, digital filters, fast-fourier transforms) for integration into the precision navigation system.
  – Developed a Global Positioning System (GPS) Model that supports Command and Control simulations.
  – Developed a multi-sensor integration technique for differential GPS precision approach and landing in a tactical environment to provide robustness during periods of GPS outages caused by jamming or masking.
- 4000 – Demonstrated battle planning functions and 3-dimensional rendering across three hardware platforms including Army Common Hardware.
  – Conducted feasibility demonstration for speaker independent continuous speech recognition for hands free operations in simulated noisy environments.
  – Developed capability to translate textual operations order into German and French.
  – Completed preliminary design work on course of action analysis and collaboration tools to support battle planning in distributed operations.

Total 6310

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology PROJECT A779

FY 1998 Planned Program:

•	3600	– Demonstrate real-time platform positioning accurate to 1-3 meters to enhance situation awareness in all environments (electronic counter measures (ECM) and nap of earth) with registration to digital terrain modeling. – Conduct flight test of the multi-sensor differential GPS precision approach/landing. Assemble a precision approach database with raw sensor data that will support the development of new techniques, algorithms and Kalman filters for multiple Army airborne platforms. – Evaluate concepts for employing GPS pseudolites (ground based devices transmitting GPS-like signals) to reduce GPS signal acquisition times under a hostile ECM environment.
•	3750	– Demonstrate a battlespace planning and visualization system that integrates emerging technologies with existing DoD systems to enhance battlespace awareness and facilitate tactical assessment, forecasting, information visualization, course of action analysis and other critical C2 functions. The resulting system will provide real time planning, rehearsal and monitoring capabilities to commanders, analysts and staff.
Total	7350	

FY 1999 Planned Program:

•	2000	– Model/simulate battlespace tactical navigation (BTN) system architecture concepts that provide robust and precise platform positioning. GPS pseudolites, anti-jam GPS, video/imagery registration and small, low cost self-contained sensor technologies will be researched and evaluated. The system concept will be scalable in that it will support multiple platform types at all echelons. – Develop prototype designs for the evaluation of BTN concepts.
•	4835	– Develop and demonstrate battle planning and visualization technology that integrates multiple existing DoD systems with emerging planning and user interface technologies to enhance all-echelon battlespace awareness down to the individual soldier. This battle planning and visualization technology will provide real-time/ near real-time hyperlinks to multiple battlefield information sources and innovatively display and interact with commanders and staff to accelerate and improve the commander's nine-step planning process. – Test and evaluate forecasting, continuous planning/scheduling, interactive 3-D exploration of the battlespace, speech interaction and other advanced capabilities in field experiments.
Total	6835	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7113	7584	8255
Appropriated Value	7113	7584	
Adjustments to Appropriated Value	-803	-234	
FY 1999 President's Budget	6310	7350	6835

Change Summary Explanation: Funding: FY 1997 funding (-803) reprogrammed to support other high priority requirements.
FY 1999 funding (-1420) reprogrammed to support other high priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602783A Information and Communication Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	6419	658	2185	3324	2217	2300	2456	Continuing	Continuing
DY10 Computer and Information Science Technology	2231	658	2185	3324	2217	2300	2456	Continuing	Continuing
A094 Tactical Software Technology	4188	0	0	0	0	0	0	0	5975

Mission Description and Budget Item Justification: This program element develops and applies information technology to improve the performance and reduce the cost of Army tactical Command and Control (C2) systems and tactical embedded real-time systems. Efforts capitalize on computationally intensive approaches that exploit the rapidly evolving capabilities of emerging commercial computer technology. Focus is on providing general solutions that can be applied to a wide variety of C2 problems. Current examples include information distribution paradigms for constrained environments (e.g., bandwidth or security limited but not computationally limited), found in tactical systems. Further specific concentrations are on applications to support tactical information distribution for situation awareness and interoperability of tactical systems. The program addresses technical issues in the development of the Army's information mission areas of automation, communication, and visual information. In addition, the program investigates the infrastructure in communications and computers to support the information and communications needs of weapons platforms. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. This program is managed primarily by the Army Research Laboratory (ARL). Efforts in this program element include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2. Funds were reprogrammed, in FY99 and out, into DY10 to leverage and transition 6.1 research in intelligent systems and telecommunications to Army Materiel Command (AMC) Research, Development and Engineering Centers (RDECs).

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602783A Information and Communication Technology

PROJECT: DY10

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DY10 Computer and Information Science Technology	2231	658	2185	3324	2217	2300	2456	Continuing	Continuing

A. **Mission Description and Justification:** This project provides for the adaptation and application of research for the development and modernization of standard Army computer, command and control, and information systems. The project addresses technical issues in the development of an information architecture which will interconnect regional, local, and end user computing services resulting in a fully connected information management system with minimum data storage and maximum data access. The objectives of this project are to improve computer and communication system efficiencies by exploiting emerging technologies to reduce system development and maintenance costs and time, and to support modernization efforts of computing and communications hardware and software presently used in Army deployments throughout the world in both tactical and non-tactical environments. In addition, this project will achieve significant software reuse across Department of Defense (DoD) systems. This project also includes the application of intelligent system techniques in such areas as medical and maintenance diagnostics. New techniques, which include fuzzy logic and neural networks, will allow for expansion of applications and an increased focus on predictive application. Both medical and maintenance diagnostics applications of intelligent systems techniques need exploration for identification of high payoff applications. Intelligent decision support has the potential for significant military impact in these areas. The potential payoffs of this project are: measurable improvements in productivity and quality; reductions in utilization of life cycle resources by institutionalizing software management procedures and practices with savings in development and maintenance costs; increased communication systems capacity; responsiveness, reliability, interoperability, availability, and maintainability.

FY 1997 Accomplishments:

•	2231	- Developed prototype medical and maintenance diagnostics applications using intelligent system techniques. - Developed concepts to be used in formulating DoD policy and in developing or procuring systems for a unified DoD records management process. - Extended records management research to incorporate data warehousing concepts and techniques into Army information systems and command, control, communications and intelligence (C3I) applications. - Used group systems in a distributed mode with one or more Army commands. - Developed Pulse-coupled neural nets for language understanding for unique military user-interface applications. - Developed collaborative group support systems concepts that enabled groups to collaborate in decision making processes; delivered to Aviation Systems/Missile Command Software Engineering Directorate, Waterways Experimental Station Information Systems Lab, Communications Electronics Command Software Engineering Center .
Total	2231	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602783A Information and Communication Technology
	PROJECT: DY10

FY 1998 Planned Program:

•	339	-Develop executable protocol specifications for and model the asynchronous transfer mode (ATM) protocol using very high speed integrated circuit hardware development language (VHDL).
•	319	-Incorporate fully developed design database into distributed Computer Aided Prototyping System (CAPS) environment.
Total	658	

FY 1999 Planned Program:

•	2185	- Integrate change/merge capability for software subsystems into rapid prototyping testbed; design system to automate configuration management to improve software evaluation. - Develop distributed and collaborative group support systems for Army Tactical Operations Center (TOC) for battle planning applications to enable geographically separated key commanders to collaborate in realtime and conduct battle planning. - Investigate communication and network techniques in order to enhance the robustness of the tactical internet. - Investigate techniques for advanced human-machine collaboration, to enable the military decision maker to seamlessly interact with the battlefield information environment - Utilize distributed interactive simulation (DIS) to develop and demonstrate interaction among physical models of weapons systems, vehicle systems and sensor systems, providing an effective cost analysis method for reducing system development and maintenance costs.
Total	2185	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2269	679	337
Appropriated Value	2269	679	
Adjustments to Appropriated Value	-38	-21	
FY 1999 President's Budget	2231	658	2185

Change Summary Explanation: Funding: FY99 funds reprogrammed (+1848) from other sources to address high priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602783A Information and Communication Technology

PROJECT: A094

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A094 Tactical Software Technology	4188	0	0	0	0	0	0	0	5975

A. **Mission Description and Justification:** This project addresses the development of software techniques to exploit the rapid advances in computer (hardware) performance that are becoming equally available to both the scientific and tactical community. The vast gap in computational performance and capabilities that used to exist between computer systems in these two domains is rapidly diminishing. Computer power previously available only to scientists and engineers is now becoming routinely available to the soldier and new concepts for one domain will be applicable to the other. This project ensures that a fresh perspective on the application of this power is maintained. It concentrates on computationally intensive paradigms for information distribution and manipulation in severely constrained environments such as those encountered in the use of existing low-bandwidth tactical radios. This includes the automation of information exchange and research into the tactical aspects of the data abstractions of military concepts. It identifies the necessary functions for a simulation capability that supports the evaluation of C4I battlefield architectures and digitization and communications science technologies for operational utility and predicted technical performance. This project seeks to develop the computational technology to achieve efficient utilization of advanced computer architectures at the tactical level. This project reflects movement of funds within ARL due to the Federated Laboratory Restructuring.

FY 1997 Accomplishments:

- 4188 - Demonstrated synthesis of communication interfaces using Very High Speed Integrated Circuit (VHSIC) Hardware Descriptive Language.
  - Incorporated heuristics of network performance into software and transitioned to the Communication and Electronics Command Technology Demonstration.
  - Developed software to support reasoning at multiple levels of abstraction which cooperatively process information from multiple heterogeneous databases.
  - Conducted research that advanced the science of rendering complex terrain, abstract data and battlefield objects in 3-D to avoid clutter and perceptual and cognitive overload.

Total 4188

FY 1998 Planned Program: Project not funded in FY 1998

FY 1999 Planned Program: Project not funded in FY 1999

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602783A Information and Communication Technology / PROJECT: A094

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4231	0	0
Appropriated Value	4231		
Adjustments to Appropriated Value	-43		
FY 1999 President's Budget	4188	0	0

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	37505	50802	37488	39998	40364	41383	42494	Continuing	Continuing
A855 Topography, Image intelligence, and Space Technology	8412	8653	9103	9426	9786	9995	10325	Continuing	Continuing
AH71 Atomospheric Investigations	6478	5690	5711	6071	6326	6591	6778	Continuing	Continuing
AT40 Mobility & Weapons Effects Technology	10837	11782	12825	13595	14081	14352	14653	Continuing	Continuing
AT41 Military Facilities Engineering Technology	4150	3371	4047	4183	3934	4111	4196	Continuing	Continuing
AT42 Cold Regions Engineering Technology	5282	4504	3375	3960	3665	3792	3928	Continuing	Continuing
AT45 Energy Technology Applied to Military Facilities	2346	2266	2427	2763	2572	2542	2614	Continuing	Continuing
AT46 Climate Change Fuel Cell Technology	0	7268	0	0	0	0	0	0	7268
AT48 Center for Geosciences and Atmospheric Research	0	7268	0	0	0	0	0	0	7268

Mission Description and Budget Item Justification: The applied research conducted in this program provides technology in direct support of critical warfighter functions of mobility, countermobility, survivability, sustainment engineering, and topography needed to win on the modern battlefield. Research is conducted that supports the special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. Key operational technologies developed are demonstrated to Army units under program element 0603734A (Military Engineering Advanced Technology). Results are tailored to support the material development, test, and acquisition community in evaluating the impacts of weather, terrain, and atmospheric obscurants on military operations. Research develops and exploits a wide range of innovative technologies and applies them to Defense unique planning, acquisition, revitalization, and sustainment processes. The goal of this research is to 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. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Defense Reliance Agreements on Civil Engineering and Battlespace Environments with oversight provided by the Joint Directors of Laboratories and Joint Engineers. These projects include non-system specific development efforts toward specific military needs and are therefore appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: A855

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A855 Topography, Image Intelligence, and Space Technology	8412	8653	9103	9426	9786	9995	10325	Continuing	Continuing

A. Mission Description and Justification: This project funds the technology to enhance the tactical commander's ability to effectively visualize the battlespace, to easily represent battlefield information, and to exploit his knowledge of combat relevant intelligence as a force multiplier to conduct and win Force XXI operations across the operational continuum. Using tactical/strategic/space sensor data, together with terrain data bases as input, the technology program emphasizes automating the processes of detecting changes on the battlefield, identifying battle significant features, exploiting space based/remote sensing information (especially for deep operations and over denied areas), and integrating the impacts of the battlefield environment to significantly improve combat planning and operations. Development efforts will enable the commander to locate and position enemy and friendly forces in day/night all-weather conditions, provide crucial terrain data for command and control systems (C2) as well as modeling and simulation systems, and enhance the speed and accuracy of maneuver and weapon systems. The technology being developed will help those who move, shoot, and communicate on the battlefield to "fight smarter" through superior knowledge of the total battlefield terrain and environment. Work in this project significantly enhance the geospatial data management and dissemination capabilities of storing, formatting, transforming, and distributing extremely large volumes of terrain data at real or near-real times. Weather/atmospheric effects data is provided by the Army Research Laboratory Project AH71 in this PE. This project is managed by the U.S. Army Topographic Engineering Center, Alexandria, VA.

FY 1997 Accomplishments:

- 8412 - Developed a DoD standard coordinate conversion and datum transformation software package.
  - Developed rapid, dynamic, 3-D battlefield environment/terrain visualization capabilities in a virtual reality environment for tactical and training applications.
  - Developed distributed interactive simulation (DIS) browser supporting dynamic changes during simulation.
  - Developed software and techniques for the identification of man-made materials using far infrared, hyperspectral data.

Total 8412

FY 1998 Planned Program:

- 8653 - Develop initial capability for automated feature attribution based on multispectral imagery data.
  - Link 3-D model and texture library to database generation capability.
  - Develop parametric modeling capability for battlefield terrain simulation.
  - Develop procedures for ensuring that mapping, charting, and geodesy (MC&G) software adheres to the Defense Information Infrastructure.
  - Develop new methods for portraying terrain analysis product reliability.

Total 8653

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602784A Military Engineering Technology
PROJECT: A855	

FY 1999 Planned Program:

•	9103	- Develop capabilities to support weapon selection by applying physics-based models to simulate applications and visualization capabilities.. - Develop standards, initiate linear feature management development, and demonstrate the management, dissemination, and integration of point data and information. - Incorporate/test initial spectral imagery and synthetic aperture radar automated feature extraction capabilities.. - Develop and explore processes to utilize a disparate array of geospatial information to support a family of common representation. - Test and evaluate an vehicular advanced tactical navigator capability and initiate design of an off-vehicle advanced tactical navigator capability.
Total	9103	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	8377	8929	9719
Appropriated Value	8377	8929	
Adjustments to Appropriated Value	35	-276	
FY 1999 President's Budget	8412	8653	9103

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AH71

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH71 Atomospheric Investigations	6478	5690	5711	6071	6326	6591	6778	Continuing	Continuing

A. **Mission Description and Justification:** This project realistically models atmospheric effects on target acquisition, mobility, lethality, and survivability to provide weather limitations for design and operation of smart weapons, improved war game realism and tactics and improved intelligence preparation of the battlefield. It develops weather decision aids for the commander applying advanced computer techniques; incorporates new technology in meteorological sensor design; develops data fusion techniques to horizontally integrate data from advanced weather sensors and non-weather sensors into decision aids to enhance combat power on the battlefield. This project supports Project Reliance theater data fusion and prediction, atmospheric effects assessment, and battlefield environmental effects joint programs.

FY 1997 Accomplishments:

- 4425 - Completed the horizontal and seamless integration of the Integrated Weather Effects Decision Aid (IWEDA) into battlefield automated systems (BAS).
  - Developed an initial capability to forecast precipitation over the battlefield at tactical scales and add 4-D data assimilation and meteorological satellite initialization capability to the Battlescale Forecast Model.
  - Developed a prototype 4-D computer assisted artillery meteorology software system which provides trajectory and target area meteorology for close and deep attack systems; and develop a proof-of-concept downsized mobile profiling system.
- 2053 - Developed user interface for 2-dimensional limited complex terrain acoustic propagation model.
  - Adapted direct numerical simulations for operational chemical/biological hazard modeling.
  - Enhanced real-time scene visualization data transformation and rendering algorithms to support the integration of battlefield environment data in situation awareness displays.

Total 6478

FY 1998 Planned Program:

- 3178 - Extend the battlescale forecast model (BFM) forecast period to 48 hours and increase forecast accuracy by initializing with higher resolution Air Force or Navy model data.
  - Develop the capability for the All Source Analysis System, the Digital Topographic Support System, the Advanced Mobile Profiling System, and the Maneuver Control System to concurrently retrieve and incorporate weather information in Intelligence Preparation of the Battlefield, trafficability, aviation, and nuclear/biological/chemical applications.
  - Convert the Electro-Optical Tactical Decision Aids including weapon zones, target acquisition ranges, and thermal reversal to distributed client/server applications.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602784A Military Engineering Technology / PROJECT: AH71

FY1998 Planned Program (Continued)

•	2470	- Demonstrate the accuracy achieved by moving the battlescale forecast model (BFM) from the meteorology measuring set to indirect fire control computers and using the BFM to correct for met effects over the entire trajectory path of a projectile. - Develop a decision aid for displaying sound levels as a function of range and direction in the 2-dimensional turbulent boundary layer over flat terrain. - Complete assembly of a prototype MMS-Profiler with data retrieval, database, and BFM software consolidated into a suite of Army computers and demonstrate at the National training Center. - Examine and devise computationally efficient algorithms for dynamic weather data transformations for parallel and scaleable processing architectures with the dynamic terrain data transformations developed in this PE under Project A855.
•	42	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	5690	

FY 1999 Planned Program:

•	3224	- Evaluate converting the BFM to a nonhydrostatic model to improve predictions of severe weather. - Enhance forecaster decision aids with improved algorithms for predicting icing, turbulence, visibility, low cloud, and precipitation. - Incorporate existing acoustic detection algorithms into tactical decision aids using the BFM output to enable troops to determine the optimum placement of acoustic sensors for detection based on atmospheric conditions. - Incorporate an improved BFM for forecast representations in combat simulation and training including clouds, fog, severe weather, and improved battlefield aerosol diffusion at tactical scales.
•	1470	- Evaluate the Prototype MMS-Profiler's ability, at 4 Infantry Division Digitized rotation to provide target area trajectory meteorology for close and deep attack systems; begin insertion of software upgrades such as improved satellite sounding retrievals and BFM.
•	1017	- Develop a user interface for 2-dimensional limited complex terrain/acoustic propagation model for integration into next generation IMETS and C2 systems. - Use transient turbulence theory to develop a high resolution, complex terrain transport and diffusion model which will permit simultaneous calculation of meteorology and hazards prediction with significantly reduced computation time through eliminating the stepwise procedure of traditional approaches for deployment in next generation IMETS and C2 systems.. - Investigate visualization techniques for fusing multiple information sources into a unified visualization of weather with the rapid, dynamic, 3-D battlefield environment/terrain visualization capabilities.
Total	5711	

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AH71

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	6551	5872	6135
Appropriated Value	6551	5872	
Adjustments to Appropriated Value	-73	-182	
FY 1999 President's Budget	6478	5690	5711

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AT40

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT40 Mobility & Weapons Effects Technology	10837	11782	12825	13595	14081	14352	14653	Continuing	Continuing

A. Mission Description and Justification: This project will provide warfighters the technologies for: rapid establishment and repair of lines of communications by both light and heavy engineers in support of US force deployment; optimal obstacle siting based on accurate predictions of enemy movement and the synergistic effects between obstacles and weapons systems; rapid obstacle and barrier creation; accurate assessments of battlefield mobility for maneuver commanders (and materiel developers during virtual prototyping); methodologies to predict coastal effects on logistics-over-the-shore (LOTS) operations; camouflage, concealment, and deception for fixed facilities to deny accurate acquisition and engagement by threat weapon systems; and designs, materials, and construction methods for battlefield, fixed, and forward base survivability against advanced conventional weapons and terrorist weapons. Civil engineering science and technology (S&T) in this project directly supports the Army's DoD Project Reliance S&T responsibilities in airfields and pavements, survivability and protective structures, and sustainment engineering. The work is managed by the U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

FY 1997 Accomplishments:

- 5857 - Completed development of first generation robust theoretical mobility model incorporating non-linear vehicle-terrain interaction; complete development of automated methods to rapidly derive, from standard available data, world-wide high-resolution mobility model input data.
  - Conducted 3-D, lab-scale experiments of rapidly emplaced breakwater concepts to support logistics-over-the-shore operations.
  - Developed design criteria for complex layered antipenetration systems to defeat large penetrating munitions and develop methodology for designing construction components to resist forced entry.
- 4980 - Demonstrated advanced materials for construction of operating surfaces on soft soils; provide guidance for design, placement, and procurement of materials for soft soil stabilization for integration into TM 5-430-00-2 and synthesize theoretical equations, laboratory experiment results, and field data into a preliminary interactive analytical pavement response and performance model.
  - Completed protective concepts for US Army aircraft parked in forward battle areas, criteria and guidance for the protection of deploying forces from sabotage attack, and concepts for protective shelters packages for light forces and evaluated fixed/long-dwell facility decoy concepts.
  - Developed techniques to predict demolition's effects on reinforced concrete and rock structural targets and evaluate integrated obstacle planning software (OPS) algorithms during a full-scale field training exercise.

Total 10837

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602784A Military Engineering Technology / PROJECT: AT40

FY 1998 Planned Program:

•	11782	- Develop simplified survivability analysis procedure for field fortifications; develop camouflage materials and light-weight material revetments for protection of aviation assets; develop/evaluate materials for large area, thermal signature tonedown. - Develop improved analytic procedures for predicting reflections from geologic layers and the ground surface due to subsurface detonations; develop and validate hardening techniques for walls to resist mortar threats. - Conduct 3-D lab-scale experiments of rapidly emplaced breakwater concepts for logistics-over-the-shore operations; develop initial methodology for rapid generation of river basin models for hydrologic forecasting. - Develop advanced pavements materials characterization and classification procedures; develop and validate algorithms to predict performance of expedient airfield pavements. - Validate algorithms to infer structural attributes that are not available but required for bridge assessments; develop techniques for rapid soils properties determination; evaluate techniques for rapid repair of damaged bridges; develop model to predict roadway deterioration under military unique loads in emerging countries. - Enhance NATO Reference Mobility Model for replication of dynamic deformable soil-tire/track interactions; evaluate epoxy/polymer materials for expedient strengthening of roadway surfaces; determine impact of mission specific digital terrain data on mobility predictions.
Total	11782	

FY 1999 Planned Program:

•	12825	- Develop techniques for troop evaluations of the structural integrity of small protective emplacements; evaluate concepts for application of sprayable multispectral CCD tonedown agents for large area signature reduction; correlate target structural damage with target type, geometry, and materials and demolition method. - Develop analytic methodologies to predict down-axis ground shock from fully coupled detonations in slabs; complete static and dynamic laboratory experiments and associated analyses of square concrete structural components with large span-to-thickness ratios; develop and validate hardening techniques for roofs to resist mortar threats. - Design specifications for rapidly installed breakwater; incorporate algorithms into Riverine Analysis Model to calculate probability bands for hydrologic predictions; incorporate real-time nowcast data analyses into logistics-over-the-shore planning model. - Establish criteria and procedures for the use of local materials and equipment for construction of expedient airfields; validate analytic models capable of replicating dynamic pavements and materials response under vehicle loadings and multiple tire interactions. - Develop an analytic capability for automated assessment and load classification of bridges; establish procedures for use of soil vitrification for soil stabilization; complete initial software for synergistic allocation of engineer assets within resource constraints to transportation infrastructure maintenance, repair, and construction tasks. - Develop soil constitutive relationships describing the traction performance of tires operating in coarse-grained soils; develop stress distribution model for tire/track/soil contact area; conduct in-situ field experiments to measure normal and tangential forces occurring at the vehicle/soil interface.
Total	12825	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602784A Military Engineering Technology	PROJECT: AT40

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	11140	12157	13751
Appropriated Value	11140	12157	
Adjustments to Appropriated Value	-303	-375	
FY 1999 President's Budget	10837	11782	12825

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AT41

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT41 Military Facilities Engineering Technology	4150	3371	4047	4183	3934	4111	4196	Continuing	Continuing

A. Mission Description and Justification: This project exploits innovative developments in a wide range of technologies to achieve critically needed cost reductions in Army facility life cycle processes (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal). Current Army infrastructure operations, maintenance, and repair costs alone are about $8.5 billion per year. The goal for the DoD Technology Area Plan is to reduce facility acquisition and maintenance and repair costs 15% by FY 2001 from a 1985 baseline. Meeting this critical goal is not possible without application of significant technology innovation. Products already developed and projected for the future have high civilian sector dual use potential. These include innovations in composite materials, concurrent engineering, collaborative decision support, corrosion resistant coatings, seismic vulnerability evaluations, and knowledge processing. Additionally, significant soldier retention benefits also accrue from providing professional work environments and high quality communities for military families. Under the DoD Project Reliance initiative, the Army is responsible for managing the conventional facilities research and development needs of all the military services through the Construction Engineering Research Laboratories, Champaign, Illinois.

FY 1997 Planned Program:

•	4150	- Integrated installation commanders' facility maintenance management system data warehouses for optimal resource allocation with special emphasis on automated inspection procedures. - Demonstrated concurrently engineered facility delivery process that facilitates multiple discipline interaction. - New design procedures prepared for use of viscoelastic dampers as passive seismic energy dissipation devices. - Developed conductive concrete for electromagnetic shielding applications for secure facilities.
Total	4150	

FY 1998 Planned Program:

•	3371	- Demonstrate the Open Collaborative Engineering framework for modular design and integrated military facility management. - Initiate development of ferromagnetic active tags to monitor status of military structural building systems. - Develop seismic evaluations and rehabilitation methods for military steel frame buildings.
Total	3371	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602784A Military Engineering Technology / PROJECT: AT41

FY 1999 Planned Program:

•	4047	- Enhance the Modular Design for Systems to accommodate 80% of Army facility types. - Initiate development of self-repairing facings, coatings, and membranes for military buildings containing distributed reactive materials in inert casings which when released enable self-repair. - Develop criteria for upgrading seismically vulnerable, concrete frame, barracks structures. - Document effectiveness of isolation and strengthening methods for protecting critical equipment.
Total	4047	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4195	3479	4376
Appropriated Value	4195	3479	
Adjustments to Appropriated Value	-45	-108	
FY 1999 President's Budget	4150	3371	4047

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AT42

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT42 Cold Regions Engineering Technology	5282	4504	3375	3960	3665	3792	3928	Continuing	Continuing

A. Mission Description and Justification: This project is the only DoD exploratory development program focused on the knowledge base and engineering principles needed to sustain an effective war fighting force in winter and the cold regions of the world, including combat support, combat engineering and base/facility construction, operation and maintenance. Research directly lowers high life-cycle costs and extends the abbreviated service life of DoD facilities and provides the basis for extending the operability of forces and materiel in cold weather. Research supports readiness and effectiveness of DoD conventional, light and special operations forces in the Arctic, Alaska, Scandinavia, Korea, Japan, Europe, the U.S. northern tier and remote/high altitude environments. This program is a source of special technologies for civilian engineering and environmental applications not obtainable through the private sector and is essential to improving projection of power and operational capabilities in cold weather areas of the world. The work is managed by the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH.

FY 1997 Accomplishments:

•	4398	- Completed integrated mobility modeling for snow, thawing soil and surface icing conditions for engineer mission analysis. - Completed prototype environmental features signature model for simulation of advanced sensing systems. - Validated prototype materials for low-temperature repairs to concrete and provide design guidance for use of low quality material in pavements for expedient use in theater of operations supporting military infrastructure repair, operation, and design cost reduction programs.
•	884	- Defined effects of snow and frozen ground on mine detection mechanisms and upgrade ability to characterize and forecast streamflow resulting from snowmelt and its impact on bridging and mobility.
Total	5282	

FY 1998 Planned Program:

•	4504	- Generate dynamic integrated IR/MMW winter backgrounds for synthetic scene simulation . - Develop winter effects conditions models for use in Army combat simulations. - Develop methods for expedient stabilization of thawing soils for theater of operations main supply route development and maintenance.
Total	4504	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602784A Military Engineering Technology / PROJECT: AT42

FY 1999 Planned Program:

•	3375	- Develop guidance for soil modifiers and geosynthetics for expedient, low-volume roads in thawing soils. - Identify engineering activities most sensitive to the winter environment in future combat simulations. - Develop finite element models of tires operating in wet, trafficked snow. - Develop map-based products for millimeter wave and infrared sensor performance for battlespace planning and operations. - Develop asphalt pavement temperature model.
Total	3375	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5425	3647	3567
Appropriated Value	5425	4647	
Adjustments to Appropriated Value	-143	-143	
FY 1999 President's Budget	5282	4504	3375

Change Summary Explanation: Funding: FY98 – Congressional add (+1000) to enhance cold regions research; undistributed Congressional reductions (-143)

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AT45

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT45 Energy Technology Applied to Military Facilities	2346	2266	2427	2763	2572	2542	2614	Continuing	Continuing

A. Mission Description Justification: Energy is essential for the modern Army to meet its mission. The research conducted in this project provides the technology for providing energy efficient facilities, adapting new energy source technologies to military facilities, applying cost effective renewable energy technologies for Army uses, and improving the efficiency of Army central energy plants. Research focuses on leveraging industry technology investments and integrating a broad range of advanced technologies into a comprehensive system to meet the specialized needs of the Army utilities systems. Activities include modeling and simulation of thermal loops and electrical systems, developing new analytic techniques, and incorporating new system designs and hardware in conjunction with industry. Research products/systems are integrated in a "low energy" model installation program. Research products are transferred to the field and used in new construction and in upgrades of existing facilities. The Executive Order implementing the Energy Policy Act of 1992 requires the Army to reduce energy consumption 20% by 2001 from the 1985 baseline. This project is managed by the Construction Engineering Research Laboratories, Champaign, Illinois.

FY 1997 Accomplishments:

- 2346 - Provided Department of Energy a repository of designs for standard military facilities.
  - Developed methods for adopting fuel cell technology in Army energy plants.
  - Developed advanced digital control for heating, ventilation, air-conditioning (HVAC) to improve accuracy, reduce energy costs, and improve indoor air quality.
  - Completed application guidelines for emerging natural gas based cooling systems.

Total 2346

FY 1998 Planned Program:

- 2266 - Develop methodology to determine the optimal mix of centralized and decentralized energy supply options for Army facilities.
  - Complete application guidelines for phosphoric acid fuel cell technology.
  - Develop methodology for optimizing natural gas distribution systems for Army facilities.
  - Initiate development of virtual reality based design tools for building envelope, electrical and mechanical systems.

Total 2266

FY 1999 Planned Program:

- 2427 - Complete self-tuning adaptive control algorithms for utility plant automation.
  - Develop methodology for optimizing electrical distribution and supply to Army facilities.
  - Develop concurrent engineering principles for community design concepts between electrical and mechanical building systems.

Total 2427

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602784A Military Engineering Technology	PROJECT: AT45

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2372	2338	2564
Appropriated Value	2372	2338	
Adjustments to Appropriated Value	-26	-72	
FY 1999 President's Budget	2346	2266	2427

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AT46

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT46 Climate Change Fuel Cell Technology	0	7268	0	0	0	0	0	0	7268

A. Mission Description and Justification: The purpose of this project is to stimulate growth in the fuel cell industry which will lower costs through economies of scale and competition and to determine the role fuel cells should play in the DoD long-term energy supply strategy. The three Services, acting through the Defense Utilities Energy Coordinating Council, requested that the U.S. Army Construction Engineering Research Laboratories, a U.S. Army Corps of Engineers laboratory affiliated with the University of Illinois at Urbana-Champaign, coordinate this fuel cell demonstration program for all three Services. Further research to lower the installed cost of fuel cells to $1,500/kW is required before this technology can be economically viable. This project will focus on that objective.

FY 1997 Accomplishments: Project not funded in FY 1997

FY 1998 Planned Program:

•	7086	- Develop fuel cell technology including cell stack, fuel processor, inverter, power plant module, and alternative fuels will ensure broader application of fuel cells to meet Army electric power requirements. This research will involve a collaborative effort with fuel cell industry partners and the National Defense Center for Environmental Excellence.
•	182	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	7268	

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value	0	7500	
Adjustments to Appropriated Value		-232	
FY 1999 President's Budget	0	7268	0

Change Summary Explanation: FY98: Project is Congressional add. Adjustment reflects undistributed Congressional reductions.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AT48

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT48 Center for Geosciences and Atmospheric Research	0	7268	0	0	0	0	0	0	7268

A. Mission Description and Justification: Through a Center for Geosciences and Atmospheric Research this project will enable the exploration of applied research solutions and further the technology transition of these solutions in the geosciences technology areas of interest to the DoD service labs. These interests include numerically based solutions for automated weather prediction, remote sensing, and hydrological coupling of complex weather and terrain. These efforts will enhance the military's tactical weather support capabilities, in such areas as chemical/biological agent defense, decision aids for mission planning, rehearsal and training, mobility assessments, and soldier stress from weather exposure. These funds have been provided to the Army Research Laboratory as a result of Congressional interest for enhanced geoscience technology applied research for DoD applications.

FY 1997 Accomplishments: Project not funded in FY 1997

FY 1998 Planned Program:

- 7086 - From first principles, develop, test, and evaluate parameterized models of the unresolved meteorological variables that support the prediction of atmospheric motions at Large Eddy Simulation scales (10s of meters) and remain consistent with the similar parameterizations used in current mesoscale (10s of kilometers) forecast models.
  - Develop and execute a field research program with the objective of developing realistic parameterization of the nocturnal, stable atmospheric boundary layer using cutting edge technology and innovative ideas for describing an intermittent, non-stationary, heterogeneous turbulent flow over highly complex terrain.
  - Develop techniques for incorporation of active and passive remotely sensed data (satellite, ground, radar, lidar) into high resolution nowcast and forecast models used by DoD.
  - Develop techniques to couple DoD atmospheric and hydrologic models permitting realistic feedback between component systems, such as the Army Battlescale Forecast Model (BFM), the Navy Coupled Ocean Atmosphere Meteorological Prediction System (COAMPS), and the Air Force's MM5 models with the Army's Watershed Modeling System.
  - Develop and validate techniques to determine multi-wavelength (millimeter wave to ultraviolet) visibility in the battlespace, emphasizing the atmospheric boundary layer, using both numerical weather prediction models and remotely sensed information.
  - Develop an understanding of how the differing interactions of visible, infrared and microwave radiations with clouds can be exploited to retrieve the vertical distribution of cloud water in a sounding and to determine what kind of satellite sensors are necessary to overcome the cloud profiling limitations of current remote sensing instruments.
  - Evaluate and exploit dual or multi-polarimetric radar to resolve range/velocity ambiguities and to aid in the characterization of within cloud hydrometer type and size distribution with particular application to discriminating supercooled water from solid particles.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE
	February 1998

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	0602784A Military Engineering Technology	AT48

FY 1998 Planned Program: (continued)

•	182	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	7268	

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value	0	7500	
Adjustments to Appropriated Value		-232	
FY 1999 President's Budget	0	7268	0

Change Summary Explanation: FY98: Project is Congressional add. Adjustment reflects undistributed Congressional reductions.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602785A Manpower/Personnel/Training Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	9196	8736	8602	9114	9159	9189	9228	Continuing	Continuing
A790 Personnel Performance and Training Technology	2979	8736	8602	9114	9159	9189	9228	Continuing	Continuing
A791 Education and Training Technology	6217	0	0	0	0	0	0	0	6217

Mission Description and Budget Item Justification: The objective of this program is to maximize soldier and unit performance based on research in selection and classification, leader assessment and development, and optimal training strategies. Research programs include training strategies for the digitized battlefield, training strategies in simulated environments, optimum designs of simulators and training devices to achieve maximum learning at minimum cost, and modernization of the selection and classification system to maintain warfighting capabilities in a downsized Army. Research in this PE is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. The research includes non-system specific development efforts pointed toward specific military needs and is therefore appropriate to Budget Activity 2. This PE is managed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences (ARI).

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602785A Manpower/Personnel/Training Technology

PROJECT: A790

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A790 Personnel Performance and Training Technology	2979	8736	8602	9114	9159	9189	9228	Continuing	Continuing

A. Mission Description and Justification: The objectives of this project are to provide the scientific basis to improve the selection and classification procedures to ensure the right person is placed in the right job, to determine leader skills and requirements for the future, and to evaluate the impact of deployments on personnel issues (e.g., career commitment, retention, etc). Research under this project supports the Human Systems – Personnel Performance and Training – Defense Technology Area. Beginning in FY1998, this project includes the education and training technology research previously reported as project A791.

FY 1997 Accomplishments:

• 2979
- Developed models of the impact of peacekeeping operations on soldier readiness, career commitment, and retention.
- Developed methods to identify the performance requirements for 21st Century Non-Commissioned Officers (NCOs).
- Designed techniques for developing and training complex problem solving and practical thinking skills.
- Developed new measures for assessing leadership potential.

Total 2979

FY 1998 Planned Program:

• 8736
- Design prototype training methods and performance assessment instruments for Force XXI.
- Identify factors which determine the effective mix of simulator and aircraft flight time for Initial Entry Rotary Wing training to produce proficient aviators at minimum cost.
- Implement and evaluate team performance assessment methods in virtual environments.
- Identify representative, Army-wide, 21st Century NCO performance requirements.
- Develop measures to assess battle commander performance.
- Develop continuous speech recognition system for language tutor to sustain highly perishable foreign language skills.
- Produce train the trainer video of most effective night operations training techniques.
- Establish baseline measures to assess the effects of stabilizing the assignments (for 24 months) of key battalion staff members (Commander, Command Sergeant Major, Executive Officer, S3).

Total 8736

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602785A Manpower/Personnel/Training Technology
	PROJECT: A790

FY 1999 Planned Program:

•	8602	- Evaluate and refine prototype training methods and performance assessment instruments in support of Force XXI.
		- Determine the post-mobilization effects of stability operations on Reserve Component soldiers' commitment, morale, and retention.
		- Demonstrate and evaluate continuous speech recognition/multilingual system for foreign language training using Special Forces soldiers as testbed.
		- Develop and evaluate prototype performance measures needed to meet NCO requirements identified for the 21st Century.
		- Develop, demonstrate, and evaluate instructional modules for versatile thinking skills required by brigade staff.
		- Assess the impact of Land Warrior Systems on institutional and unit training.
		- Continue the longitudinal assessment of the effects of stabilizing the assignments for key battalion staff positions.
		- Develop and implement prototype small unit training for Military Operations in Urban Terrain (MOUT)/contingency operations using immersive Virtual-Environment (VE) systems as testbeds.
Total	8602	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3042	9014	9019
Appropriated Value	3042	9014	
Adjustments to Appropriated Value	-63	-278	
FY 1999 President's Budget	2979	8736	8602

Change Summary Explanation: This PE has been restructured to combine Personnel Performance Technology Research (project A790) and Education and Training Technology Research (project A791) into one project, A790, renamed Personnel Performance and Training Technology, starting in FY 1998.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602785A Manpower/Personnel/Training Technology

PROJECT: A791

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A791 Education and Training Technology	6217	0	0	0	0	0	0	0	6217

A. Mission Description and Justification: The objectives of this project are to provide the behavioral technologies required for the development of effective individual and collective (unit) training strategies using simulation-based synthetic environments. Research conducted in this project builds on recent advances in the cognitive sciences and will provide an empirical basis for improved collective (unit) training strategies and techniques focusing on the digitized battlefield of the future. It will develop training methods to improve night operations, individual training strategies exploiting "virtual reality" technology for training and rehearsal of warfighting missions and stability operations, and determination of requirements for cost-effective simulator training on selected aviation tasks. Beginning in FY1998, this research is combined with project A790, Personnel Performance and Training Technology.

FY 1997 Accomplishments:

- 6217
  - Determined simulator fidelity required for crew task training on a variety of rotary-wing aircraft.
  - Reviewed the acquisition, retention, and transfer issues for computer-based skills to prepare for transition to digitized systems.
  - Developed prototype simulation-based immersive training techniques for dismounted combatants.
  - Completed development of prototype training techniques to improve combat vehicle identification utilizing 2nd generation forward looking infrared (FLIR) sensors.
  - Determined the extent of transfer of terrain knowledge from virtual to real environments.
  - Developed field-expedient procedures for adjusting the visual acuity of night vision goggles.
  - Developed a language tutor authoring system using discrete speech recognition.

Total 6217

FY 1998 Planned Program: Project combined with project A790

FY 1999 Planned Program: Project combined with project A790

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602785A Manpower/Personnel/Training Technology
	PROJECT: A791

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	6287	0	0
Appropriated Value	6287		
Adjustments to Appropriated Value	-70		
FY 1999 President's Budget	6217	0	0

Change Summary Explanation: As a result of ARI restructuring, Education and Training Technology Research and Personnel Performance Technology Research (Projects A791 and A790, respectively) have been combined into one project, Personnel Performance and Training Technology, A790, beginning in FY1998.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Warfighter Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	23513	18088	18661	19701	19456	22212	23246	Continuing	Continuing
AC60 AC60	3124	2940	1969	2156	957	2184	1792	Continuing	Continuing
AH98 Clothing and Equipment Technology	11718	9084	10347	10968	11766	13173	14462	Continuing	Continuing
AH99 Joint Services Food/System Technology	4195	4371	4638	4765	4891	5011	5143	Continuing	Continuing
DJ10 Combat Rations Quality Enhancement	2859	0	0	0	0	0	0	0	2859
D283 Airdrop Advanced Technology	1617	1693	1707	1812	1842	1844	1849	Continuing	Continuing

Mission Description and Budget Item Justification: This program element provides technology for the individual soldier and airdrop. Unusual battlefield and weapons demands must be addressed by the future soldier and the soldier's support systems. In order to achieve required individual performance, mobility, and effectiveness, there must be associated technology developments evolving in soldier support equipment, supplies, and systems to make them smaller, lighter, more reliable and durable, more survivable, less manpower intensive, affordable, and more mobile. Technology efforts on clothing and equipment and cutting edge technologies for high pressure airbeam supported shelters provide enhanced warfighter protection from both combat threats and from the natural field environment. The Joint Services Food/System Technology program supports all Military Services, the Special Operations Command, and the Defense Logistics Agency with research and development of high impact/high payoff technologies for military food products, packaging, and combat food service equipment. The Combat Ration Quality Enhancement project establishes quality quantification parameters and criteria to minimize physical, chemical, and nutritional degradation of combat rations, thus maintaining/enhancing acceptance and consumption by the military community. Similarly, work on advanced airdrop technology 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. This is a critical capability for rapid force projection, particularly into hostile environments. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. It adheres to Tri-Service Reliance agreements on clothing, textiles, and operational rations and field food service equipment, with oversight and coordination provided by the Human Systems Reliance Panel and the DoD Food & Nutrition Research & Engineering Board. There is no unwarranted duplication of effort among the military departments. Efforts are coordinated with those in PE 0603001A (Warfighter Advanced Technology). The program is managed by the U.S. Army Natick Research, Development and Engineering Center, Natick, MA. Research in this program element includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Warfighter Technology

PROJECT: AH98

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH98 Clothing and Equipment Technology	11718	9084	10347	10968	11766	13173	14462	Continuing	Continuing

A. Mission Description and Justification: This project provides applied research to improve soldier survivability and performance through significantly improved materials and new technology applications for combat clothing and personal equipment. Areas of emphasis include: material development to improve ballistic, flame, and directed energy protection; enhanced signature management; materials/concepts for protection in arctic, temperate, tropical, and desert environments; improvements to lighten the soldier's load; and concepts/materials for rapidly deployable airbeam supported shelters. Human factors research and simulation and modeling tools applicable to the soldier system are used to quantify soldier performance and determine optimal research and development (R&D) alternatives. In FY 1997, technology on selectively permeable membranes for chemical protection was restructured to DoD PE 0602384BP as part of the consolidated DoD Chemical/Biological Defense program.

FY 1997 Accomplishments:

- 4627 - Identified ballistic protective material system candidates that may provide combined small arms and fragmentation protection with the potential for a 20% reduction in system areal density (weight) without significant increase in cost.
  - Produced spun fibers from genetically engineered spider silk; evaluated the ballistic protective properties of spider silk, silk worm silk and resolubilized silk worm silk and developed an extensive database to compare the properties with synthetic high performance fibers. Initial analysis shows potential for a new group of bioengineered high performance fibers.
  - Demonstrated Phase I thermal signature reducing textile materials that reduce the soldier's contrast with the background by 30 percent, without significant degradation of current camouflage protection.
  - Synthesized modified porphyrins and identified a new family of compounds for use in optical limiting materials for tunable laser eye protection; performed a field evaluation of one of the components of the band blocking strategy to provide broader protection and with no degradation in performance compared to the current dye technology.
- 4283 - Defined the military flame and thermal hazard and developed a high resolution scenario for the mounted soldier; established a trained sensory tactile panel and database for new and improved comfort battledress uniform materials; conducted a combat clothing wear test and characterized the wear trends of the uniform to be used in the development of future durability performance requirements.
  - Provided modeling, simulation and conducted analysis to support the design of the Force XXI Land Warrior early user test; developed initial suite of modeling, simulation and analytic tools for integrated ballistics, heat stress reduction and ground mobility to support combat effectiveness assessments of emerging Land Warrior systems.
  - Conducted field investigation of soldier performance in combat-related activities to baseline current performance and validate lab findings on the soldier clothing/equipment interface; performed lab-based biomechanical evaluations on prototype footwear; and downselected boot designs for the FY98 limited field test. Completed proof of concept study for a lightweight non-electric microclimate cooling system which identified the best design approach and materials.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology	PROJECT AH98

FY 1997 Accomplishments (Continued):

•	2808	- Congressionally directed real-time automated cargo tracking and control system will be completed during FY98.
Total	11718	

FY 1998 Planned Program:

•	5054	-Demonstrate advanced material system for protection against combined fragmentation and small arms threats (known ball threats up to/including 0.30 caliber) at a 20-30% reduced areal density (weight) compared to current small arms protection without significantly increasing other penalties. - Optimize fibers spun from genetically engineered silk proteins; increase expression levels of first generation silk protein, for genetically engineered ballistic protective materials, to 100mg/liter; synthesize novel polymers produced by enzymatic catalysis for flame retardant additives or coatings, and conductive textile material applications. - Optimize thermal signature reducing facepaint materials and conduct small scale field experiments to establish level of improvement to performance. - Incorporate the best nonlinear materials for laser/ballistic eye protection into thin films and molded substrates to evaluate the optical attenuation they provide as solids from which optical limiters can be designed.
•	4030	- Incorporate novel flame retardant chemical additives into an extrudable nylon polymer and demonstrate the fiber production capability; develop topical flame retardant treatments for use on standard combat uniform fabrics which do not currently provide flame protection. - Provide modeling, simulation and analytic tools to facilitate the cost and operational effectiveness analysis of Land Warrior and associated risk reduction efforts and for analytic assessment of Force XXI Land Warrior program advanced technology components. - Develop whole body scan protocols compatible with ANSUR 2-D database standards for sizing of combat uniform systems; conduct field test to obtain user feedback and verification of evaluation on biomechanically enhanced footwear characteristics; design and demonstrate a breadboard lightweight non-electric microclimate cooling prototype.
Total	9084	

FY 1999 Planned Program:

•	5231	- Transition improved small arms protective material system to advanced development and/or as technology insertions to modify existing individual protective items; conduct optimization of new materials for next generation multiple ballistic threat protection (increased small arms, advanced fragmentation, and improved blast protection). - Evaluate enzymatic produced polymers for performance in conductive textile applications. - Demonstrate combat uniform systems technology that reduce the soldier's thermal signature by 50 percent from background levels. - Assemble a breadboard tunable laser protective device for laser/ballistic eye protection
•	5116	- Establish performance based protection criteria for flame resistant combat clothing. - Demonstrate a 10-15 percent reduction in lower extremity disorders among ground troops wearing new biomechanically enhanced combat boots. - Scale up airbeam textile technology to meet wide span (65 ft) shelter structural requirements and fabricate prototype shelter module - Complete analytic assessment of Force XXI Land Warrior's early user test to quantify improvements in combat power.
Total	10347	

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Warfighter Technology

PROJECT: AH98

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9245	9398	9971
Appropriated Value	9464	9398	
Adjustments to Appropriated Value	2254	-314	
FY 1999 President's Budget	11718	9084	10347

Change Summary Explanation: Funding: FY 1997 – Funding reprogrammed (+2678) to support a Congressionally directed program for a real-time cargo tracking and control system.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Warfighter Technology

PROJECT: AH99

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH99 Joint Services Food/System Technology	4195	4371	4638	4765	4891	5011	5143	Continuing	Continuing

A. **Mission Description and Justification:** This DoD program, for which the Army has Executive Agency responsibility, addresses high impact, high payoff food and food system technologies to support all military Services, Special Operations Command, and the Defense Logistics Agency. Thrust areas include the applied research of combat rations, packaging, field food service equipment and combat food service systems, all of which enhance the survivability, sustainability, and supportability of the Armed Forces by ensuring optimal nutritional intake to maximize cognitive and physical performance on the battlefield.

FY 1997 Accomplishments:

- 2014 - Completed initial performance test of high barrier packaging films for application over commercial packaging to enable shelf life extension and increased use of commercial products in operational rations; completed production of test samples of polymeric trays for group heat and serve rations fabricated from glass embedded laminated film; demonstrated improved oxygen and moisture permeability in oxygen absorbing pouch prototype; validated the antimicrobial effects of Wasa Ouro and nisin for fresh like and shelf stable rations.
  - Finalized base matrix for incorporating nutrient enhancers into performance enhancing ration components and completed commercial producability testing; signed two Cooperative Research and Development Agreements (CRADAs) with major food companies to transition concepts for intermediate moisture products in the Mobility Enhancing Ration Components (MERCs) to demonstrate eat out of hand, eat on the move capability.
- 880 - Developed data relating to human performance-nutrition. Applied chemical marker methods to reveal thermal profile of microwave sterilization of rations; developed model to predict stability in food matrices of different moisture levels, demonstrated ohmic heating rates using intrinsic chemical marker and magnetic resonance imaging analyses to assure ration safety in novel hurdle food processing technology.
- 1301 - Established conceptual design approaches for diesel to gas reformers to provide a natural-gas like fuel for commercial gas field cooking appliances, based on multiple catalyst tubes and fuel cell auto thermal reformer. Transitioned an experimental powered-burner-driven adsorption type field refrigerator to Advanced Technology Development. Evaluated future shipboard galley concepts to show feasibility and functionality with increased mission flexibility and decreased reliance on manpower.

Total 4195

FY 1998 Planned Program:

- 1753 - Investigate cell culture and other model systems for potential incorporation of Performance Enhancing Ration Components (PERCs) to counteract short term acute stresses of battlefield; determine effects of food components on sleep/wake cycles to enhance combat effectiveness; model the effects of nutrition and hydration on soldier performance.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology	PROJECT AH99

FY 1998 Planned Program: (continued)

- Evaluate/develop novel preservation technologies (water activity reducing components and novel processes such as radio frequency sterilization) for military rations, identify suitable recognition compounds and biosensor systems to improve veterinary inspection of stored rations; continue to investigate high dose sterilization for improved quality military ration components and quantify logistics savings; investigate innovative non-thermal processes for moisture control in ration components, to ensure stability and quality of eat out of hand ration components.
- Redesign individual ration based on warfighter acceptability, consumption and nutritional adequacy to reduce logistics burden.
- Complete analysis of tyrosine and carbohydrate anti-fatigue studies for PERCs.

•	1368	- Improve efficiencies of ration packaging systems by: (1) Incorporating interactive packaging technologies (e.g., oxygen and moisture absorbing) into ration component systems to reduce or eliminate combat ration degradation during storage; (2) Fabricating/testing high barrier, glass-coated, retortable polymeric tray with easy-open lid for multi-serve, shelf-stable food containers; (3) Finalizing methodology/application techniques of barrier packaging films for application over commercial packaging to enable military use of commercial products and transition to Fielded Group Ration Improvement Program (FGRIP). - Complete component development and testing of individual warfighter mobility enhancing ration components.
•	1229	- Design and test a fuel reformer based on multiple catalyst tubes; design and test a fuel cell autothermal reformer for use with gas applications for field cooking burners; develop concepts for a Marine expeditionary field feeding system; investigate capillary feed boiler technology for small stove applications; investigate methods/technology for reducing or eliminating water requirements for field kitchen sanitation, for heating individual beverages, and for improving cold storage and frozen handling capabilities for field kitchens.
•	21	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	4371	

FY 1999 Planned Program:

•	1254	- Investigate/evaluate evolving preservation technologies for ration components to exploit novel ingredients/processes for stabilizing structure and for controlling microbial growth to produce shelf stable, non-retorted ration components; optimize processing and packaging parameters for shelf-stable vegetables and fruit ration components. - Determine effects of food components on sleep/wake cycles and downselect the effective nutrients for transitioning to the Fielded Individual Ration Improvement Program (FIRIP). - Exploit high dose irradiation and radio frequency sterilization technologies to facilitate the incorporation of "home cooked" components in military rations. - Evaluate and optimize nutraceutical products for ration supplementation to optimize combat effectiveness.
•	1669	- Optimize processing variables of non-thermal and preconcentration processes on a range of selected ration components to reduce degrative effects, cube, and weight; explore synergistic combinations of new thermal (ohmic and microwave) and non thermal (high pressure) technologies to reduce overall processing and produce stable, "just prepared" rations; develop and optimize biosensor probes for quality determination of combat rations by ration inspectors.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602786A Warfighter Technology
PROJECT: AH99	

FY 1999 Planned Program: (continued)

- Evaluate concepts for bioengineering of high energy ration components, incorporation of complex "nutri-fuels" into rations for improved performance, stress reduction, and protein enhancement of ration components for improved nutritional quality.

• 1715 - Complete field tests of individual beverage heater and transition to ration improvement program for fielding; complete fuel reformer experiments to demonstrate a 90% high heat value conversion efficiency and integrate into field kitchen; complete investigation of capillary feed boiler technology, design and test small experimental stove, and transition to Advanced Technology Development; develop concepts for a waterless field kitchen sanitation system (coatings, wipes, sanitizers), and develop treatment methods for on-site disposal of waste water from field feeding systems and transition to Advanced Technology Development; develop components for reliable, passive cold storage and frozen food handling system for field kitchens to enable more fresh and frozen foods while insuring food safety and transition to Advanced Technology Development.

Total 4638

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4299	4510	4615
Appropriated Value	4402	4510	
Adjustments to Appropriated Value	-207	-139	
FY 1999 President's Budget	4195	4371	4638

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Warfighter Technology

PROJECT: DJ10

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DJ10 Combat Rations Quality Enhancement	2859	0	0	0	0	0	0	0	2859

A. **Mission Description and Justification:** This project was initiated in FY1992 at the request of Congress to establish a 5 year project to develop technologies for quantifying food quality in combat rations and other emergency feeding situations to enhance consumer acceptance. Upon completion of the directed 5 year project, the project continued in FY 1997 through additional Congressional interest funds. Parameters affecting food quality, including interrelationships among raw materials, processing, packaging, and storage, were determined and analytical techniques for quantification were developed. Innovative processing methods (ohmic heating and combination preservation processes) are investigated. Optimal raw material processing techniques and packaging systems were selected to minimize deteriorative changes in foods and maximize the deliverable quality of subsistence to the user community. The project included the use of novel electric field and high pressure technologies to pasteurize acidic foods and explores the efficacy and practicality of non-thermal pasteurization.

FY 1997 Accomplishments:

•	2859	- Established good manufacturing practice demonstration sites to facilitate regulatory approval of high pressure and pulsed electric field processing. - Conducted efficiency and efficacy tests of batch vs. semi-continuous high pressure processes. - Validated test methods and models which quantify the quality of combat rations.
Total	2859	

FY 1998 Planned Program: Project not funded in FY98.

FY 1999 Planned Program: Project not funded in FY99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2937	0	0
Appropriated Value	3000		
Adjustments to Appropriated Value	-141		
FY 1999 President's Budget	2859	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Warfighter Technology

PROJECT: D283

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D283 Airdrop Advanced Technology	1617	1693	1707	1812	1842	1844	1849	Continuing	Continuing

A. **Mission Description and Justification:** This project provides applied research to enhance personnel and cargo airdrop capabilities. These are key capabilities for force projection, particularly into hostile areas. Areas of emphasis include parachute technology for improved performance, precision offset aerial delivery, soft landing system development, airdrop simulation, and low altitude/high speed airdrop systems technologies. Efforts will result in increased personnel safety and reduced personnel, aircraft, and cargo vulnerability.

FY 1997 Accomplishments:

- 760 - Developed a new inflation method for ram-air gliding wings for use at higher altitudes and greater distances to reduce aircraft vulnerability.
  - Demonstrated autonomous soft landing capability with a parachute retraction concept.
  - Completed and demonstrated the 20% reduction in weight and bulk and equivalent flight performance (as compared to a T-10 parachute) of a new personnel-sized parachute.
  - Demonstrated 3D stand alone Computational Fluid Dynamics and Structural Dynamics parachute system models for round, cross and gliding wing type systems to minimize full scale airdrop testing.
- 857 - Conducted analysis of initial deployment of a jumper from an aircraft using the ADAMS and Android computer codes to improve parachutist safety.
  - Programmed logic for coupled state-of-the-art parachute fluid-structure interaction model to identify characteristics/factors that will enhance parachute performance.
  - Completed virtual analysis of Guided Parafoil Airdrop Systems (GPADS), assessing possible warfighting benefits.
  - Conducted lab-scale experiments of spring and magnetic air release valves for airbags. Demonstrated a new air release valve for controlled venting of an airbag. Airbags will provide soft landing, a drive/on drive/off capability, and decreased rigging and derigging requirements resulting in a reduced logistics burden.
  - Completed research and demonstrated a fifty meter circular error probability of the autonomous six degree of freedom, government owned, guidance, navigation, and control simulation and flight code on a fully instrumented parafoil system test bed (testing and hardware integration support by NASA).

Total 1617

FY 1998 Planned Program:

- 1170 - Demonstrate a gliding personnel parachute with 20% increase in maximum jump altitude and 25% increase in glide ratio as compared to the current MC-4 parachute.
  - Demonstrate a less than 10 ft/sec soft landing velocity of a 1000-lb payload using the retraction of a cluster of parachutes to allow for airdrop of critical items too fragile for airdrop with conventional systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602786A Warfighter Technology
	PROJECT: D283

FY 1998 Planned Program: (continued)

- Develop new canopy design and construction methods for a new light weight, low bulk, low altitude and affordable cargo parachute.
- Complete testing of the spring and magnetic air release valves for airbags for soft landing, and drive on/drive off capability.
- Design and construct a pneumatic muscle for soft landing of payloads.

• 537 - Apply soft landing modeling capabilities to the Advanced Tactical Parachute System development program (personnel) and cargo systems to include incorporation of a novel "Pneumatic Muscle" technology and validate results with experimentally obtained data.
- Demonstrate and validate steady state modeling capability for a variety of parachute systems utilizing coupled parachute model executing on DoD High Performance Computers.
- Incorporate a user defined wind option into state-of-the-art parachute inflation model and perform initial simulations of parachute system wind interactions for both Army and Air Force parachute delivery systems.
- Pursue additional partnerships with the US Air Force and the parachute industry to apply government parachute system models to experimental and development programs to assist these programs and validate the models.

• 10 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1693

FY 1999 Planned Program:

• 1226 - Complete testing of the high performance personnel gliding parachute in preparation for development.
- Construct new cargo parachutes based on the new design for light weight, low bulk, low altitude and affordable cargo parachute.
- Test and demonstrate the pneumatic muscle for soft landing of payloads.
- Downselect an air release valve; design and construct an airbag system for roll-on/roll-off cargo airdrop.
- Investigate the new parafoil inflation method for cargo airdrop to increase reliability of full parafoil deployment.

• 563 - Apply state-of-the-art parachute system models to analyze performance, minimize full-scale airdrop testing and assist in design trade-off decisions. Models include soft landing models, trajectory models and Guidance Navigation & Control models.
- Complete first generation simulations of fully coupled 3D parachute inflation model on round systems and disreefing models of cross and gliding wing systems, validate results with experimental data.
- Demonstrate parachute/wind interaction model and validate from on-going science and technology programs in the Army and Air Force.

Total 1707

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602786A Warfighter Technology	PROJECT: D283

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1630	1747	1903
Appropriated Value	1665	1747	
Adjustments to Appropriated Value	-48	-54	
FY 1999 President's Budget	1617	1693	1707

Change Summary Explanation: Funding: FY 1999 – (-196) reprogrammed to higher priority programs.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	106131	160376	67255	66701	67834	68687	70160	Continuing	Continuing
A825 Combat Maxillofacial Injury	491	0	0	0	0	0	0	0	491
A838 Neurotoxin Exposure Treatment	23831	24228	0	0	0	0	0	0	23831
A839 Computer-Assisted Signaling Cancer Cell Proliferation	2193	0	0	0	0	0	0	0	2193
A841 Computer-Assisted Minimally Invasive Surgery	2384	0	0	0	0	0	0	0	2384
A842 ENT Minimally Invasive Simulation	953	0	0	0	0	0	0	0	953
A843 Health Tech Roadmaps	3336	0	0	0	0	0	0	0	3336
A845 Bone Disease Research Program	9533	0	0	0	0	0	0	0	9533
A863 Battlefield Surgical Replacement	5905	0	0	0	0	0	0	0	5905
A869 Telemedicine/Advanced Technology	0	0	3364	3102	3101	3082	3025	Continuing	Continuing
A870 DoD Medical Defense Against Infectious Diseases	28736	27640	23996	24101	25200	25893	26628	Continuing	Continuing
A872 Neurofibromatosis Research	0	9497	0	0	0	0	0	0	9497
D873 HIV Exploratory Research	2643	21119	14648	13176	12250	11741	11691	Continuing	Continuing
A874 Combat Casualty Care Technology	10804	8549	8482	8693	8915	9139	9422	Continuing	Continuing
A878 Health Hazards of Military Materiel	6952	7765	8737	9548	9921	10155	10460	Continuing	Continuing
A879 Medical Factors Enhancing Soldier Effectiveness	8370	10698	8028	8081	8447	8677	8934	Continuing	Continuing
A919 Orthopedic Implant Research	0	2423	0	0	0	0	0	0	2423

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A920 Prostate Cancer Research	0	38765	0	0	0	0	0	0	38765
A921 Ovarian Cancer Research	0	9692	0	0	0	0	0	0	9692

Mission Description and Budget Item Justification: This program element funds exploratory development in Department of Defense (DoD) medical protection against naturally occurring diseases of military importance and combat dentistry, as well as exploratory development for Department of Army care of combat casualties, health hazard assessment of military materiel, and medical factors enhancing soldier effectiveness. The primary goal of medical research and development is to sustain medical technology superiority to improve the protection and survivability of U.S. forces on conventional battlefields as well as in potential areas of low intensity conflict and military operations short of war. This program element is the core DoD technology base to develop methods and materials for infectious disease prevention and treatment including vaccines, prophylactic and therapeutic drugs, insect repellents, and methods of diagnosis and identification of naturally occurring infectious diseases; prevention and treatment of combat maxillofacial (face and neck) injuries, and essential dental treatment on the battlefield; combat casualty care of trauma and burns due to weapons, organ system survival, shock resulting from blood loss and infection, blood preservation and potential blood substitutes for battlefield care; assessment of the health hazards of military materiel, and the sustainment or enhancement of soldier performance. The work in this PE is consistent with the Army Science and Technology Master Plan, Army force modernization plans, and Project Reliance. This program is managed primarily by the U.S. Army Medical Research and Materiel Command. Efforts in this PE include non-system-specific development efforts pointed toward specific military needs and are appropriate to Budget Activity 2.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A825

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A825 Combat Maxillofacial Injury	491	0	0	0	0	0	0	0	491

A. Mission Description and Justification: This project has as its major thrusts exploratory development of new/improved methods and materiel for rapid simplified treatment of face and neck wounds and provision of field dental treatment.

FY 1997 Accomplishments:

- 100 Evaluated toxicity of novel analgesics.
- 200 Began design of hyper-speed parallel computer interface to hyper-speed parallel camera for robotic surgical assistant testbed.
- 191 Conducted Base Realignment and Closure Commission (BRAC)-mandated move to collocate Army Dental research assets with Navy Research at Great Lakes Naval Station.

Total 491

FY 1998 Planned Program: Program incorporated into PE 0602787A, Project A874, Combat Casualty Care Technology.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	504	0	0
Appropriated Value	504		
Adjustments to Appropriated Value	-13		
FY 1999 President's Budget	491	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A838

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A838 Neurotoxin Exposure Treatment	23831	24228	0	0	0	0	0	0	23831

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for neurotoxin exposure treatment.

FY 1997 Accomplishments:

- 21131 Solicited competitive contracts/grants to initiate research on neurotoxin exposure treatment; to be evaluated in first quarter FY 1998.
- 350 Convened expert panel to issue recommendations on antioxidant nutrient requirements including nutritional interventions to protect against and treat neurodegenerative diseases.
- 850 Investigated the biological basis of military microwave hazards on neural tissue and potential role in neurodegenerative diseases.
- 750 Evaluated role of melatonin as a neuroprotectant.
- 750 Evaluated role of brain enzyme inhibitors that prevent brain injury after extreme stress and head injury.

Total 23831

FY 1998 Planned Program:

- 23621 Follow-on program solicitation to be advertised in second quarter FY 1998.
- 607 Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 24228

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	24477	0	0
Appropriated Value	24477	25000	
Adjustments to Appropriated Value	-646	-772	
FY 1999 President's Budget	23831	24228	0

Change Summary Explanation: Funding: FY 1998 funding added by Congress.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A839

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A839 Computer-Assisted Signaling Cancer Cell Proliferation	2193	0	0	0	0	0	0	0	2193

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for computer-assisted signaling cancer cell proliferation.

FY 1997 Accomplishments:

•	2193	Grants will be awarded by July 1998.
Total	2193	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2252	0	0
Appropriated Value	2252		
Adjustments to Appropriated Value	-59		
FY 1999 President's Budget	2193	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A841

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A841 Computer-Assisted Minimally Invasive Surgery	2384	0	0	0	0	0	0	0	2384

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for computer-assisted minimally invasive surgery.

FY 1997 Accomplishments:

•	2384	Evaluated competitive contracts/grants to initiate research on computer-assisted minimally invasive surgery.
Total	2384	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2448	0	0
Appropriated Value	2448		
Adjustments to Appropriated Value	-64		
FY 1999 President's Budget	2384	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A842

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A842 ENT Minimally Invasive Simulation	953	0	0	0	0	0	0	0	953

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for ENT, minimally invasive simulation.

FY 1997 Accomplishments:

•	953	Initiated studies in remote health care delivery and telemonitoring of patients from their homes and modeled health care options for treatments of benign prostatic hypertrophy and coronary artery disease.
Total	953	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	979	0	0
Appropriated Value	979		
Adjustments to Appropriated Value	-26		
FY 1999 President's Budget	953	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A843

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A843 Health Tech Roadmaps	3336	0	0	0	0	0	0	0	3336

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for health tech roadmaps.

FY 1997 Accomplishments:

•	3336	Initiated research on health tech roadmaps at Sandia Laboratories.
Total	3336	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3427	0	0
Appropriated Value	3427		
Adjustments to Appropriated Value	-91		
FY 1999 President's Budget	3336	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A845

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A845 Bone Disease Research Program	9533	0	0	0	0	0	0	0	9533

A. **Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for bone disease research.

FY 1997 Accomplishments:

•	9533	Evaluated competitive contracts/grants to initiate research on bone disease research.
Total	9533	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9791	0	0
Appropriated Value	9791		
Adjustments to Appropriated Value	-258		
FY 1999 President's Budget	9533	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A863

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A863 Battlefield Surgical Replacement	5905	0	0	0	0	0	0	0	5905

A. Mission Description and Justification: This research is directed toward development of equipment and biomaterial for use in repairing trauma and burn injuries in the field.

FY 1997 Accomplishments:

•	5905	Proposal reviewed and award in progress for development of equipment and biomaterial to repair trauma and burn injuries in the field.
Total	5905	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1958	0	0
Appropriated Value	1958		
Adjustments to Appropriated Value	+3947		
FY 1999 President's Budget	5905	0	0

Change Summary Explanation: Funding: FY 1997: Funds reprogrammed (3947) from lower priority projects.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A869

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A869 Telemedicine/Advanced Technology	0	0	3364	3102	3101	3082	3025	Continuing	Continuing

A. Mission Description and Budget Item Justification: The purpose of this program is to perform research contributing to superior combat casualty care for troops through faster diagnosis and treatment while allowing on-site health care providers to consult with specialists worldwide. Research will focus on developing the means to determine soldier physiological status. This will include developing the means to determine when a soldier is minimally impaired but still capable of functioning. Work will also focus on the development of rapid diagnostic tools to aid in the delivery of actual medical care on the modern battlefield.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program:

- 464 Gather information on soldier status to iteratively refine predictive models and guide the development of the status monitor.
- 663 Integrate physiological monitoring with sensor fusion software leading to early medical decision assistance algorithms.
- 525 Using changes in neural electrical activity, differentiate between immediate determination of a traumatic physical injury and other combat induced stressors.
- 222 Research teleophthalmology, Internet-based clinical archive and medical record.
- 380 Integrate sensor data in CSTAT and miniSTAT.
- 624 Research miniaturization of anesthetic and delivery systems for far-forward surgical care.
- 486 Research remote surgical mentoring, telerobotic surgery.

Total 3364

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value			
Adjustments to Appropriated Value			
FY 1999 President's Budget	0	0	3364

Change Summary Explanation: Funding: FY 1999: Funds reprogrammed from other lower priority medical research efforts to establish this project.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A870

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A870 DoD Medical Defense Against Infectious Diseases	28736	27640	23996	24101	25200	25893	26628	Continuing	Continuing

A. Mission Description and Justification: This project supports development of medical countermeasures to naturally occurring infectious diseases, a significant threat to forces deployed outside the United States. These countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations.

FY 1997 Accomplishments:

- 2399 Tested numerous malaria antigens for immunogenicity in mouse and monkey models. Evaluated 16 candidate malaria vaccines in animal models. Conducted malaria surveillance to identify possible field sites for future malaria vaccine trials.
- 1168 Prepared candidate antimalaria drugs for testing in animals. Analyzed the antimalaria activity of novel candidate compounds.
- 280 Studied resistance of malaria parasites to new antimalarial drugs and drug combinations. Conducted surveillance and threat assessment for multidrug resistant malaria and to monitor for emergence of new drug resistant strains worldwide.
- 493 Completed preclinical trials supporting the Investigational New Drug (IND) applications for a live, oral *Shigella sonnei* vaccine and a subunit Proteosome/LPS *Shigella flexneri* 2a intranasal vaccine. Conducted surveillance at possible field sites in Thailand and Kenya to determine incidence of disease and suitability of sites for future vaccine trials. Developed an ELISA-based detection of PCR-amplified products to allow quantitation of *Shigella* in a vaccine, a necessary step in Food and Drug Administration (FDA) approval of a *Shigella* vaccine.
- 458 Optimized the microencapsulation procedure of Enterotoxigenic *Escherichia coli* (ETEC) colonization factor antigens in a laboratory-scale procedure suitable for Good Manufacturing Practices (GMP) scale-up for use in oral vaccine production. Refined and standardized an ELISA assay that will be used in surveillance and to measure vaccine immunogenicity in trials.
- 657 Expressed recombinant *Campylobacter* flagellin in a wild-type *Shigella* strain, progress which paves the way toward a combined live-attenuated vaccine. Demonstrated that recombinant flagellin, the first candidate subunit vaccine, induces protective immunity against challenge in the mouse intranasal model. Successfully evaluated a multiplex PCR diagnostic test to identify *Campylobacter* and *Shigella* in stool samples during Cobra Gold exercise.
- 158 Performed limited field testing of forward diagnostic tests for dengue, hantavirus, hemorrhagic fever and encephalitis viruses.
- 1312 Evaluated various candidate dengue diagnostic assays for use in future vaccine field trials.
- 845 Evaluated safety of candidate DNA vaccines for several hantaviruses in animals.
- 500 Further characterized HEV infection in nonhuman primates to aid in future evaluations of safety and immunogenicity of candidate HEV vaccines.
- 304 Developed novel methodologies for the diagnosis of scrub typhus and antibiotic resistance in scrub typhus. Defined ecology of the principal chigger vector in Northern Thailand. Completed serosurveys for rickettsial disease in Egypt, Brazil and Indonesia.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology
PROJECT: A870	

FY 1997 Accomplishments: (continued)

•	330	Purified the soluble promastigote antigen for use in development of a *Leishmania* immunodiagnostic assay. Developed multiple novel methodologies for diagnosis of *Leishmania* infection, including antibody detection, PCR and skin-testing.
•	246	Developed a new method for recombining outer membrane proteins with detoxified lipopolysaccharide and lipids for use as a vaccine to protect against bacterial meningitis.
•	983	Drafted protocols for clinical studies of the etiology of illnesses that could affect deployed troops such as fevers, encephalitis, hemorrhagic fever and hepatitis.
•	599	Reported the first successful cultivation of the human malaria parasite, *Plasmodium vivax*, opening the way for vaccine development. Designed a self-supporting, insecticide-treated bednet and a lethal ovitrap to protect soldiers from disease-bearing mosquitoes. Developed a method for the protein-free cultivation of *Leishmania* parasites that will facilitate isolating antigens for assay development. Characterized a protein produced by mosquitoes that triggers *Plasmodium* fertilization and that could be a target to prevent transmission of malaria. Sequenced the gene in mosquitoes that is responsible for the mosquito's natural immunity to malaria parasites.
•	34	Developed standard operating procedures for all aspects of GMP production of vaccines for human use. Provided, monitored and validated storage of vaccines and seed stocks. Initiated cleaning validation of equipment.
•	11470	Administrative overhead costs at the Walter Reed Army Institute of Research (WRAIR).
•	1300	Armed Forces Research Institute for Medical Science (AFRIMS, Bangkok, Thailand) Veterinary Medicine facility renovation.
•	5200	Transition costs of moving the WRAIR into a new facility.
Total	28736	

FY 1998 Planned Program:

•	3024	Improve evaluation of the immune response and compare immunity stimulated by malaria infection and different vaccine systems. Evaluate new malaria vaccine approaches in animal models. Improve characterization of the immune response to malaria to determine critical elements that should be mimicked in a protective vaccine.
•	1683	Express and purify recombinant proteins of at least five different targets for structure-based drug design of novel antimalaria drugs. Expand existing antimalaria drug screening. Analyze the antimalaria activity of novel candidate compounds.
•	362	Analyze surveillance data on the threat of drug resistant malaria to military operations worldwide, including recommendations for prophylaxis or treatment of soldiers with malaria and for monitoring treated soldiers to assure they have been cured. Develop tests to monitor the development and spread of drug resistant malaria.
•	512	Prepare and submit IND applications supporting trials of a live-attenuated *Shigella sonnei* vaccine. Conduct surveillance at possible field sites in Egypt, Thailand and Kenya to determine incidence of disease and suitability of sites for vaccine trials. Optimize the PCR diagnostic procedure for detection of *Shigella* in stool samples.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology	PROJECT A870

FY 1998 Planned Program: (continued)

•	384	Clone genes encoding three ETEC colonization factor antigens into GMP-suitable expression vectors for testing as possible vaccine candidates to stimulate protective mucosal antibodies. Identify possible field sites in Nepal, Vietnam and Abu Homos (Egypt) by conducting surveillance for ETEC diarrhea incidence and characterizing ETEC isolates.
•	730	Analyze samples from *Campylobacter* challenge study to fully characterize the cellular and humoral immune responses to *Campylobacter* infection. Identify virulent *Campylobacter* strains of differing serotypes for possible inclusion in multivalent vaccine. Develop ELISA tests to detect and quantify *Campylobacter* antigens in a vaccine candidate.
•	189	Submit protocol to FDA to begin process of licensure of a malaria diagnostic device. Determine sensitivity of nucleic acid-based diagnostic tests and evaluate combined specimen collection devices to support development of a hand-held system for diagnosis of infectious diseases.
•	1433	Evaluate safety and immunogenicity of candidate recombinant, DNA, and killed dengue vaccines in animals.
•	914	Evaluate candidate antiviral compounds for effectiveness against Ebola virus in animal models.
•	399	Characterize epidemiology of HEV to select for future evaluation of candidate HEV vaccines.
•	234	Clone genes from antibiotic-resistant scrub typhus to develop and define genetic markers and to help define mechanisms of antibiotic resistance. Assess significance of rickettsial infection as a threat to deployed warfighters. Establish archive of antibody and antigen positive sera for scrub typhus diagnostic assay development.
•	285	Produce and evaluate multiple new reagents for development of *Leishmania* diagnostics.
•	182	Complete preclinical safety and immunogenicity studies of bacterial meningitis outer membrane protein vaccine formulations.
•	760	Perform disease surveillance and characterization of infectious agents causing illnesses such as hemorrhagic fever, encephalitis and hepatitis in Cambodia, the Amazon River area, Kenya, and Egypt to identify targets for future specific research.
•	1028	Select strains of cultivated *Plasmodium vivax* needed for malaria vaccine testing. Conduct technology demonstration tests of collapsible bednet and lethal mosquito traps. Characterize the genes responsible for gametogenesis and subsequent transmission of the malaria parasite *Plasmodium falciparum* to humans.
•	42	Apply novel technologies to improve scale-up for vaccine production under GMP conditions at the vaccine pilot production facility.
•	11056	Administrative overhead costs at the WRAIR.
•	4307	Transition costs of moving the WRAIR into a new facility.
•	116	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	27640	

FY 1999 Planned Program:

•	3026	Complete construction of transfer RNA plasmids that permit high expression of malaria proteins in the *E. coli* expression system. Demonstrate feasibility of immunization against *Plasmodium vivax* using a viral replicon system.
•	954	Express and purify recombinant proteins of at least five different target proteins for structure-based drug design. Expand existing capabilities to screen antimalaria drugs by developing new animal models. Analyze the antimalaria activity of novel candidate compounds.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology
PROJECT: A870	

FY 1999 Planned Program: (continued)

- 585 Produce purified *Shigella* vaccine candidate antigens based on the virulence protein epitopes identified in FY 1998.
- 735 Characterize human mucosal immune responses to ETEC infection by quantifying serum and luminal antibody responses. Assess role of newly identified ETEC toxins as virulence factors in *E. coli*-mediated diarrheal disease.
- 783 Determine safety, efficacy and optimal dose schedule of an attenuated live or carrier-based *Campylobacter* vaccine in animal models. Determine feasibility of developing monkey model to assess combined *Campylobacter*, *Shigella* and enterotoxigenic *E. coli* vaccine efficacy. Determine optimum methods for industrial-scale growth of *Campylobacter* strains for vaccine production.
- 187 Produce malaria and hantavirus diagnostic devices under GMP conditions. Identify appropriate field sites for testing the malaria and hantavirus diagnostic tests.
- 1373 Evaluate safety and immunogenicity of candidate recombinant, DNA, and killed dengue vaccines in animals.
- 1002 Evaluate safety of candidate DNA vaccines for Congo Crimean Hemorrhagic Fever virus in animals.
- 595 Determine feasibility of potential components of future diagnostic tests for hepatitis E.
- 363 Complete assessment of threat of rickettsiae to military operations. Develop method for rapid, early diagnosis of scrub typhus.
- 585 Define antigens and/or immunization strategies for induction of resistance to *Leishmania*. Define role of sandfly vector saliva in the human immune response to *Leishmania*.
- 307 Conduct preclinical animal studies with vaccine for prevention of Type B meningococcal infection.
- 184 Identify a candidate cholera vaccine.
- 368 Expand disease surveillance worldwide locations and networks and complete threat assessment report. Characterize the new infectious agents and determine if a specific research effort on that agent must be considered.
- 964 Test a method for controlling sand flies in the Middle East by distributing insecticide treated baits. Clone a drug resistant strain of *Plasmodium vivax* malaria in culture. Test a synthetic replacement for the insect repellent DEET.
- 81 Apply novel technologies to improve manufacture of vaccines and adjuvants, working within GMP conditions at the vaccine pilot production facility.
- 11054 Administrative overhead costs at the WRAIR.
- 850 Transition costs of moving the WRAIR into a new facility.
- 23996 Total

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	28799	28520	25753
Appropriated Value	29799	28520	
Adjustments to Appropriated Value	-63	-880	
FY 1999 President's Budget	28736	27640	23996

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A872

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A872 Neurofibromatosis Research	0	9497	0	0	0	0	0	0	9497

A. Mission Description and Budget Item Justification: By Congressional direction, the purpose of this project is to develop initial research models for neurofibromatosis.

FY 1997 Accomplishments: Program funded in PE 0603002A, Project D814 in FY 1997.

FY 1998 Planned Program:

•	9259	Publish a Broad Agency Announcement (BAA) in May 1998. Conduct scientific peer review and programmatic review by February 1999. Initial awards will be made in February 1999 with all awards completed no later than 30 September 1999.
•	238	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	9497	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
Previous President's Budget	0	0	0
Appropriated Value		9800	
Adjustments to Appropriated Value		-303	
Current Budget Submit/President's Budget	0	9497	0

Change Summary Explanation: Funding: FY 1998 funding added by Congress.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT D873

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D873 HIV Exploratory Research	2643	21119	14648	13176	12250	11741	11691	Continuing	Continuing

A. **Mission Description and Justification:** This project provides for exploratory development of improved diagnostics, epidemiology, candidate immunogens, promising drugs and behavioral modification for prevention and treatment of Human Immunodeficiency Virus (HIV). Main efforts include developing experimental models of disease, preparation of new vaccine candidates, improved diagnosis of disease and risk assessment. Current policy prohibits antibody positive service members from outside the continental United States deployment. A safe and effective vaccine for prevention of infection and intervention techniques will permit all service members to become worldwide deployable.

FY 1997 Accomplishments:

•	427	Conducted vaccination/challenge studies of HIV candidate vaccines and bacterial and viral delivery systems in animal models to determine the effect of vaccine formulation and regimen.
•	427	Determined correlates of immunity and identified less virulent strains of HIV to assist in vaccine construction.
•	427	Evaluated live-attenuated HIV-1 for clinical development potential.
•	1362	Improved vaccine candidate diversification to increase coverage of global variants.
Total	2643	

FY 1998 Planned Program:

•	4061	Conduct animal model and other preclinical studies of candidate vaccines (including complex protein, subunit, recombinant DNA, and inactivated whole virus candidates) to prevent infection with HIV.
•	2685	Develop and maintain international laboratories to support efficacy trials. Includes quality control and standardization of laboratory assays.
•	2944	Prepare for efficacy testing by conducting cohort development including identifying high incidence groups and coordinating the efforts of regulatory agencies and scientific collaborators as they relate to populations at risk.
•	2684	Conduct national and international surveillance of HIV genotypes, conduct threat analysis of HIV strains, and characterize HIV-specific epitopes to construct candidate vaccines for national and international use.
•	1819	Conduct studies of the natural history of HIV disease to determine vaccine trial endpoints. Expand the natural history database and maintain a repository of sera samples.
•	1905	Improve vaccine candidates by investigating molecular conformation of protein antigens, role of specific cell receptors and viral correlates in infectivity and pathogenicity.
•	1732	Conduct studies on the clinical management of HIV by immune reconstitution.
•	1039	Conduct studies on HIV antiviral drugs, resistance evaluation, and rapid diagnosis of HIV infection.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology
	PROJECT: D873

FY 1998 Planned Program: (continued)

•	1720	Pay administrative overhead costs for Walter Reed Army Institute of Research (WRAIR)
•	530	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	21119	

FY 1999 Planned Program:

•	2777	Evaluate animal model and other preclinical studies of candidate vaccines (including complex protein, subunit, recombinant DNA, and inactivated whole virus candidates) to prevent infection with HIV.
•	1961	Continue to upgrade and support international and domestic laboratories to support efficacy trials. Ensure quality control and standardization of laboratory assays.
•	2025	Prepare for trials by conducting cohort development including identifying high incidence groups and coordinating the efforts of regulatory agencies and scientific collaborators as they related to populations at risk.
•	1961	Conduct national and international surveillance of HIV genotypes, conduct threat analysis of HIV strains, and characterize HIV specific epitopes to construct candidate vaccines for national and international use.
•	1328	Conduct studies of the natural history of HIV disease to determine vaccine trial endpoints. Expand the natural history database and maintain a repository of sera samples.
•	1327	Improve vaccine candidates by investigating molecular conformation of protein antigens, role of specific cell receptors and viral correlates in infectivity and pathogenicity.
•	1139	Complete and evaluate initial studies on the clinical management of HIV by immune reconstitution.
•	496	Conduct studies on HIV antiviral drugs, resistance evaluation, and rapid diagnosis of HIV infection. Continue to monitor the appearance of drug resistance and prepare to implement rapid diagnosis of HIV infection.
•	1634	Pay administrative overhead costs for the WRAIR.
Total	14648	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2869	21791	20576
Appropriated Value	2869	21791	
Adjustments to Appropriated Value	-226	-672	
FY 1999 President's Budget	2643	21119	14648

Change Summary Explanation: Funding: FY 1999: Funds reprogrammed to 0603105.DH29, (+2548) and 0603807.D811 (+2742) to allow further product development in HIV/AIDS.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A874

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A874 Combat Casualty Care Technology	10804	8549	8482	8693	8915	9139	9422	Continuing	Continuing

A. **Mission Description and Justification:** This project funds the core technology base to develop concepts, techniques and material for the treatment and return-to-duty of soldiers wounded in combat and to support Low Intensity Combat as well as military operations other than war. This project addresses investigation of the treatments for weapons-induced trauma and burns, and shock due to blood loss. It also funds technologies for resuscitation fluid and blood preservation.

FY 1997 Accomplishments:

•	400	Increased the life span of whole blood in refrigerated storage to 8 weeks. Clinical trial successful.
•	3769	Characterized novel pharmacological mechanisms and receptor targets of central nervous system injury and defined effects of potential countermeasures. Defined in vivo neuroprotective efficacy of lead candidate dextromethorphan and carbetapentane analogs in large animal models to justify advanced clinical development. Evaluated feasibility of radar tags in physiologic monitoring and assessment of soldiers and casualties.
•	750	Evaluated efficacy of microencapsulated anesthetic and analgesic compounds in animal models.
•	1156	Developed interfaces and controllers to link medical sensors to monitoring systems (Soldier Individual Computer or other dedicated system).
•	1056	Evaluated use of silver-nylon fabric as an antimicrobial wound dressing.
•	3673	Evaluated CSTAT, ASSTC, and other advance technology prototypes.
Total	10804	

FY 1998 Planned Program:

•	1932	Continue evaluating and refining sensors, surgical and evacuation technology (CSTAT and ASSTC).
•	871	Begin evaluation of miniature version of CSTAT (miniSTAT) as far-forward intensive care and diagnostic support platforms.
•	1421	Compare early versus delayed fluid resuscitation following massive hemorrhage associated with penetrating trauma.
•	1624	Determine performance-based standards for red blood cell storage.
•	1243	Evaluate effectiveness of silver-coated pins for far-forward fracture fixation and stabilization.
•	1319	Determine feasibility of laser burn debridement in models of militarily relevant burns or other appropriate wounds.
	139	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	8549	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology / PROJECT: A874

FY 1999 Planned Program:

•	2164	Evaluate various phospholipase A2 inhibitors and serine protease inhibitors for prevention of ischemia/reperfusion injury in brain, spinal cord, and other organs.
•	1385	Evaluate various oxygen free radical scavengers for their ability to mitigate ischemia/reperfusion injury in central nervous and other soft tissues.
•	2102	Evaluate use of laser burn debridement in militarily relevant burns or other appropriate wounds.
•	1281	Conduct evaluations of candidate cartilage repair techniques to correct battle or training injuries to joints.
•	1550	Continue evaluation of miniature version of CSTAT (miniSTAT) as a far-forward intensive care and diagnostic platform.
Total	8482	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	11176	8822	10159
Appropriated Value	11176	8822	
Adjustments to Appropriated Value	-372	-273	
FY 1999 President's Budget	10804	8549	8482

Change Summary Explanation: Funding: FY 1999 funds reprogrammed to PE 0602787A, Project A869, to create a telemedicine S&T program.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A878

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A878 Health Hazards of Military Materiel	6952	7765	8737	9548	9921	10155	10460	Continuing	Continuing

A. Mission Description and Justification: This project focuses on protecting soldiers from health hazards associated with their own materiel and operational environments. Emphasis is on identification of health hazards inherent to the engineering design and operational use of equipment, systems and materiel used in Army combat operations and training. Specific hazards include repeated impact/jolt and vibration stress from the operation of combat vehicles and aircraft; blast overpressure and impulse noise generated by firing weapons systems; toxic chemical hazards associated with deployment into environments contaminated with industrial waste and agricultural chemicals; non-ionizing radiation directed energy sources (laser); and environmental stressors (e.g., heat, cold, terrestrial altitude). Specific medical 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.

FY 1997 Accomplishments:

•	1896	Developed blast overpressure injury model for generic blast health hazards assessments.
•	842	Demonstrated effectiveness of individual soldier medical monitoring system in preventing heat and cold injury.
•	500	Characterized the health hazards of electromagnetic pulse from prototype electromagnetic weapon systems.
•	879	Characterized effects of likely concurrent exposure to multiple chemicals from Army systems.
•	1835	Demonstrated efficacy of early-phase anti-inflammatory therapy for treatment of laser eye injury.
•	1000	Completed dose response curve model for mechanical jolt and repeated impacts.
Total	6952	

FY 1998 Planned Program:

•	1500	Establish performance-based models characterizing levels of visual impairment pertinent to battlefield laser injury.
•	875	Develop biofidelic models for head and neck response to biodynamic forces.
•	900	Develop a user friendly model for thermal strain health hazards assessments involving individual equipment and in military vehicles.
•	1258	Develop finite elements model of thoracic and abdominal injury for prediction of blunt trauma injuries for health risk estimates in evaluation of nonlethal weapons technologies.
•	2187	Develop and validate nonmammalian near-real-time animal sentinel or in vitro bioassay models that detect developmental and neurotoxic chemical hazards.
•	850	Develop, validate and replace existing MILSTD 1474C standards for freefield impulse noise hazards.
	195	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	7765	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology
	PROJECT A878

FY 1999 Planned Program:

•	500	Develop and test field therapy kits for laser retinal therapy.
•	1200	Develop methodology and models to assess efficacy of vehicle crashworthiness design criteria and provide recommendations for improvement.
•	2127	Determine the relationship between blunt trauma and a valid and reliable measurement that can be used to assess the protective value of body armor, for which no valid standards currently exist.
•	2827	Develop nonmammalian near-real time animal sentinel or in vitro bioassay models that detect oxidative stress hazards acutely threatening to military performance.
•	350	Validate and transition field impulse noise damage risk criteria.
•	733	Develop a predictive model of injury and incapacitation from combined toxic gases from combustion in enclosed spaces for use in survivability assessments.
•	1000	Field improved human tolerance criteria for head impact protection in air and ground combat vehicles.
Total	8737	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7141	8012	9629
Appropriated Value	7141	8012	
Adjustments to Appropriated Value	-189	-247	
FY 1999 President's Budget	6952	7765	8737

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A879

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A879 Medical Factors Enhancing Soldier Effectiveness	8370	10698	8028	8081	8447	8677	8934	Continuing	Continuing

A. Mission Description and Justification: This project focuses on sustaining warfighting capability by preventing health and performance degradation in the military environment. Emphasis is on identification of baseline physiological performance and assessment of degradations produced by operational stressors. This database and collection of rules and algorithms for performance degradation in multistressor environments form the basis for the development of behavioral, training, pharmacological and nutritional ("skin-in") 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.

FY 1997 Accomplishments:

- 3213 Developed new safety tables for immersion exposure based on modeling data from U.S. Army Ranger students.
- 1856 Demonstrated behavioral and pharmacological strategies to enhance thermoregulation in hot and cold environments.
- 3301 Developed recommendations for a single set of body fat standards for the services which enhance and do not impair readiness.

Total 8370

FY 1998 Planned Program:

- 800 Evaluate efficacy of nutritional supplements currently in widespread use for enhancement of physical performance (creatine and choline).
- 900 Demonstrate practical applications of physiological status monitoring (activity, locomotory energy expenditure, core temperature, GIS computed movement, etc.) during small unit operations in a CEP with DBSBL.
- 941 Demonstrate effects of intermittent exercise on physiologic tolerance to uncompensable heat stress.
- 1275 Integrate real-time, satellite-derived weather data into thermal strain decision aids for commanders in the field.
- 423 Transition recommendations on appropriate use and fielding of a caffeine product to maintain soldier effectiveness in sustained operations.
- 625 Develop recommendations to improve initial entry training physical training programs so that military performance is optimized and training injuries are reduced.
- 700 Determine the effects of melatonin on visual performance in a simulator and in night flight.
- 600 Develop methods for evaluating candidate display systems and associated imagery and define specifications that will optimize compatibility with human visual systems.
- 325 Determine critical factors relating soldier stress and mental health during long-term deployments to Bosnia.
- 475 Complete sleep-dose experiment to provide new data for the accurate prediction of performance decrements associated with inadequate restorative sleep.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology
	PROJECT: A879

FY 1998 Planned Program: (continued)

•	100	Validate exposure guidelines and safety limits to prevent cold injury during specialized intensive military training.
•	375	Determine efficacy of intermittent hypobaric hypoxia exposures to induce altitude acclimatization.
	3033	By Congressional direction, conduct field and laboratory studies on the nutritional status of military personnel and develop performance enhancing ration components in joint studies with the Pennington Biomedical Research Center at Louisiana State University.
	126	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	10698	

FY 1999 Planned Program:

•	1700	Identify means to enhance absorption, deposition, and mobilization of optimal metabolic fuels to support energy demands of the deployed soldier.
•	1300	Demonstrate efficacy of hyper-hydration to improve cardiovascular stability and tolerance during incompensable heat stress.
•	900	Integrate physiological strain prediction models with micro-electronic environmental sensor systems.
•	750	Develop training strategies and countermeasures to reduce the high rate of stress fractures in young women during basic training.
•	588	Evaluate new pharmacological stimulants (modafinil) and hypnotics (zolpidem) to prevent aviator sleep loss and maintain performance during sustained operations.
•	500	Develop methodology for testing dynamic visual performance.
•	550	Test field-ready combined biochemical, physiological and psychometric stress diagnostics for potential real-time assessment of severely stressed soldiers at risk for combat stress reaction.
•	675	Validate a new continuous operations simulation designed to demonstrate and refine the sleep-induction/rapid reawakening and stimulant components of the Sleep Management System.
•	690	Develop strategies to safely extend cold tolerance and enhance performance during cold weather.
•	375	Determine if speech pattern disturbances are predictive of acute mountain sickness.
Total	8028	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	8511	7539	9190
Appropriated Value	8511	11039	
Adjustments to Appropriated Value	-141	-341	
FY 1999 President's Budget	8370	10698	8028

Change Summary Explanation:

Funding: FY 1998 Congressional add (+3500) for Army Nutrition Research.
FY 1999 funds reprogrammed (-800) to 0602787A.A879 to create a telemedicine S&T program.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A919

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A919 Orthopedic Implant Research	0	2423	0	0	0	0	0	0	2423

A. Mission Description and Budget Item Justification: By Congressional direction, develop a prototype artificial hip stem using the volumetrically controlled manufacturing (VCM) technique for precision fabrication using synthetic biomaterials. This will eliminate a major cause of artificial hip replacement failures.

FY 1997 Accomplishments: This program not funded in FY 1997.

FY 1998 Planned Program:

•	2363	Solicit proposals, evaluate and make contract award.
•	60	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	2423	

FY 1999 Planned Program: This program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
Previous President's Budget	0	0	0
Appropriated Value		2500	
Adjustments to Appropriated Value		-77	
Current Budget Submit/President's Budget	0	2423	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A920

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A920 Prostate Cancer Research	0	38765	0	0	0	0	0	0	38765

A. Mission Description and Budget Item Justification: By Congressional direction, the purpose of this project is to develop initial research models for prostate cancer research to include studying prostate cancer diagnosis and treatment in cooperation with the Center for Prostate Disease Research.

FY 1997 Accomplishments: Program funded in PE 0603002A, Project D804 in FY 1997.

FY 1998 Planned Program:

•	37793	Publish a Broad Agency Announcement (BAA) in May 1998. Conduct scientific and programmatic reviews in November 1998 and make first awards in December 1998. Complete awards no later than 30 September 1998.
•	972	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	38765	

FY 1999 Planned Program: Program not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
Previous President's Budget	0	0	0
Appropriated Value		40000	
Adjustments to Appropriated Value		-1235	
Current Budget Submit/President's Budget	0	38765	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A921

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A921 Ovarian Cancer Research	0	9692	0	0	0	0	0	0	9692

A. Mission Description and Budget Item Justification: By Congressional direction, the purpose of this project is to develop initial research models for a comprehensive preventive program in ovarian cancer that expands into endometrial, cervical, and other cancer research that would include prevention, planning, implementation, and development planning.

FY 1997 Accomplishments: Program funded in PE 0603002A, Project 887 in FY 1997.

FY 1998 Planned Program:

•	9449	Publish a Broad Agency Announcement (BAA) in May 1998. Conduct scientific peer review and programmatic review by February 1999. Initial awards will be made in March 1999 and awards completed by 30 September 1999.
•	243	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	9692	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
Previous President's Budget	0	0	0
Appropriated Value		10000	
Adjustments to Appropriated Value		-308	
Current Budget Submit/President's Budget	0	9692	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602789A Army Artificial Intelligence Technology

PROJECT: A880

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A880 Army Artificial intelligence Technology	2122	1205	1164	1206	1260	1277	1288	Continuing	Continuing

A. Mission Description and Budget Item Justification: The goal of the Artificial Intelligence (AI) exploratory development program is to mature AI and advanced information technology for future insertion into Army applications to achieve the strategic advantage needed to perform the Army's world-wide missions. The threefold purpose of the program is to: (1) develop/apply AI technology to solve large scale, highly complex management problems; (2) apply AI technology to solve Army-wide problems in policy, personnel training and management, and applications development; and (3) transfer technology to the Army through exploratory development efforts. In addition, the program seeks to identify high potential, but embryonic AI methodologies and mature them for high payoff applications through targeted technology demonstration projects and the development of working models. This program has established a number of sophisticated AI cells (knowledge engineering groups (KEGs)) focusing on the integration and application of AI technologies to problems in functional communities such as command and control, management, force integration, logistics, modeling, intelligence, resource management, test and evaluation, training, and medical. Focus for this science and technology effort is assisted through these functionally oriented cells. In addition, an office of AI research, analysis and evaluation has been established at the United States Military Academy to conduct AI applications research and development. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Force XXI. This project includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. This program is overseen by the U.S. Army AI Program General Officer Steering Committee (GOSC) and is managed primarily by the US Army AI Center, Pentagon.

FY 1997 Accomplishments:

•	2122	- Demonstrated use of AI technology in integrating vastly different data and technologies to solve highly complex problems.
		- Demonstrated effectiveness of hybrid systems within manufacturing and robotics domains.
		- Investigated integration of hybrid systems within synthetic environments for command and control AI systems.
		- Demonstrated the integration of hybrid systems for the testing and evaluation of AI systems.
		- Investigated the application of Intelligent Agent Technology in AI systems supporting Force XXI.
Total	2122	

FY 1998 Planned Program:

•	1174	- Demonstrate use of AI technology in integrating vastly different data and technologies to solve highly complex problems.
		- Demonstrate effectiveness of AI and information technology to manage information overload.
		- Investigate AI based prognostics technology for logistics and maintenance.
	31	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	1205	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602789A Army Artificial Intelligence Technology / PROJECT: A880

FY 1999 Planned Program:

•	1164	- Demonstrate use of AI technology in integrating vastly different data and technologies to solve highly complex problems. - Demonstrate effectiveness of hybrid systems within manufacturing and robotics domains. - Demonstrate integration of hybrid systems within synthetic environments for command and control AI systems. - Demonstrate the integration of hybrid systems for the testing and evaluation of AI systems. - Demonstrate the effectiveness of AI based prognostics systems in achieving "just-in-time" supply and maintenance.
Total	1164	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2179	1255	1330
Appropriated Value	2179	1255	
Adjustments to Appropriated Value	-57	-50	
FY 1999 President's Budget	2122	1205	1164

Change Summary Explanation: Funding: FY 1999: Funding reprogrammed to higher priority requirements (-166).

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

DATE: February 1998

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602805A Dual Use Applications Program

PROJECT: A105

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A105 Dual Use Application Program	0	0	20000	18700	18750	18700	18800	Continuing	Continuing

A. Mission Description and Budget Item Justification: The goal of the Dual-Use Applications Program (DUAP) is to provide an incentive for Army agencies to exploit new ways of doing business with the private sector in the development of technologies having both military and commercial applications. This PE provides matching funds to those invested by the sponsoring agencies on projects proposed by the private sector. Private sector partners propose projects for which they are willing to invest at least half of the cost (i.e., $\geq$ 50%). The sponsoring agency then provides half of the government cost ($\leq$ 25%), with the remainder coming from this PE ($\leq$ 25%). The cost-sharing by industry is intended to demonstrate their willingness to share in the development costs for items having substantive commercial applications. The cost sharing from this PE is intended to incentivize Army agencies to participate in the dual-use effort and to exploit new instruments (e.g., Other Transactions) for partnering with the private sector. The program exploits dual-use opportunities in a number of areas of significant interest to the Army, including automotive, rotorcraft, communications, sensors, medical, construction, environmental, food, clothing, and logistics technologies. This program provides significant savings to the Army, both in terms of initial development costs and, due to the parallel commercial products, reduced costs for end items. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Force XXI. This project includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. This program is overseen by the Office of the Secretary of Defense (OSD) Dual-Use Steering Committee and is managed primarily by the Office of the Deputy Assistant Secretary for Research and Technology. Prior to FY1999, DUAP was funded by DARPA.

FY 1997 Accomplishments: Program funded by a Defense Advanced Research Projects Agency (DARPA) PE.

FY 1998 Planned Program: Program funded by a DARPA PE.

FY 1999 Planned Program:

- 20000 - Provide up to 25% of funding for dual-use technology projects proposed by industry for which industry pays at least 50% of the cost and the sponsoring Army agency provides the remaining funds (i.e., up to 25%, matching or exceeding the amount contributed from this PE).

Total 20000

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value			
Adjustments to Appropriated Value			
FY 1999 President's Budget	0	0	20000

Change Summary Explanation: FY 1999: Funds for DUAP transferred from DARPA to Army.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	23211	34361	32969	30376	14445	16037	14840	Continuing	Continuing
DC07 Joint Service Food Technology Demonstration	1796	1881	1997	2049	2099	2148	2205	Continuing	Continuing
DJ28 Test Measurement Technology Development	240	0	0	0	0	0	0	0	240
DJ50 Force XXI Land Warrior	18515	10948	9316	6423	6434	7669	7997	Continuing	Continuing
D242 Airdrop Equipment	1191	1219	1279	1940	3268	3592	3762	Continuing	Continuing
D393 Military Operations in Urban Terrain	0	19630	19576	19144	1804	1771	0	0	61925
D543 Ammunition Logistics	1045	683	801	820	840	857	876	Continuing	Continuing
D594 Metrology and Calibration	424	0	0	0	0	0	0	0	424

Mission Description and Budget Item Justification: This program supports demonstration of technology for the dismounted soldier and materiel essential to support and sustain wartime operations and peacetime readiness, both strategically and tactically. Program's purpose is to develop, demonstrate, and transfer affordable technologies to enhance dismounted soldier system performance and capabilities, reduce the logistics burden on the battlefield, reduce operation and support (O&S) costs, and improve ammunition logistics system performance. It links diverse projects by applications benefiting whole categories of weapons systems and providing high return on investment. The Joint Service Food Technology project demonstrates food service systems and food products, processing, preservation, and serving equipment resulting from technology programs jointly approved by the Services and the Defense Logistics Agency (DLA) that will improve field feeding efficiencies, ration quality, and warfighter combat effectiveness. Force XXI Land Warrior develops and demonstrates advanced technology components for insertion into the Land Warrior program and performs the integration of future soldier system technologies focused on improving soldier performance, lethality and survivability. Enhancements to airdrop equipment for rapid deployment are required for dropping cargo from higher altitudes, greater offset distances and higher speeds, which will result in increased survivability of aircraft and crews and increased the probability that materials delivered will land in a usable condition. The Military Operations in Urban Terrain (MOUT) ACTD will identify, integrate, and demonstrate a system of existing and emerging technologies to provide improved Command, Control, Communications, and Intelligence (C4I), engagement, and force protection for Soldiers and Marines operating in the restrictive urban environment. The Ammunition Logistics project 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. Contractors performing the work for this PE include Motorola, Hughes, Honeywell, Gentex, Battelle, Arthur D. Little, Tecogen, Pioneer Aerospace, Giordano Automation, and InterVision. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology

Plan. This program adheres to Tri-Service Reliance Agreements on clothing, textiles and food and explosive ordnance disposal with oversight and coordination provided by the Joint Directors of Laboratories. Work in this program element is related to and fully coordinated with efforts in PE 0602786A (Warfighter Technology), Navy's integrated diagnostic support system, Missile Command Infrared (IR) scene generation, Defense Advanced Research Project Agency (DARPA) millimeter/microwave integrated circuit (MMIC), DARPA Small Unit Operations projects, and the Joint Services Calibration Coordination Committee. The Ammunition Logistics project is related to PE 0602624A (Weapons and Munitions Technology) and PE 0603004A (Weapons and Munitions Advanced Development). These efforts contain no unwarranted duplication of effort among the Military Departments. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology

PROJECT: DC07

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DC07 Joint Service Food Technology Demonstration	1796	1881	1997	2049	2099	2148	2205	Continuing	Continuing

A. **Mission Description and Justification:** Joint Service Food is a DoD program, for which the Army has executive agent responsibility, which demonstrates nutritionally advanced rations and logistically streamlined food delivery systems to sustain DoD personnel in all operations and to enhance their combat performance under diverse battlefield scenarios. The project focuses on demonstrations of advances in food technology, materials, energy utilization, and combination heating technologies to provide extended, simplified field feeding without resupply. It exploits advances in ration formulation and quality, packaging, preservation, and nutritional content to improve morale, extend endurance, and sharpen mental acuity. This project is managed by the U.S. Army Natick Research, Development, and Engineering Center, Natick, MA.

FY 1997 Accomplishments:

- 975 - Completed field demonstration of Mobility Enhancing Ration Component (MERC) prototypes during hot weather field study of modified Meal Ready to Eat (MREs) that showed an increase in mobility and operational capabilities of the warfighter.
  - Completed hot weather test of MRE prototypes demonstrating 20% increase in nutrient bioavailability.
  - Completed time-temperature indicator test and transitioned to DLA for use on predicting quality of all stored MREs.
  - Conducted demonstrations of selected performance enhancing nutrients and food components (carbohydrate enhancing beverage and performance enhancing bar) that demonstrated a 17% increase in performance, and obtained Joint Service Operational Rations Forum (JSORF) approval to incorporate components into the (MRE) Meal Ready to Eat.
  - Completed demonstration of producibility and microbiological safety for four species of fish using multibarrier processing technologies.
- 821 - Demonstrated a self-contained thermoelectric generator-driven Thermal-Powered Washer in the field Food Sanitation Center that reduces water and fuel consumption by more than 50% while providing more effective sanitation, and transitioned to Demonstration and Validation; demonstrated an adsorption type heat-driven refrigerator for non-powered mobile field kitchens, and transitioned to Demonstration and Validation; developed fuel cell and thermophotovoltaic generator concepts for cogenerating electric power in field kitchens to replace engine driven generators to increase efficiency, while reducing noise, weight and cost.

Total 1796

FY 1998 Planned Program:

- 933 - Complete technology demonstration of MERCs and transition to Fielded Individual Rations Improvement Program (FIRIP); conduct technology demonstration of multibarrier processing of marine ration components and transition to FIRIP; conduct technology demonstration of Performance Enhancing Ration Components (PERCs) and transition to FIRIP.
  - Validate the modeling of nutrition and hydration on combat performance of the warfighter.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology
	PROJECT DC07

FY 1998 Planned Program (Continued):

- Conduct field demonstration of Horizontal-Form-Fill-Seal pouch/tray concepts and transition to fielded ration systems for procurement and finalize design of the polymeric alternative to the metal group ration tray can.

•	901	- Improve field logistics support efficiency by: (1) Demonstrating an adsorption type heat driven refrigerator that will keep food cold for one to three days, and that can be regenerated with a standard field burner and transitioning to Demonstration and Validation; (2) Designing and fabricating fuel cell and thermophotovoltaic generator concepts for cogenerating electric power in field kitchens; (3) Completing test and evaluation of future shipboard galley concept incorporating new food service equipment technologies.
•	47	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	1881	

FY 1999 Planned Program:

•	1997	- Complete demonstration of a field feeding system based on recent advances in catalytic diesel combustion, thermal fluid heat transfer, integral power cogeneration and regenerative refrigeration that is rapidly deployable (minutes), more efficient (50% decrease in fuel), more reliable (50% increase in mean-time between failure (MTBF)), and that expands the tactical situations (by 40%) in which hot meals can be prepared and delivered.
		- Demonstrate producibility of interactive packaging technologies and quantify the effects of interactive packaging on improving ration acceptance and consumption while decreasing weight/volume of package rations; transition to DLA.
		- Model the effects of incremental differences in carbohydrate sources on mission effectiveness and completion.
		- Demonstrate shockwave technologies for processing that improve texture of meat items for combat rations.
Total	1997	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1851	1940	1987
Appropriated Value	1851	1940	
Adjustments to Appropriated Value	-55	-59	
FY 1999 President's Budget	1796	1881	1997

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology

PROJECT: DJ28

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DJ28 Test Measurement Technology Development	240	0	0	0	0	0	0	0	240

A. **Mission Description Justification:** This program developed diagnostics and prognostics technology to allow weapon systems to anticipate failure or, when failure occurs, self diagnose by means of embedded diagnostics. Embedded diagnostics make possible multicapable maintainers, allowing a reduction in the number of Military Occupational Specialties (MOS) and training times; it also supports the concept of "fix forward" for the purpose of reducing the levels of maintenance. Older systems will be maintained by a wearable, hands-free, intelligent maintenance aid now under development. This project was managed by the U.S. Army Test, Measurement, and Diagnostic Equipment Activity, Redstone Arsenal, AL.

FY 1997 Accomplishments:

•	240	- Enhanced Apache prototype electronics manuals with Maintenance And Repair Support System (MARSS) wearable electronic maintenance aid with advanced diagnostics.
Total	240	

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	246	0	0
Appropriated Value	246		
Adjustments to Appropriated Value	-6		
FY 1999 President's Budget	240	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology

PROJECT: DJ50

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DJ50 Force XXI Land Warrior	18515	10948	9316	6423	6434	7669	7997	Continuing	Continuing

A. **Mission Description and Justification:** This project addresses the critical Army need to enhance the performance, lethality, survivability, and sustainment of the individual soldier. This project is the Land Warrior science and technology (S&T) program. In the near term, the Force XXI Land Warrior efforts will focus on near-term technology insertions to the Land Warrior system. These technologies include: enhanced weapon mounted sensor interfaces to increase reliability, reduce weapon weight and increase usability, an integrated navigation component that will provide soldier's accurate geo-location information when GPS is not available, enhanced soldier radio which will provide a better link margin for the soldier radio and increase radio range, system voice control which will provide voice control of the essential Land Warrior functions without the use of a hand control device, combat identification functionality which will provide positive ID of friendly Land Warrior and non-Land Warrior combatants, low power helmet electronics which will reduce the overall power requirements of the Land Warrior helmet system, and a head orientation sensor which in combination with weapon mounted sensors will provide a rapid target acquisition capability when switching between the image intensifier and the weapon sight. Another Force XXI Land Warrior component is the Integrated Sight Technology Demonstration (TD), which will demonstrate a lighter, fully integrated weapon sensor (thermal, laser pointer, laser range finder, digital compass, daylight camera), with integrated target handover functions. In FY99, the FXXI Land Warrior program will perform an Early User Test (EUT) to validate the improvement of advanced technologies for the Land Warrior system. This EUT will demonstrate the improved individual and small unit operational effectiveness afforded by the modular integration of advanced components onto the Land Warrior platform. These results will be utilized to ensure that future Land Warrior procurements are upgraded with current technological advancements. Other emerging technology base components (from ongoing Defense Technology Objectives, Science and Technology Objectives, and DARPA efforts) will also be considered as candidates for technology insertion onto the Land Warrior platform. Force XXI Land Warrior will also pursue a variety of future technology developments for upgrading the Land Warrior platform. This effort will chart a course for future Land Warrior modernization with a focus on technologies available for fielding in the FY05-08 timeframe. The focus of these improvements will be system weight reduction, minimization of system power and energy requirements, system life cycle cost reduction, and improved system fightability. This program will leverage the commercial microelectronics and telecommunications industries as well as other ongoing DOD programs such as DARPA's Small Unit Operations (SUO) program to achieve lightweight, miniaturized components. This project is managed by the U.S. Army Soldier Systems Command, Natick, MA.

FY 1997 Accomplishments:

- 8750
  - Produced and evaluated prototype enhanced weapon interface
  - Produced and evaluated prototype rapid target acquisition capability
  - Produced and evaluated prototype integrated navigation component hardware and software
  - Evaluated and selected "off-the-shelf" voice control software
  - Completed critical design review (CDR) for the Integrated Sight TD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology
	PROJECT: DJ50

FY 1997 Accomplishments (Continued):

•	2765	- Conducted radio propagation tests of Land Warrior radio
		- Transitioned low power helmet electronics to the Land Warrior program
		- Updated Technology Insertion Plans
		- Completed Load Assessment Methodology
•	5000	- Initiated combat identification capability for Land Warrior
		- Conducted multiple advanced warfighter assessments of advanced components for Land Warrior at the Army's Dismounted Battlespace Battlelab
		- Formed a Future Warrior Architecture Team to address long term technical advances to the soldier system
•	2000	- Instrumented test site for urban operations of individual ground warriors
Total	18515	

FY 1998 Planned Program:

•	6848	- Complete design and fabrication of Integrated Sights
		- Build additional Integrated Sight thermal components and deliver to the Objective Individual Combat Weapon program
		- Complete development of the enhanced weapon interface, perform proof of concept demo, and build EUT components
		- Complete development of the system voice control system, perform proof of concept demo, and build EUT components
		- Complete development of the Combat ID component, perform proof of concept demo, and build EUT components
		- Complete development of the enhanced soldier radio, perform proof of concept demo, and build EUT components
		- Complete development of the integrated navigation component, perform proof of concept demo, and build EUT components
		- Complete development of the head orientation sensor/rapid target acquisition capability, perform proof of concept demo, and build EUT components
•	3825	- Continue assessment and development of future technology insertion components for the Land Warrior system
		- Obtain Land Warrior systems and integrate technology insertions onto the Land Warrior platform
		- Begin training for the Early User Test
•	275	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	10948	

FY 1999 Planned Program:

•	5616	- Continue assessment and development of future technology insertion components for the Land Warrior system
		- Complete fabrication of Early User Test items (Land Warrior prototypes upgraded with technology insertions)
		- Complete Early User Test Training
•	3700	- Perform Early User Test of upgraded Land Warrior systems
		- Prepare transition documents for transitioning successful Early User Test advanced technology components to the Land Warrior system
		- Demonstrate future component integration onto the Land Warrior platform (technologies from MOUT and SUO)
Total	9316	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology — PROJECT: DJ50

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	15936	11298	7016
Appropriated Value	15936	11298	
Adjustments to Appropriated Value	2579	-350	
FY 1999 President's Budget	18515	10948	9316

Change Summary Explanation: Funding: FY1997 – Funds reprogrammed to cover increases in restructured program and to instrument test site for urban operations of individual ground warriors; FY 1999 – Funds increased to perform the Early User Test with additional number of technologies.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology	PROJECT D242

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D242 Airdrop Equipment	1191	1219	1279	1940	3268	3592	3762	Continuing	Continuing

A. **Mission Description and Justification:** This project focuses on the demonstration and development of equipment and innovative techniques for aerial delivery of cargo and personnel, a key capability for rapid force projection, particularly into hostile areas. The goal is precision delivery of payloads from extremely high altitude (up to 25,000 ft) and long offset distances. Delivery from high altitudes and large offset distances improves cargo/personnel and aircraft survivability. In the near-term, revolutionary technologies for the reliable precision guided delivery of combat essential munitions/sensors and equipment using high glide wing technology will be demonstrated which incorporate a low cost, modular global positioning system (GPS) guidance package and control system. Specific near-term goal is a system capable of a 2,000-5,000 lb. payload, a glide ratio of at least 6:1, and an optional glide augmentation system with a range of 75-300 km.

FY 1997 Accomplishments:

•	1191	- Designed and began fabrication of High Glide Air Delivery system prototype using high glide wing technology. - Integrated and demonstrated guidance, navigation and control system with high glide wing technology.
Total	1191	

FY 1998 Planned Program:

•	1188	- Complete fabrication of High Glide Air Delivery prototypes. - Conduct extraction test from USAF aircraft. - Conduct testing of glide augmentation system.
•	31	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	1219	

FY 1999 Planned Program:

•	1279	- Conduct flight testing of High Glide Air Delivery System. - Conduct demonstration of High Glide Air Delivery System.
Total	1279	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1223	1258	1273
Appropriated Value	1223	1258	
Adjustments to Appropriated Value	-32	-39	
FY 1999 President's Budget	1191	1219	1279

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology

PROJECT: D393

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D393 Military Operations In Urban Terrain	0	19630	19576	19144	1804	1771	0	0	61925

A. **Mission Description and Justification:** This project conducts the integration of technology products into a "System of Systems", development of operational concepts and tactics/techniques/procedures (TTPs), and execution of live experiments and simulations to determine their military utility in enhancing operational capabilities in the urban environment. The Military Operations in Urban Terrain (MOUT) Advanced Concept Technology Demonstration (ACTD) will integrate promising Commercial-off-the-Shelf (COTS), Government-off-the-Shelf (GOTS) products and technology products from on-going Army, Marine Corps and Defense Advanced Research Projects Agency (DARPA) programs to create the MOUT System of Systems. The objective is to improve the command, control, communications, computers and intelligence (C4I), engagement, force protection and mobility capabilities of soldiers and Marines, and ensure the effective interoperability of these capabilities in the particularly challenging urban environment. The program will transition to rapid and efficient acquisition and fielding of the value-added components following the completion of the ACTD culminating demonstration in FY00. Hardware successfully demonstrating capabilities will be provided to operational units as an interim capability, including follow-on support, during FY2001/2002. The MOUT ACTD is a joint Army/Marine Corps program with participation from DARPA. This project is managed by U.S. Army Natick Research, Development and Engineering Center, Natick, MA.

FY 1997 Accomplishments: Project not funded in FY 1997

FY 1998 Planned Program:

- 10415 - Develop the MOUT Systems Architecture.
  - Complete engineering characterization of the MOUT environment.
  - Conduct integration, interoperability assessments, and diagnoses of mature technology products from the Army, Marine Corps, DARPA, COTS, and GOTS.
  - Exercise models and conduct simulations to assess and quantify military utility of hardware and software in MOUT.
- 8723 - Procure prototype hardware and software for use in MOUT experiments.
  - Conduct baseline MOUT experiments at Fort Benning and Camp Lejeune.
  - Conduct squad/platoon MOUT experiments of mature technologies at Fort Benning and Camp Lejeune.
  - Plan, manage, coordinate, and execute the MOUT ACTD program.
- 492 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 19630

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology
	PROJECT D393

FY 1999 Planned Program:

- 9141 - Implement integration, interoperability assessments, and diagnoses of advanced technology candidate products.
  - Conduct modeling and simulation to quantify military utility of advanced technology hardware and software.
  - Assess MOUT operational concepts and Tactics, Techniques and Procedures.
- 10435 - Procure prototype hardware and software for use in MOUT experiments.
  - Conduct follow-on platoon/company level MOUT experiments with prototype hardware.
  - Conduct MOUT experiments with integrated hardware and software.
  - Manage, coordinate, and execute the MOUT ACTD program.

Total 19576

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	20255	21124
Appropriated Value	0	20255	
Adjustments to Appropriated Value		-625	
FY 1999 President's Budget	0	19630	19576

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology

PROJECT: D543

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D543 Ammunition Logistics	1045	683	801	820	840	857	876	Continuing	Continuing

A. **Mission Description and Justification:** This project develops technology that maximizes munitions availability and survivability for the force projection Army. It enhances logistics survivability and force readiness through improvements in explosive safety, materiel handling equipment, ammunition and missile packaging/palletization, and asset throughput/management. It also improves weapon system rearm for artillery, armor, air defense, aviation, and infantry. Emerging technologies and productivity enhancers/cost savers are exploited to provide quantum improvements to the force projection (strategic), in-theater (operational), and combat-focused (tactical) logistics systems. This project is managed by the U.S. Army Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ. Efforts will transition to weapons and munitions technology/development programs and the Total Army Distribution System.

FY 1997 Accomplishments:

- 146 - Demonstrated prototype handling equipment enhancements for improved munitions velocity management.
  - Developed prototype decision aid software to help soldiers design survivable forward area ammunition storage sites.
- 899 - Selected and initiated testing of lightweight, fire retardant and shock absorbing material candidates for a rapid ammunition protection system to limit loss at a forward ammunition storage area to only 1% of assets from a direct hit and also reduce ammunition storage area footprint by 60%.
  - Developed heat transport computer codes and hydrocode sympathetic detonation models for treating shocks, rapid compression, and penetration in porous rapid ammo protection system material candidates.
  - Completed upgrade of FASTLOAD (artillery rearm module on HEMMT) automated rearm system for towed and self-propelled howitzers.

Total 1045

FY 1998 Planned Program:

- 675 - Calibrate sympathetic detonation computational models to define specifications for a rapid ammunition protection system which prevents fire propagation and achieves optimum shock attenuating performance.
- 8 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 683

FY 1999 Planned Program:

- 801 - Conduct full scale experiments to verify sympathetic detonation computational models of a rapid ammo protection system utilizing lightweight, high performance materials and designs optimized to prevent fire propagation and mitigate explosive propagation.

Total 801

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology — PROJECT: D543

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3032	718	797
Appropriated Value	3032	718	
Adjustments to Appropriated Value	-1987	-35	
FY 1999 President's Budget	1045	683	801

Change Summary Explanation: Funding: FY1997 – Funds reprogrammed to other high priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology

PROJECT: D594

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D594 Metrology and Calibration	424	0	0	0	0	0	0	0	424

A. Mission Description and Justification: This project provided Army weapon systems and technology developers with cost effective, time saving, legally mandated, traceable calibration equipment for microwave, electro-optics, mechanical, and electronic systems. This was a Joint Logistics Commanders program, closely coordinated with the Navy and Air Force, which directly supported Army research, development, and engineering centers (RDECs), test ranges, and proving grounds. Among the weapons systems directly supported were Search and Destroy Armor (SADARM), Longbow, Military Strategy Tactical and Relay Satellite System (MILSTAR), Integrated Family of Test Equipment (IFTE), and High Power Coherent Radar (HIPCOR). The Intrinsic Standards Voltage Calibrator that stemed from this project was an advance of international significance, and was reported at the National Conference of Standards Laboratory Conference in 1994. The United States National Institute for Standards and Technology (NIST) directly participated in this calibrator program and benefited from technology transfer, as has the United States cryogenics industry. The calibrator has improved the Army's calibration program, and the U.S. Navy, Air Force, and NASA are expected to apply this technology to their programs. This project was managed by the U.S. Army Test Measurement and Diagnostic Equipment Activity, Redstone Arsenal, AL.

FY 1997 Accomplishments:

•	424	- Developed wireless access of weapon system test data for remote analysis.
		- Developed prototype lightweight glasses for displaying test data.
Total	424	

FY 1998 Planned Program: Project not funded in FY98.

FY 1999 Planned Program: Project not funded in FY99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	436	0	0
Appropriated Value	436		
Adjustments to Appropriated Value	-12		
FY 1999 President's Budget	424	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	195884	176737	11012	10788	10977	12147	12757	Continuing	Continuing
D804 Prostate Cancer Research	42895	0	0	0	0	0	0	0	42895
D806 Breast Cancer Research	95314	130833	0	0	0	0	0	0	95314
D810 Industrial Base/Infectious Disease Vaccines and Drugs	8796	8019	8545	8105	8260	8846	9319	Continuing	Continuing
D813 Trichloromelamine Testing	477	0	0	0	0	0	0	0	477
D814 Neurofibromatosis	7625	0	0	0	0	0	0	0	7625
D815 National Medical Testbed	5719	7753	0	0	0	0	0	0	5719
D816 Computer-Based Decision Support System	5719	0	0	0	0	0	0	0	5719
D817 Computer-Aided Diagnostic Research	2865	0	0	0	0	0	0	0	2865
D818 Advanced Cancer Detection Center	3336	3391	0	0	0	0	0	0	3336
D819 Field Medical Protection and Human Performance Enhancement-Non-Systems Advanced Development	2288	0	0	190	182	515	523	Continuing	Continuing
D840 Combat Injury Management	2262	2329	2467	2493	2535	2786	2915	Continuing	Continuing
D887 Ovarian Cancer Research	7149	0	0	0	0	0	0	0	7149
D893 Tissue Replacement	11439	0	0	0	0	0	0	0	11439
D922 Emergency Telemedicine	0	2423	0	0	0	0	0	0	2423
D923 Prostate Diagnostic Image	0	4845	0	0	0	0	0	0	4845

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D924 Advanced Trauma Care	0	2907	0	0	0	0	0	0	2907
D929 Artificial Lung Technology	0	1453	0	0	0	0	0	0	1453
D930 Cooperative Teleradiology	0	2907	0	0	0	0	0	0	2907
D931 WRAMC Catherization Lab	0	6000	0	0	0	0	0	0	6000
D934 Volume Angiocat	0	3877	0	0	0	0	0	0	3877

Mission Description and Budget Item Justification: This program element funds advanced technology development for the DoD core Vaccine and Drug Program, field medical protective devices, and combat injury management. These last two projects focus on diagnostic imaging devices, clinical studies of combat casualty care treatment modalities, and nutrition and soldier performance enhancement. The DoD core Vaccine and Drug Program provides, in accordance with Food and Drug Administration (FDA) regulations, drugs and vaccines for development that are effective protectants, treatments, and antidotes against military disease threats. Pilot and standard lots of candidate pharmaceutical-grade drugs, antidotes and vaccines are produced. The primary goal of this program is to provide, with minimum adverse effects, maximum soldier survivability and sustainability on the integrated battlefield as well as in military operations other than war. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This program is managed primarily by the U.S. Army Medical Research and Materiel Command. This program is dedicated to conducting proof of principle field demonstrations and tests of non-system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3. This program element also serves to track funds for Congressionally directed medical research in projects 804, 806, 814, 816, 817, 818, and 887.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D804

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D804 Prostate Cancer Research	42895	0	0	0	0	0	0	0	42895

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for prostate cancer research to include studying prostate cancer diagnosis and treatment in cooperation with the Center for Prostate Disease Research.

FY 1997 Accomplishments:

- 42895 Developed Implementation Plan and published Broad Agency Announcement (BAA). Received 605 proposals; conducting scientific peer review and programmatic review and will make initial awards in May 1998. Awards will be completed by 30 September 1998.

Total 42895

FY 1998 Planned Program: Program funded in PE 602787A, Project D804 in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	44058	0	0
Appropriated Value	44058		
Adjustments to Appropriated Value	-1163		
FY 1999 President's Budget	42895	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D806

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D806 Breast Cancer Research	95314	130833	0	0	0	0	0	0	95314

A. **Mission Description and Justification:** By Congressional direction, the purpose of this project is to continue the peer-reviewed Breast Cancer Research Program, specifically for improvements within the military health care system, for in-house DoD training, education, access to care, and improved detection technology programs dedicated to serving service members and their families.

FY 1997 Accomplishments:

•	95314	Published Broad Agency Announcement (BAA), received 1840 proposals that were evaluated in scientific programmatic peer review. Completed award of 300 grants for FY 1996 competition by 30 September 1997. Initiated awards January 1998 and will complete all awards no later than 30 September 1998.
Total	95314	

FY 1998 Planned Program:

•	127552	Will publish a Broad Agency Announcement (BAA) in March 1998; conduct scientific peer review and programmatic review by December 1998 and make initial awards in January 1999. Complete awards no later than 30 September 1999.
•	3281	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	130833	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	97906	0	0
Appropriated Value	97906	135000	
Adjustments to Appropriated Value	-2592	-4167	
FY 1999 President's Budget	95314	130833	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology — PROJECT: D810

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D810 Industrial Base/Infectious Disease Vaccines and Drugs	8796	8019	8545	8105	8260	8846	9319	Continuing	Continuing

A. Mission Description and Justification: This project funds development of medical countermeasures for naturally occurring diseases that are militarily significant due to their potential impact on military operations. Development of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalization and evacuations from the theater of operations. Major contractors are the University of California, San Francisco, CA; SRI, Inc., Menlo Park, CA; Starks Associates, Inc., Buffalo, NY; ASH Stevens, Inc., Detroit, MI; Research Triangle Associates, Research Triangle Park, NC; and Kenya Medical Research Institute, Nairobi, Kenya.

FY 1997 Accomplishments:

- 1568 Initiated the world's first malaria DNA vaccine trial in humans. Completed clinical trials evaluating four candidate *Plasmodium falciparum* malaria vaccines. Completed a dose range trial for administration of the leading malaria vaccine candidate, RTS,S. Prepared field sites in Brazil and Kenya for trials of the RTS,S vaccine.
- 2529 Evaluated the safety of the leading antimalaria compound in animals.
- 191 Documented the spread of the novel chloroquine resistant strain of *Plasmodium vivax* in Oceana and additionally found that all *Plasmodium falciparum* isolates from the Brazilian Amazon were resistant to chloroquine and most were resistant to the second line of treatment, Fansdiar; these data are important for determining the most appropriate prophylactic or therapeutic regimen for soldiers deployed to these malaria endemic areas.
- 551 Completed successful Phase I trial of *Shigella sonnei* Proteosomes/LPS intranasal vaccine demonstrating both safety and immunogenicity. Completed successful Phase I and Phase II trials of a live oral *Shigella flexneri* 2a vaccine demonstrating both safety and immunogenicity. Successfully scaled-up Good Manufacturing Practices (GMP) production of a live-attenuated *Shigella sonnei* vaccine.
- 387 Scaled-up and produced microencapsulated Enterotoxigenic *Escherichia coli* (ETEC) CS6 protein under GMP conditions for use in a Phase I clinical proof of concept trial.
- 468 Completed field surveillance studies which continue to show *Campylobacter* is the major cause of food borne illness in the United States and a leading cause of diarrhea in deployed forces. Surveillance data also showed that resistance to the antibiotics commonly used to treat *Campylobacter* enteritis continues to increase. Completed volunteer studies which demonstrated that an *E. coli* modified heat labile toxin (mLT) has adjuvant activity of increasing the immune response when combined with a candidate *Campylobacter* vaccine. Established a human *Campylobacter* challenge model that can be used in evaluating all candidate *Campylobacter* vaccines. Using this human *Campylobacter* challenge model, confirmed that prior *Campylobacter* infection provides solid protection against disease after re-challenge with a homologous strain.
- 548 Evaluated safety and immunogenicity of four candidate live-attenuated dengue vaccines in humans.
- 139 Evaluated effectiveness of an antiviral drug (ribavirin) against sandfly fever virus in humans.
- 66 Determined feasibility of a combined hepatitis A/B vaccine to decrease current logistical burdens of protecting U.S. forces against hepatitis A and B.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology
	PROJECT D810

FY 1997 Accomplishments: (continued)

•	72	Field tested scrub typhus dipstick and PCR diagnostics. Conducted antibiotic efficacy studies of new agents for treatment of scrub typhus.
•	167	Advanced *Leishmania* skin-test antigen (LSTA-MFL) to Milestone I in acquisition process. Prepared field site for evaluation of new diagnostics.
•	124	Conducted Phase I study of intranasal outer membrane protein vaccine to protect against bacterial meningitis.
•	191	Completed field testing of a combination face paint and insect repellent at Ft. Bragg and Panama. Completed a one-year field test of insecticide-treated tents and ground covers in Korea and Honduras. Completed a one-year epidemiological evaluation of a filter paper diagnostic for malaria in Honduras. Investigated the occurrence of Oropouche virus in Peru. Completed epidemiological assessments of malaria transmission in Brazil and Thailand.
•	1395	Manufactured vaccines and additional clinical products under GMP conditions and in compliance with research laboratory specifications for the following diseases or pathogens of military importance: *Shigella* (three vaccines), *Campylobacter* (three vaccines), Meningitis (one vaccine), Malaria (four vaccines), dengue (two vaccines), Bacterial Sepsis (one vaccine), ETEC (one product), HIV (six products). Provided full quality control services for each vaccine production.
•	400	Paid for Armed Forces Research Institute of Medical Science (AFRIMS, Bangkok, Thailand) Veterinary Medicine facility renovation.
Total	8796	

FY 1998 Planned Program:

•	1395	Compare different prime boost strategies using the vaccinia-vectored multiple antigen vaccine NYVAC-7. Evaluate data from the field trial of the RTS,S vaccine. Complete preclinical studies of a combined RTS,S/SSP2 *Plasmodium falciparum* vaccine. Complete Aotus monkey trials of four-gene *Plasmodium vivax* DNA vaccines. Analyze immune response to epidermally administered, gene gun-delivered, DNA vaccines. Prepare field sites for additional trials of the RTS,S vaccine. Formulate a blood stage DNA vaccine cocktail containing 5-8 genes. Complete Phase I and initiate Phase II evaluation of single and multiple gene DNA *P. falciparum* vaccines.
•	2706	Evaluate the metabolism of the leading antimalaria compound in animals.
•	179	Conduct surveillance for drug resistant *Leishmania* in Brazil and drug resistant malaria in East Africa, South America, Southeast Asia, and Oceana.
•	376	Conduct Phase I trials of the Proteosome/LPS *Shigella flexneri* 2a intranasal vaccine. Conduct Phase I dose selection trial for the live, oral *Shigella sonnei* vaccine. Conduct a Phase I outpatient trial of the live-attenuated *Shigella flexneri* 2a vaccine.
•	406	Perform preclinical evaluation and general safety of ETEC CS6 vaccine. Produce microencapsulated CFA/I ETEC vaccine under GMP conditions. Test ETEC strains in human volunteers to assess immunologic markers of protection and to establish an ETEC challenge protocol.
•	448	Compare immune responses of volunteers receiving adjuvanted killed whole-cell vaccine to immune responses from natural infection. Produce a prototype live-attenuated or carrier-based *Campylobacter* vaccine. Conduct surveillance at multiple global locations to determine optimal field sites for *Campylobacter* vaccine trials. Continue surveillance and characterization of *Campylobacter* infection in deployed forces. Determine the role of antibiotic resistance in treatment of *Campylobacter* enteritis.
•	95	Produce malaria and hantavirus diagnostic devices under GMP conditions. Identify appropriate field sites for testing the malaria and hantavirus diagnostic tests.
•	537	Determine infection and disease rates in selected field site for future field evaluation of candidate dengue virus vaccines.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology
	PROJECT: D810

FY 1998 Planned Program: (continued)

- 143 Complete assessment of effectiveness of an antiviral drug (ribavirin) against sandfly fever virus in humans.
- 37 Determine feasibility of candidate hepatitis E vaccines in animal models.
- 104 Define risk factors for infection with antibiotic resistant scrub typhus. Field test diagnostic assay for scrub typhus.
- 52 Field test new clinical diagnostic assays for *Leishmania*. Develop archives of *Leishmania*-infected tissues and *Leishmania* parasites at field sites.
- 271 Prepare second lot of outer membrane protein vaccine against bacterial meningitis for further clinical evaluation. Submit Investigational New Drug (IND) application to the Food and Drug Administration (FDA) for this vaccine.
- 176 Prepare field sites for large-scale testing of a lethal ovitrap device in Brazil and of a self-supporting bednet in Peru. Prepare field sites in Thailand, Kenya and Jakarta for testing vector control methods and diagnostic tests and begin field testing of assay for detection of *P. falciparum* and *P. vivax* malaria parasites in mosquitoes. Prepare field sites for typhus control tactics in Thailand and Kenya.
- 893 Produce, purify and bottle 15-20 new vaccines at the vaccine pilot production plant under GMP conditions. Conduct clinical trials of 10-15 vaccine candidates in volunteer recipients at the Clinical Trials Department at the Walter Reed Army Institute of Research.
- 201 Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 8019

FY 1999 Planned Program:

- 1545 Refine methods to measure immune responses to *Plasmodium falciparum* RTS,S and TRAP proteins to support Phase I trials of new formulations of combined vaccines containing both of these antigens. Identify correlation between specific immune antibody and cellular responses and protection against malaria in human volunteers. Conduct Phase I trial of new *Plasmodium falciparum* MSP-1 vaccine candidate.
- 3060 Complete all remaining studies on the leading antimalaria compound necessary to obtain FDA approval for an IND application that permits evaluation of the compound in humans.
- 386 Submit IND application to FDA for trials of combined live, oral *Shigella flexneri 2a* and *Shigella sonnei* vaccines. Conduct Phase I dose selection testing of the combined *Shigella flexneri 2a* and *Shigella sonnei* vaccines. Perform field trials with the *Shigella* PCR diagnostic device.
- 376 Conduct Phase I clinical trial of microencapsulated ETEC CS6 vaccine to confirm its safety and immunogenicity.
- 456 Assess protection by candidate live-attenuated or carrier-based *Campylobacter* vaccines against homologous and heterologous challenge in animal models. Scale-up production of a live-attenuated or carrier-based *Campylobacter* vaccine under GMP conditions.
- 170 Field test malaria and enteric diagnostic tests. Field test multiple specimen collection and processing systems to support development of a hand-held system for far-forward diagnosis of infectious diseases.
- 557 Evaluate sensitivity and specificity of a rapid dengue antibody test for clinical use in future vaccine field trials.
- 145 Evaluate safety of a hantavirus vaccine in humans.
- 86 Determine infection and disease rates in selected field site for future evaluation of candidate hepatitis E virus vaccines.
- 112 Further characterize the nature of apparent antibiotic resistance in *Orientia tsutsugamushi*. Provide alternative means for prevention of scrub typhus.
- 381 Support field site development in endemic areas, particularly at OCONUS labs, for evaluation of new *Leishmania* diagnostic and control strategies.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology
	PROJECT D810

FY 1999 Planned Program: (continued)

- 130 Conduct Phase I studies of two vaccines for prevention of bacterial meningitis.
- 214 Demonstrate the effectiveness of Global Information Systems (GIS) in mapping, monitoring and predicting risk of vector-borne disease transmission. Field test device to detect any combination of dengue, *P. falciparum* and *P. vivax* in mosquitoes. Field test ELISA assay for identification of *Leishmania donovoni* in sand flies. Evaluate a prototype expert system for rapid assessment of vector borne diseases at the Army Medical Department Center and School.
- 927 Produce, purify and bottle 15-20 new vaccines at the vaccine pilot production facility under GMP conditions, applying the new technologies tested in FY 1998 research efforts. Conduct clinical trials of 10-15 vaccine candidates in volunteer recipients at the Clinical Trials Department of the Walter Reed Army Institute of Research.

Total 8545

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9034	8274	8504
Appropriated Value	9034	8274	
Adjustments to Appropriated Value	-238	-255	
FY 1999 President's Budget	8796	8019	8545

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D813

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D813 Trichloromelamine Testing	477	0	0	0	0	0	0	0	477

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for trichloromelamine (TCM) testing that include a 90-day toxicity disinfectant study in a non-rodent species. Purpose of test is to provide appropriate Environmental Protection Agency (EPA) registration for Army future procurement for TCM suppliers, thus ensuring competition.

FY 1997 Accomplishments:

•	477	Acquired data from non-rodent testing for submission to EPA for approval for trichloromelamine use.
Total	477	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	490	0	0
Appropriated Value	490		
Adjustments to Appropriated Value	-13		
FY 1999 President's Budget	477	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D814

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D814 Neurofibromatosis	7625	0	0	0	0	0	0	0	7625

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for neurofibromatosis.

FY 1997 Accomplishments:

- 7625 Developed Implementation Plan, published Broad Agency Announcement (BAA). Peer review and programmatic review will be completed by March 1998. Initial awards will be made in April 1998 and all awards completed no later than 30 September 1998.

Total 7625

FY 1998 Planned Program: Program funded in PE 602787A, Project A872 in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7832	0	0
Appropriated Value	7832		
Adjustments to Appropriated Value	-207		
FY 1999 President's Budget	7625	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D815

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D815 National Medical Testbed	5719	7753	0	0	0	0	0	0	5719

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for national medical testbed which display measurable improvements in cost and effectiveness in many areas of health care delivery.

FY 1997 Accomplishments:

•	5719	Evaluated competitive contracts/grants to initiate research on national medical testbed; awards process began.
Total	5719	

FY 1998 Planned Program:

•	3160	Evaluate advanced acoustic signal processing diagnostic aids for cardiac evaluation.
•	2276	Evaluate sensor/transmitter technology for vital signs.
•	2123	Evaluate non-invasive glucose sensing using a novel optical technique.
•	194	Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	7753	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5874	0	0
Appropriated Value	5874	8000	
Adjustments to Appropriated Value	-155	-247	
FY 1999 President's Budget	5719	7753	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D816

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D816 Computer-Based Decision Support System	5719	0	0	0	0	0	0	0	5719

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for computer-based decision support systems to allow patients to better understand the diagnosis, treatment options, and risk factors associated with treatment.

FY 1997 Accomplishments:

•	5719	Published Broad Agency Announcement (BAA), received proposals, conducted two-tier review. Awards began in January 1998 and will be completed no later than 30 September 1998.
Total	5719	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5874	0	0
Appropriated Value	5874		
Adjustments to Appropriated Value	-155		
FY 1999 President's Budget	5719	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D817

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D817 Computer-Aided Diagnostic Research	2865	0	0	0	0	0	0	0	2865

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for computer-aided diagnostic research that utilize image enhancement and segmentation by adaptive multiresolution/multiorientation wavelet transform methods, which are suitable for more generalized application and are useful to the DoD in digital mammography, digital x-ray imaging, and teleradiology applications.

FY 1997 Accomplishments:

•	2865	Funds were transferred to Navy Medical Research Command, Bethesda, MD, in May 1997 for program continuity in Computer-Aided Diagnostic Research.
Total	2865	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2937	0	0
Appropriated Value	2937		
Adjustments to Appropriated Value	-72		
FY 1999 President's Budget	2865	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D818

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D818 Advanced Cancer Detection Center	3336	3391	0	0	0	0	0	0	3336

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for an advanced cancer detection center for military personnel, dependents, and retired service members, using a network including a military hospital or hospitals, a regional TRICARE provider, a Department of Veteran Affairs hospital or hospitals, and a medical facility with a focused cancer center, in order to conduct coordinated screening for early detection and treatment to train military cancer specialists, and to develop improved cancer detection equipment and technology.

FY 1997 Accomplishments:

•	3336	Funds were transferred to Navy Medical Research Command, Bethesda, MD, in May 1997 for program management.
Total	3336	

FY 1998 Planned Program:

•	3306	Funds will be transferred to the Navy Medical Research Command, Bethesda, MD, for continuity in program management.
•	85	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	3391	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3427	0	0
Appropriated Value	3427	3500	
Adjustments to Appropriated Value	-91	-109	
FY 1999 President's Budget	3336	3391	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D819

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D819 Field Medical Protection and Human Performance Enhancement-Non-Systems Advanced Development	2288	0	0	190	182	515	523	Continuing	Continuing

A. Mission Description and Justification: This project supports laboratory validation studies and field demonstrations focused on soldier protection, sustainment, and enhancement associated with soldiers operating, wearing, and consuming materiel systems in all climatic and operational conditions. Specific support includes medical non-systems advanced development of laser eye protection technologies and laser bioeffects treatment, medical protection against military electromagnetic radiation hazards, environmental health monitoring methods to link soldier physiological status with climatic and environmental conditions, methods to enhance sleep and alertness during continuous/sustained operational scenarios, nutritional strategies to enhance soldier mental and physiological performance, and medical protection from vibration and repeated shock hazards arising from the operation of combat vehicle and aircraft systems.

FY 1997 Accomplishments:

•	2288	Used non-invasive sensors and stable isotope technologies; established a database of energy requirements and activity patterns for men and women in Army, Navy, and Marine Corps jobs to predict and plan for voluntary energy requirements.
Total	2288	

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2350	0	0
Appropriated Value	2350		
Adjustments to Appropriated Value	-62		
FY 1999 President's Budget	2288	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D840

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D840 Combat Injury Management	2262	2329	2467	2493	2535	2786	2915	Continuing	Continuing

A. Mission Description and Justification: This project funds Advanced Development prototypes of non-system-specific medical materiel items for far-forward medical management of shock and trauma, and for casualty resuscitation, including preclinical testing of large standard lots of candidate compounds and equipment, to obtain data necessary for Food and Drug Administration (FDA) approval for human use. A major contractor is the University of North Carolina, Chapel Hill, NC.

FY 1997 Accomplishments:

•	494	Designed prototype omni-directional maneuverable platform for robotic surgical assistant testbed.
•	716	Conducted preclinical studies to evaluate fibrin-based hemostatic bandage formulation for hemorrhage control in otherwise fatal liver trauma.
•	732	Evaluated preclinical efficacy and mechanism of oxygen administration in hemorrhage models.
•	199	Evaluated efficacy of tobramycin and vancomycin microspheres against antibiotic-resistant strains of *Pseudomonas aeruginosa.*
•	121	Evaluated anabolic steroid treatment to enhance musculoskeletal rehabilitation after extremity trauma.
Total	2262	

FY 1998 Planned Program:

•	187	Complete laboratory validation of individual, far-forward version of the microwave resuscitation fluid warmer.
•	124	Transition non-invasive deep tissue pH and deep tissue oxygen sensors to Advanced Development.
•	250	Transition Life Support for Trauma and Transport (LSTAT) 1996 Test Article (prototype version with FDA-approved, commercially developed off-the-shelf equipment) to Advanced Development.
•	188	Transition Advanced Surgical Suite for Trauma Casualties (ASSTC) to Advanced Development.
•	200	Analyze healed patellar tendon donor site tensile strength to determine adequacy to serve as autograft material.
•	300	Complete testing of hypertonic saline dextran treatment as therapy for massive hemorrhage in large animal model.
•	461	Test dextromethorphan and carbetapentane analogs in large animal models to assess neuroprotective efficacy.
•	561	Assess efficacy of fibrin spray and foams as hemostatic agents in preclinical models of organ trauma.
•	58	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	2329	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology / PROJECT: D840

FY 1999 Planned Program:

- 264 Transition DataPak individual physiologic sensor monitor to Advanced Development.
- 280 Transition non-invasive intracranial pressure monitor to Advanced Development.
- 268 Transition medical decision assist algorithm(s) to Advanced Development.
- 755 Transition dextromethorphan and carbetapentane analog pharmaceuticals to Phase I clinical trials.
- 900 Transition fibrin bandages, spray and foams to Advanced Development.

Total 2467

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2324	2403	2455
Appropriated Value	2324	2403	
Adjustments to Appropriated Value	-62	-74	
FY 1999 President's Budget	2262	2329	2467

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D887

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D887 Ovarian Cancer Research	7149	0	0	0	0	0	0	0	7149

A. Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for a comprehensive preventive program in ovarian cancer that expands into endometrial, cervical, and other cancer research that would include prevention planning, implementation, and development planning.

FY 1997 Accomplishments:

- 7149 Developed Implementation Plan, published Broad Agency Announcement (BAA) and received eight proposals. Initial awards will be made in April 1998 and awards completed by 30 September 1998 after conducting scientific peer review in January 1998 and completing a program review in April 1998.

Total 7149

FY 1998 Planned Program: Program funded in PE 0602787A, Project D921 in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7343	0	0
Appropriated Value	7343		
Adjustments to Appropriated Value	-194		
FY 1999 President's Budget	7149	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D893

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D893 Tissue Replacement	11439	0	0	0	0	0	0	0	11439

A. Mission Description and Justification: By Congressional direction, this project supports tissue replacement research/technologies.

FY 1997 Accomplishments:

- 11439 Evaluated and awarded competitive contracts/grants to initiate research on tissue replacement.

Total 11439

FY 1998 Planned Program: Program not funded in FY 1998.

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	11749	0	0
Appropriated Value	11749		
Adjustments to Appropriated Value	-310		
FY 1999 President's Budget	11439	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D922

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D922 Emergency Telemedicine	0	2423	0	0	0	0	0	0	2423

A. Mission Description and Budget Item Justification: By Congressional direction, this program will support efforts to develop, facilitate, and improve the application of telemedicine technologies. This program will develop critical knowledge engineering applications specific to emergency medicine including trauma, medical imaging, lab outreach and patient tracking.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program:

•	2363	Prepare request for competitive proposals, evaluate and award contracts for research on emergency telemedicine.
•	60	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	2423	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		2500	
Adjustments to Appropriated Value		-77	
FY 1999 President's Budget	0	2423	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D923

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D923 Prostate Diagnostic Image	0	4845	0	0	0	0	0	0	4845

A. Mission Description and Budget Item Justification: By Congressional direction, the purpose of this project is to develop initial research models for prostate cancer research to include studying prostate cancer diagnosis and treatment. The Army will establish a public/private research project with appropriate government agencies and private institutions to explore promising technologies for improvement of prostate diagnostic imaging and treatment technology.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program:

•	4723	Initiate public/private research agreement and institute research program.
•	122	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	4845	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		5000	
Adjustments to Appropriated Value		-155	
FY 1999 President's Budget	0	4845	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D924

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D924 Advanced Trauma Care	0	2907	0	0	0	0	0	0	2907

A. Mission Description and Budget Item Justification: By Congressional direction, this program funds the development of technology to promote real-time medical situational awareness through medical mentoring and consultation.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program:

•	2834	Solicit proposals and award contract no later than September 1998.
•	73	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	2907	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		3000	
Adjustments to Appropriated Value		-93	
FY 1999 President's Budget	0	2907	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D929

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D929 Artificial Lung Technology	0	1453	0	0	0	0	0	0	1453

A. Mission Description and Budget Item Justification: By Congressional direction, the purpose of this project is to conduct advanced research efforts on artificial lung technology and intravenous membrane oxygenator.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program:

•	1417	Solicit proposals, evaluate and make award.
•	36	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	1453	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		1500	
Adjustments to Appropriated Value		-47	
FY 1999 President's Budget	0	1453	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D930

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D930 Cooperative Teleradiology	0	2907	0	0	0	0	0	0	2907

A. Mission Description and Budget Item Justification: By Congressional direction, this program funds the development of experimental technologies that will allow medical imaging to be deployed in remote and far-forward locations. Additionally, this program will fund the research for the development of imaging networks that can deliver medical studies for interpretation.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program:

•	2834	Solicit proposals, evaluate and make award.
•	73	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	2907	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		3000	
Adjustments to Appropriated Value		-93	
FY 1999 President's Budget	0	2907	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D931

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D931 WRAMC Catherization Lab	0	6000	0	0	0	0	0	0	6000

A. Mission Description and Budget Item Justification: By Congressional direction, the purpose of this project is to upgrade and refurbish the cardiac catheterization laboratories at the Walter Reed Army Medical Center. These funds are inappropriately placed in this Program Element and should be placed in the Defense Health Program (DHP) funding line; a reprogramming is being processed which will move the funds to the DHP.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program:

•	6000	Transfer funds to DHP
Total	6000	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		6000	
Adjustments to Appropriated Value		0	
FY 1999 President's Budget	0	6000	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D934

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D934 Volume Angiocat	0	3877	0	0	0	0	0	0	3877

A. Mission Description and Budget Item Justification: By Congressional direction, this project will fund development of a multimodality platform integrated into a single device that will perform many aspects of diagnostic studies.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program:

•	3779	Solicit proposals, evaluate and make awards.
•	98	Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	3877	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		4000	
Adjustments to Appropriated Value		-123	
FY 1999 President's Budget	0	3877	0

Change Summary Explanation: Funding: FY 1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	54901	89467	30048	36197	39742	46397	57621	Continuing	Continuing
D313 Advanced Rotary Wing Vehicle Technology	3361	5821	17115	24590	24868	29715	37952	Continuing	Continuing
D391 D391	4803	943	959	977	0	0	0	0	7682
D435 Aircraft Weapons	0	0	0	1359	4010	4300	4938	Continuing	Continuing
D436 Rotary-Wing MEP Integration	23387	17792	5105	2048	3672	5281	7489	Continuing	Continuing
D447 Aircraft Demonstration Engines	7415	6377	6630	7223	7192	7101	7242	Continuing	Continuing
D448 Stinger Universal Launcher	0	11242	0	0	0	0	0	0	11242
D464 Outrider Unmanned Aerial Vehicle*	0	43611	0	0	0	0	0	0	43611
DA38 Starstreak	14296	3295	0	0	0	0	0	0	18090
DB38 DB38	1178	0	0	0	0	0	0	0	1178
DB97 Aircraft Avionics Equipment	461	386	239	0	0	0	0	0	1086

*Funding for this project in FY 1999 – FY 2003 is included in PE 0305204A.

Mission Description and Budget Item Justification: The objective of this program element (PE) is to conduct advanced technology development, integration, demonstration and transition of rotary wing vehicle (RWV) technologies to new and / or upgraded DoD / Army rotorcraft systems in support of Joint Vision 2010 and Army After-Next. RWVs offer practical solutions to many of the DoD / Army's current and future operational needs by their ability to accomplish tasks and missions which no other air or ground vehicle can perform (e.g., takeoff and land vertically, operate below tree-top level for Nap-of-the-Earth (NOE) missions). RWV configurations require significantly different analysis, integration and design challenges from traditional fixed wing vehicles that fly at higher altitudes. The Army Aviation Science and Technology program's functional organization, supported by the National Aeronautics and Space Administration (NASA) at three co-located activities, is the focal point for US efforts in rotorcraft technology. Technology areas for development / demonstration include aeromechanics, aerodynamics, structures, propulsion, reliability and maintainability, safety and survivability, mission support equipment integration, aircraft subsystems, advanced helicopter rotors and flight controls, flight simulation, aircrew-aircraft system

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology

integration, aircraft weapons integration for air-to-air / air-to-ground, aircraft avionics for command and control, communications, controls and displays, digital avionics and architectures, NOE navigation, mission planning, and air traffic management. These technologies are continuously being developed for applications that will improve and correct deficiencies in current DoD / Army RWV systems, and to improve the capabilities of future rotorcraft. The work in this PE is consistent with the DoD Technology Area Plans, DoD Warfighting Science and Technology Master Plan, DoD Reliance Agreements (for which the Army is the lead service for the rotorcraft technology development) the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and a coordinated government / industry / academia national RWV Technology Development Approach. This PE also supports Congressionally directed programs and funding adds including technical assessment of the feasibility of integrating the Air to-Air Starstreak missile system on to the AH-64 Apache helicopter (FY96-98), development of the Stinger Universal Launcher (FY98), and testing and evaluation of the Outrider Unmanned Aerial Vehicle Advanced Concept Technology Demonstration (FY98). This program is dedicated to conducting proof-of-principle simulations, field demonstrations, and tests of technologies to meet specific military needs and is therefore appropriately funded in Budget Activity 3.

Work in this PE is performed by contractors including Georgia Institute of Technology, Atlanta, GA; Boeing Company, Mesa, AZ; and Philadelphia, PA; Loral Western Development Laboratories, San Jose, CA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Lockheed Martin, Atlanta, GA; General Electric, Lynn, MA; Allied Signal Engines, Phoenix, AZ; Honeywell, Minneapolis, MN; Sikorsky Aircraft, Stratford, CT; BDM International, Albuquerque, NM; MITRE, McLean, VA; Shorts Missile Systems, Belfast Northern Ireland, and CAE Electronics, Montreal, Canada.

Primary in-house developers of the technology under this program element include: Aviation and Missile Command (AMCOM), Redstone Arsenal, AL., Aeroflightdynamics Directorate, AMCOM, NASA Ames Research Center, Moffett Field, CA; Aviation Applied Technology Directorate, AMCOM, Ft. Eustis, VA; Vehicle Technology Center, Army Research Laboratory (ARL), NASA Langley Research Center, Hampton, VA; and Vehicle Technology Center, ARL, NASA Lewis Research Center, Cleveland, OH. Related activities are performed by National Aeronautics and Space Administration.

This program adheres to DoD Reliance Agreements on Aeropropulsion and Air Vehicles (Rotary) with oversight and coordination provided by the Joint Directors of Laboratories. Related applied research is conducted under PE 0602211A (Aviation Technology). Efforts under this PE transition and provide risk reduction for and lead into Demonstration/Validation and Engineering Development programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). In addition, this PE's deliverables provide technical support and technology transition to PE 0604223A (RAH-66 Comanche), PE 0604816A (Longbow), and PE 0203744A (Aircraft Modifications/Product Improvement).

The Army participates in and with the following groups, organizations and programs for total coordination: the DoD Tri-Service Joint Technical Coordination Group for Munitions Development and Aircraft Survivability; Aircraft Instruments and Aircrew Station Working Group; the Joint Integrated Avionics Working Group (JIAWG); Integrated High Performance Turbine Engine Technology (IHPTET) Steering Committee; and the Air Armament Working Party of NATO. This participation enables the gathering of technical information and assets in determining the joint use and standardization of airborne weaponization items. The Army Munitions Research and Development Committee, an organization within the Office of the Secretary of Defense, functions to establish Joint Service requirements and the development of air munitions. International related activities are the Technical Cooperation Programs with Australian, Canadian and United Kingdom governments, and Defense Development Share Plans. Formal Memoranda of Understanding (MOUs) and Data Exchange Agreements (DEAs) with various friendly nations are actively pursued to allow technology information exchange.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: D313

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D313 Advanced Rotary Wing Vehicle Technology	3361	5821	17115	24590	24868	29715	37952	Continuing	Continuing

A. **Mission Description and Justification:** This project provides for RWV technology demonstrations in support of research for advanced rotors / controls, flight controls, airframes / structures, crew / vehicle survivability, drivetrains and subsystems to: increase strategic/tactical mobility; increase maneuverability / agility; increase reliability through improved maintainability / sustainability, and reduce operational cost. Technology programs have been established for demonstrations in; Rotary Wing Structures Technology (RWST), Advanced Rotorcraft Transmission Phase II (ART-II), Helicopter Active Control Technology (HACT), Third Generation Advanced Rotor Demo (3rd GARD), On-Board Integrated Diagnostics System (OBIDS) and Full Spectrum Threat Protection (FSTP). These efforts will focus the enabling technology results on the next generation Joint Transport Rotorcraft (JTR) to meet the cargo / transport and commuter needs of the military and civilian sectors, as well as technology insertion for other system upgrades. This project focuses on demonstrating technologies to enable rotorcraft to operate affordably throughout the military spectrum from peacekeeping to combat missions. Funding increases for this project from FY97 thru FY98, FY99, FY00 are required to support the above approved technology demonstrations and contracts planned and / or executed in FY99-02, and approved DoD modernization plans for rotorcraft. These plans include the development of the future DoD JTR identified to potentially replace the aging Army CH-47D Chinook and Navy CH-53 Super Stallion helicopters.

FY 1997 Accomplishments:

- 2000 - Completed ART II preliminary design; confirmed performance and cost benefits.
  - Ordered long lead items including gear forgings, housings and hybrid bearings for ART II demonstrator fabrication.
- 569 - Conducted part task and part mission system engineering simulations for RPA.
- 792 - Defined composite structural baseline technology for cargo class RWV and developed structural manufacturing concepts to achieve manufacturing labor and weight goals for the RWST demonstration.

Total 3361

FY 1998 Planned Program:

- 1435 - Conduct preliminary design of structural concepts to satisfy structural integrity requirements of the RWST demonstration to reduce manufacturing labor costs and structural airframe weight.
- 3775 - Conduct ART II component testing on positive engagement overrunning clutch for initial performance assessment.
  - Begin fabrication of complex, long lead ART II demonstrator parts including precision forged planet gears, ceramic / composite hybrid spherical roller bearings, large high temperature / corrosion resistant magnesium alloy housing, and forging for large double helical gears.
- 465 - Define and develop a Helicopter Active Control Technology (HACT) program to flight demonstrate a highly-affordable, advanced digital, optical rotorcraft flight control system to improve vehicle performance and flight path accuracy; improve NOE flight capabilities, reduce control system development and modifications.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology
	PROJECT D313

FY 1998 Planned Program (Continued):

•	146	- Small Business Innovative Research / Small Business Tech Transfer Program
Total	5821	

FY 1999 Planned Program:

•	9000	- Assemble ART II demonstrator and conduct development testing consisting of fit and function, oil management, gear tooth and bearing pattern verification, split torque path load sharing assessment, 50 hour endurance run, and gear tooth scoring testing for initial performance and cost assessment.
•	3267	- Develop baseline HACT flight control system designs; evaluate design methodologies through perturbation in requirements to demonstrate improvement in affordability; conduct analysis, engineering modeling and simulation and evaluate candidate HACT control system designs.
•	4848	- Conduct detailed designs of structural concepts for RWST Demonstration and verify producibility through virtual prototyping to reduce manufacturing risk of demonstration assembly.
Total	17115	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3453	6013	17031
Appropriated Value	3453	6013	
Adjustments to Appropriated Value	-92	-192	
FY 1999 President's Budget	3361	5821	17115

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: D436

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D436 Rotary-Wing MEP Integration	23387	17792	5105	2048	3672	5281	7489	Continuing	Continuing

A. Mission Description and Justification: The objective of this project is to demonstrate man-machine integration and mission equipment technology to provide enhanced helicopter pilotage capability, improved crew workload distribution and improve overall mission execution. This is the primary project for the Rotorcraft Pilot's Associate (RPA) Advanced Technology Demonstration (ATD). It provides for the demonstration of rotorcraft crew stations utilizing knowledge-based information systems to develop Cognitive Decision Aiding (CDA) for crews. Advanced technology in information technology computing methods, sensors, displays, and controls will be demonstrated to maximize combat helicopter mission effectiveness and survivability for day / night adverse weather operations. System Build 4 of the RPA program will demonstrate data fusion, battlefield assessment, route, reconnaissance, survivability and sensor planning, and cockpit information management for single crew operations. System Build 5 will extend System Build 4 and demonstrate additional attack planning and crew intent estimation for dual crew operations. System Build 6 will complete and refine the RPA CDA software for use in the Combined Arms II simulation exercise and flight test program. This demonstration of simulation capability will therefore be used as the foundation for evaluating combined rotorcraft control and crew performance via virtual prototyping and Distributed Interactive Simulation (DIS) and pursues state of the art technology for integration and linking a manned scout / attack rotorcraft with an unmanned aviation system to perform Army aviation missions. The manned/unmanned team will be capable of performing scout and reconnaissance assignments and alerting manned rotorcraft of "just ahead" tactical situation awareness. The system will use state-of-the-art approaches in artificial intelligence, sensors, avionics, communications, pilot vehicle interfaces, and unmanned aerial vehicles, along with a level of autonomy that will result in an integrated team that augments the battlefield effectiveness of Army aviation. The Airborne Manned/Unmanned System Technology (AMUST) program integrates advanced technologies in sensors, displays, communication and controls necessary to team airborne manned and unmanned vehicle to maximize the teams' lethality, survivability, and operational tempo in support of the maneuver commander.

FY 1997 Accomplishments:

- 18591 - Completed RPA knowledge acquisition collection activities and software detailed design; performed system builds 4 & 5.
  - Focused RPA build 4 maturation on key cognitive decision aiding system (CDAS) components for route planner, recon planner, attack planner and the data fusion / battlefield assessor.
  - Delivered RPA route planner to RAH-66 Comanche program office for evaluation and possible transition / use.
  - Conducted RPA engineering and full mission simulation System Formal Evaluations I in accordance with RPA exit criteria.
  - Performed subsystems integration and ground-based testing in preparation for the FY 1998 RPA system flight evaluation at Yuma Proving Ground (YPG), AZ.
- 4796 - Maintained and improved combined arms simulation capabilities through Simulation Program for Improved Rotorcraft Integration Technology (SPIRIT) commitments.
  - Refined operational evaluation techniques and performed RPA system performance evaluations during concurrent software development activities in preparation for the FY 1998 full system combined arm distributed simulation warfighting evaluations.

Total 23387

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology
	PROJECT D436

FY 1998 Planned Program:

•	16401	- Complete development of core architecture software; perform system build 6 (full RPA functionality); integrate and test Version 6 software; conduct performance demonstration, conduct engineering/integration flight testing; conduct operational evaluation flight testing; conduct government/industry system demonstrations (simulation and flight test). - Conduct RPA engineering and full mission simulation System Formal Evaluations II in accordance with RPA exit criteria. - Expand development of functional requirements for RPA software builds. - Integrate classified data files into RPA; complete RPA development of dual crew in the cockpit information management and improve the capacity of CDAS with respect to team operations. - Conduct RPA flight test including operationally relevant scenarios and threats which will be subject to the same tactical environments used in the virtual simulations.
•	945	- Conduct trade-off analysis to define potential operational value and key technical issues related to manned and unmanned aerial vehicle scout teams. - Conduct virtual simulation of manned / unmanned aerial scout teams to identify critical operational functions and man-machine interfaces. - Conduct limited demonstration of connectivity between manned and unmanned aerial systems.
•	446	- Small Business Innovative Research / Small Business Tech Transfer Program
Total	17792	

FY 1999 Planned Program:

•	5105	- Complete virtual simulation tests which serves as the RPA program's capstone effort with respect to the exit criteria. - Complete RPA flight test at YPG; complete data reduction, analysis, final report / briefing and transition RPA technology and lessons learned to fielded / development systems and follow-ons.
Total	5105	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	24022	17366	5080
Appropriated Value	24022	18366	
Adjustments to Appropriated Value	-635	-574	
FY 1999 President's Budget	23387	17792	5105

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: D447

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D447 Aircraft Demonstration Engines	7415	6377	6630	7223	7192	7101	7242	Continuing	Continuing

A. **Mission Description and Justification:** The objective of this project is to competitively perform design, fabrication and test of advanced technology engines and integrated components to demonstrate achievable improved performance levels for current and future DoD RWV emphasizing Army unique requirements. The current/planned 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.

FY 1997 Accomplishments:

- 7415 - Completed initial JTAGG II component tests including splittered rotor, dual alloy centrifugal compressor, rich-quench-lean combustor, high work high pressure turbine, niobium low pressure turbine vanes, and hybrid bearings.
  - Completed design and fabrication of engine hardware for first build of JTAGG II.
  - Conducted gas generator test and accessories preliminary design.

Total 7415

FY 1998 Planned Program:

- 6217 - Complete design and fabrication of JTAGG II gas generator test and accessories.
  - Integrate JTAGG II components that have advanced aerothermodynamic, mechanical, material and structural technologies into the first build of the gas generator.
  - Perform JTAGG II gas generator test to provide a mechanical ckeck-out of the gas generator and baseline performance demonstration.
  - Analyze test data and optimize component designs for JTAGG II gas generator.
  - Perform JTAGG II goal demonstration of 80% increase in shaft horsepower to weight, 30% decrease in specific fuel consumption and 20% reduction in acquisition and maintenance costs.
  - Initiate JTAGG III components detail design including metal matrix composite impellers, rich quench lean combustor with ceramic matrix composite liners, ceramic and ceramic matrix composite turbine airfoils, and magnetic bearings.
- 160 -Small Business Innovative Research / Small Business Tech Transfer Program

Total 6377

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology
	PROJECT D447

FY 1999 Planned Program:

•	6630	- Complete JTAGG III components detail design including metal matrix composite impellers, rich quench lean combustor with ceramic matrix composite liners, ceramic and ceramic matrix composite turbine airfoils, and magnetic bearings. - Procure long-lead JTAGG III hardware. - Conduct initial component testing in support of initial gas generator build.
Total	6630	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7617	6580	6598
Appropriated Value	7617		
Adjustments to Appropriated Value	-202	-203	
FY 1999 President's Budget	7415	6217	6630

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: D448

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D448 Stinger Universal Launcher	0	11242	0	0	0	0	0	0	11242

A. **Mission Description and Budget Item Justification**: This project provides funding for the development of the Apache Longbow's Stinger Universal Launcher (SUL). The SUL will be developed by FY99 with the highest degree of commonality between various host platforms.

Acquisition Strategy: An IPT led by the AH-64 Apache PM will contract with Boeing (MDHS), Raytheon, United Defense Limited Partnership (UDLP) and the Boeing-Sikorsky First Team to develop necessary "A kit" modifications that consist of aircraft software, electrical and mechanical interfaces for the "B Kit". The "B Kit" SUL will be developed to support the highest degree of commonality between the Apache and Comanche aviation platforms. Additionally, the SUL electronics will be developed to provide commonality with the Bradley Linebacker

FY 1997 Accomplishments: Project was not funded in FY 1997

FY 1998 Planned Program:

- 6130 - Initiate development of SUL/Stinger Universal Electronics (SUE) to support Apache, Comanche and Bradley Linebacker.
- 3750 - Develop Apache Longbow interface for the SUL/SUE and conduct integration testing
- 750 - Develop Comanche SUL interface
- 330 - Develop Bradley Linebacker SUE interfaces.
- 282 - Small Business Innovative Research / Small Business Tech Transfer Program

Total 11242

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998 / 1999 President's Budget	0	0	0
Appropriated Value	0	11600	
Adjustments to Appropriated Value	0	-358	
FY 99 President's Budget	0	11242	0

Change Summary Explanation: Funding: FY98 – Project is Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: D464

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D464 Outrider Unmanned Aerial Vehicle*	0	43611	0	0	0	0	0	0	43611

A. Mission Description and Budget Item Justification: The Tactical Unmanned Aerial Vehicle (TUAV), "Outrider", provides Army brigades/battalions, USMC regiments/battalions, and Navy forces with dedicated day/night, reconnaissance, surveillance and target acquisition (RSTA) and intelligence. Outrider provides the tactical warfighting commander with critical battlefield information in the rapid cycle time required for success at the tactical level. The Joint Requirements Oversight Council (JROC) reassessed warfighter UAV priorities and reconfirmed the TUAV as the JROC's top UAV priority to meet Service requirements in JROCM 173-96, Unmanned Aerial Vehicles, 12 November 1996. The Outrider Advanced Concept Technology Demonstration (ACTD) system consist of four air vehicles, each configured with an electro-optic (EO)/infrared (IR) sensor payload, ground control equipment, including communications equipment and launch and recovery equipment, remote video terminal, two HMMWV's and a trailer, and one mobile maintenance facility for every three TUAV systems. The ACTD contract has an option for six (6) LRIP systems. The Outrider LRIP options supports a Full Rate Production (FRP) decision. The ACTD will address Joint Services (Army, Navy, Marine Corps) tactical UAV requirements and will validate military utility for each Service. The TUAV program will employ "cost as an independent variable" in acquiring any follow-on systems.

Acquisition Strategy: The TUAV ACTD provides for the placement of systems in the hands of the operational users as quickly as possible for use in demonstrations and exercises. The ACTD process provides users with the opportunity to assess the military utility of the system thereby becoming informed buyers and applying lessons learned while evolving system requirement. The TUAV ACTD contract was competitively awarded with industry being advised of the possibility of follow-on production buys should the ACTD system demonstrate a military utility.

FY 1997 Accomplishments: Project funded in DoD Program Element 0305204D, Tactical UAVs Defense-Wide.

FY 1998 Planned Program:

•	42517	- Complete 18 flights totaling 11 hours and 22 minutes of flight time in first quarter. - Continue flight testing in support of Military Utility Assessment (MUA). - Complete system integration and demonstration. - Continue Common Automatic Recovery & Launch System (CARS) development. - Train users for MUA. - Complete MUA (land & land / sea) and ACTD. - Evaluate and execute MUA users lessons learned. - Perform activities to transition from ACTD to Low Rate of Initial Production (i.e., Documentation, air vehicle improvements, weight reduction).
•	1094	- Small Business Innovative Research / Small Business Tech Transfer Program
Total	43611	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology — PROJECT: D464

FY 1999 Planned Program: FY 1999 efforts are funded under Program Element 0605204A (Tactical Unmanned Aerial Vehicles).

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998 / 1999 President's Budget	0	0	0
Appropriated Value		45000	
Adjustments to Appropriated Value		-1389	
FY 99 President's Budget	0	43611	0

Change Summary Explanation: Funding: FY98 – Project transferred to Army from DoD by Congress.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: DA38

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DA38 Starstreak	14296	3295	0	0	0	0	0	0	18090

A. Mission Description and Justification: This project supports a congressionally directed program to investigate air-to-air (ATA) applications of the Starstreak missile on rotary wing platforms. The program is conducted through a two phases. Phase I evaluates initial technical feasibility and safety aspects of the Starstreak missile for the AH-64 Apache helicopter. Phase II evaluates the system effectiveness of the Starstreak missile on the AH-64 Apache helicopter. Technical feasibility of the Starstreak missile integration on a rotary wing platform was determined through analysis and flight tests. A missile system cost estimate was performed as part of a preliminary assessment of the military worth of the Starstreak missile as an ATA self defense weapon.

FY 1997 Accomplishments:

•	14296	-Conducted detailed design, analysis and simulation, including AH-64 Apache and Target Acquisition Designation System (TADS) / Laser Guidance Unit (LGU) integration; conducted Starstreak systems modifications and began fabrication of components; initiated modeling and simulation of the integrated system in a few-on-few environment; initiated demonstration flight testing including airborne tracking trials, flight envelope verification, and live fire tests against airborne targets. - Completed independent government cost analyses of the integration of the Starstreak missile on to the Apache helicopter.
Total	14296	

FY 1998 Planned Program:

•	3212	- Incorporate roll stabilizing gimbal into Starstreak airborne laser guidance unit; modify Apache Longbow to integrate Starstreak missile system into complete Phase II.
	83	- Small Business Innovative Research / Small Business Tech Transfer Program
Total	3295	

FY 1999 Planned Program: Project not funded.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY1998/1999 President's Budget	14686	0	0
Appropriated Value	14686	3400	
Adjustments to Appropriated Value	-390	-105	
FY 1999 President's Budget	14296	3295	0

Change Summary Explanation: Funding: FY98 – Project is Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: DB97

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DB97 Aircraft Avionics Equipment	461	386	239	0	0	0	0	0	1086

A. **Mission Description and Budget Item Justification:** This project supports development and demonstration of advanced, integrated avionics equipment in support of aviation integration into the digitized battlefield. Evolving concepts in digital avionics will provide new functional capability in the areas of situational awareness, flight path guidance, position reporting and digital data transfer. Work in this project supports the Rotorcraft Pilot's Associate (RPA) program.

FY 1997 Planned Program:

•	461	- Provided RPA mission equipment integration support in the areas of communication, navigation, advanced helicopter pilotage (AHP), voice recognition, controls and displays, and artificial intelligence.
Total	461	

FY 1998 Planned Program:

•	376	- Provide RPA mission equipment integration support in the areas of communication, navigation, pilotage, voice recognition, controls and displays, and artificial intelligence to support the instrumentation/calibration phase of the RPA flight test program.
•	10	- Small Business Innovative Research/Small Business Tech Transfer Program.
Total	386	

FY 1999 Planned Program:

•	239	- Complete RPA mission equipment integration support in the areas of communication, navigation, AHP, voice recognition, controls and displays, and artificial intelligence, during the flight test program.
Total	239	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998 / 1999 President's Budget	474	398	258
Appropriated Value	474		
Adjustments to Appropriated Value	-13	-12	
FY 99 President's Budget	461	386	239

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	30161	25444	24555	42076	35558	33105	38582	Continuing	Continuing
DL94 Electric Gun Systems Demonstration	0	0	0	0	0	2468	4383	Continuing	Continuing
DL95 Landmine Warfare Development	3979	0	0	0	0	0	0	0	3979
D43A Advanced Weaponry Technology Demonstration*	20714	7980	12954	27394	18405	17646	18954	Continuing	Continuing
D232 Advanced Munitions Demonstration	5468	11649	11601	14682	17153	12991	15245	Continuing	Continuing
D233 Trajectory Correctable Munitions Development	0	5815	0	0	0	0	0	0	5815

*D43A - FY97 R-1 exhibit contains an administrative error. Funding shown here is correct.

Mission Description and Budget Item Justification: The objective of this Program Element (PE) is to demonstrate affordable, advanced weapons and munitions technologies that will increase battlefield lethality and survivability. This PE funds several stand-off, anti-armor weapons demonstrations within the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) to significantly increase the capability of Early Entry Forces. The RFPI demonstrations funded within this PE include: the Precision Guided Mortar Munition (PGMM), Autonomous Intelligent Submunition (AIS) Damocles, and more responsive digitized fire control for a towed 155mm automated howitzer. An initiative in response to recent threat information, especially against new explosive reactive armors (which appears as appliqués), is the Direct Fire Lethality Program, the purpose of which is to significantly enhance anti-tank lethality in terms of hit and kill by maximizing warhead/penetrator effectiveness and significantly increase tank gun accuracy under dynamic battlefield conditions. In the area of combat vehicle anti-armor munitions, advanced explosively formed penetrator warheads exploit technologies in explosives, liner materials and modeling, and demonstrate increased armor penetration through advanced warhead concepts. Technologies were Congressionally supported through FY 1997 to demonstrate an artillery projectile capable of delivering dual purpose improved conventional munition (DPICM) cargo to ranges in excess of 40 kilometers. Innovative applications for electro-rheological (ER) fluids were Congressionally supported in FY1996 and FY1997 for use in next generation artillery recoil mechanisms. Work in this program element is consistent with Army Vision 2010, Army After Next, the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armament Research and Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ. 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) and PE 0604802A (Weapons and Munitions-Engineering Development). This work is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

PROJECT: DL95

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DL95 Landmine Warfare Development	3979	0	0	0	0	0	0	0	3979

A. Mission Description and Justification: This project funds the Intelligent Minefield (IMF) demonstration, which is an anti-armor weapon candidate under the Rapid Force Projection Initiative (RFPI) and which provides product improvement opportunities for the Wide Area Munition (WAM). The IMF will demonstrate the flexibility and battlefield effectiveness of coordinated smart mine attack utilizing artificial intelligence (AI), decision aids, automatic target recognition (ATR), intermine communication, and extended range command and control. Mines that can defeat targets over a wide area have a tremendous payoff, especially for light forces that are weight and space constrained when they deploy. Additionally, anti-tank features such as a high probability of kill provided by top attack and command and control (e.g., on/off capability) make such mines very effective force multipliers. The IMF will include advanced acoustic sensors to cue mines as well as to provide remote sensors for the RFPI "hunter/stand-off killer" concept. The IMF advanced acoustic sensor sub-system re-configured as the integrated acoustic system (IAS) is a key residual sensor component of the RFPI Advanced Concept Technology Demonstration (ACTD) Program. In-house efforts are accomplished by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

FY 1997 Accomplishments:

- 1983 - Completed IMF advanced technology demonstration (ATD) including analysis and report.
- 1996 - Modified advanced acoustic sensors to meet RFPI ACTD "residual" requirements.
  - Conducted field test and system integration of integrated acoustic system for RFPI ACTD.

Total 3979

FY 1998 Planned Program: Project not funded in FY 1998

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2117	0	0
Appropriated Value	2117		
Adjustments to Appropriated Value	1862		
FY 1999 President's Budget	3979	0	0

Change Summary Explanation: Funding: FY 1997 funds increased due to a reprogramming for RFPI acoustic sensor efforts

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT D43A

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D43A Advanced Weaponry Technology Demonstration*	20714	7980	12954	27394	18405	17646	18954	Continuing	Continuing

A. Mission Description and Justification: This project includes the non-missile stand-off weapon residuals and advanced concepts for the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) and lethality enhancements under the Direct Fire Lethality Program. Weapon demonstrations are vital to assessing new tactics and technologies for early entry forces to defeat armor. Collectively, weapons under RFPI constitute stand-off killer options for a "hunter/stand-off killer" approach. The Precision Guided Mortar Munition (PGMM) demonstration will feature an affordable, extended range, top-attack, high value target capability for light forces. It has included assessments of both 81mm and 120mm non-developmental item candidates and will demonstrate a 120mm PGMM. Large footprint, smart munition sensor technologies applicable to the Multiple Launch Rocket System (MLRS) will also be evaluated. Increased sensor footprints are important to provide capabilities to attack moving targets. Towed howitzer fire control enhancements applicable to both Army and Marine Corps artillery requirements are included under the RFPI ACTD. A key RFPI ACTD residual sensor integrated acoustic system will be fabricated. Most of these concepts being demonstrated are candidates for technology insertions and most provide significant enhancement to early entry forces. A FY 1997 Congressionally-mandated Extended Range Artillery projectile (XM982) program develops required technology for resolving the Army's artillery range deficit. In FY 1996 and FY 1997 Congress also mandated applications for electro-rheological (ER) fluids for use in next generation artillery recoil mechanisms. Beginning in FY 1999, product improvements to the Sense and Destroy Armor (SADARM) submunition will culminate with a demonstration of its potential for use as an MLRS Smart Tactical Rocket (MSTAR) submunition; this will be followed by a "Block II" SADARM design, exhibiting greater lethality and a factor of twenty greater search area compared to the original version of SADARM. Direct fire advanced gearless azimuth technology will be demonstrated for improved precision and reduced operation and support (O&S) costs for Army After Next application. Funding increases in this project are required in FY99 and FY00 to support the above approved technology demonstrations and contracts to be planned and/or executed. In-house efforts are accomplished by the Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Major contractors include: Alliant Tech Systems, Minneapolis, MN; Science Applications International Corp. (SAIC), McLean, VA; LTV Aerospace, Dallas, TX; Textron, Lowell, MA; Ferrulmatic, Inc., Totowa, NJ; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; Olin-Flinchbaugh, Red Lion, PA; Textron, Inc., Willington, MA; Technical Solutions Incorporated (TSI), Mesina Park, NM; Motorola, Scottsdale, AZ; Lockheed Martin, Sunnyvale, CA; MEI Technology, Lexington, MA; Computing Device International, Minneapolis, MN; Singer Kearfott, Wayne, NJ; Diehl GmbH., Rothenbach, Germany.

FY 1997 Accomplishments:

- 9936
  - Conducted 105/120mm common tactical seeker captive flight test (CFT); completed integration of seeker and air frame and conduct 'high g' test; develop software for mortar fire control ballistic computer and fire control simulator; modified PGMM system hardware-in-the-loop.
  - Fabricated and tested towed howitzer fire control units for RFPI ACTD training.
  - Procured towed howitzer fire control lab system for RFPI system integration.
  - Tested and integrated fire control hardware and software for 155mm automated howitzer.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT D43A

FY 1997 Accomplishments: (continued)

•	7607	- Conducted XM982 extended range artillery range demonstration fired by M198 howitzer; completed ballistic range demonstration. - Conducted electro-rheological (ER) fluid recoil sub-scale test fire and refinements.
•	3171	- Conducted AIS-Damocles captive carry test against RFPI targets and participated in RFPI ACTD simulation as an advanced concept; demonstrated sensor suite in light and heavy clutter and urban environments; fabricated tactical sensor hardware; developed rapid target insertion modeling and software.
Total	20714	

FY 1998 Planned Program:

•	5873	- Complete PGMM ATD projectile integration. - Conduct 12 kilometer extended range flight demonstrations.
•	1933	- Complete testing of towed howitzer fire control for safety release. - Develop tactics, techniques and procedures for the 155mm automated howitzer. - Upgrade one battery with digitized fire control system; conduct RFPI field experiment. - Refurbish 155mm automated howitzer hardware for RFPI extended user evaluation residual period.
•	174	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	7980	

FY 1999 Planned Program:

•	1911	- Conduct PGMM ATD telemetry round and laser designation firing tests. - Complete manufacturing producibility evaluation
•	892	- Support towed howitzer and integrated acoustic sensor RFPI extended user evaluation residual effort under the RFPI ACTD.
•	2500	- Define Sense and Destroy Armor (SADARM) pre-planned product improvement (P3I) requirements to meet the MLRS Smart Tactical Rocket (MSTAR) operational requirements document; conduct simulations of submunition performance against MSTAR targets.
•	7051	- Fabricate gearless azimuth drive hardware and demonstrate on dynamic simulator, a tank/ turret drive system with reduced stabilization error, greater precision and reduced O&S costs for Army After Next systems. - Complete feasibility design of fully integrated gearless turret drive for Abrams tank. - Complete gearless gun elevation design. - Demonstrate optical fiber muzzle reference sensor capability to continuously measure gun tube flexure.
•	600	- Conduct fire control system concept definition for launching extended range munitions.
Total	12954	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology
	PROJECT D43A

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	21353	6234	17691
Appropriated Value	21353	8234	
Adjustments to Appropriated Value	-639	-254	
FY 1999 President's Budget	20714	7980	12954

Change Summary Explanation:

Funding: FY 1998 Congressional increase (+2000) for Precision Guided Mortar Munition; undistributed Congressional reductions (-254).
FY 1999 funds reprogrammed (-4737) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

PROJECT: D232

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D232 Advanced Munitions Demonstration	5468	11649	11601	14682	17153	12991	15245	Continuing	Continuing

A. **Mission Description and Justification:** This project includes the Direct Fire Lethality (DFL) program which will enhance tank kinetic energy (KE) penetrator lethality, particularly against explosively reactive armor (ERA) appliqué arrays now available on fielded threat systems, through use of a precursor defeat mechanism. The program will demonstrate range and lethality enhancements for tank munitions and demonstrate the emerging technologies needed to defeat the active protection system (APS) threat. In the near term, this project demonstrates advanced warhead and cartridge concepts, utilizing novel explosively formed penetrators (EFP) and shaped charged designs, that can be applied to product improvements to fielded and developmental anti-armor munitions, (e.g., autonomous intelligent submunition (AIS) Damocles, wide area munitions (WAM), smart target activated fire and forget (STAFF), 120mm chemical energy (CE) cartridge and the Sense and Destroy Armor (SADARM) submunition. It advances warhead technology to enhance the lethality of smart projectiles by providing multi-role, multi-effect warheads capable of defeating point and area targets. This project will fund demonstrations of advanced fuzes for near term munitions concepts. Low Cost Competent Munition (LCCM) concepts integrating global positioning system (GPS) into fuzing are being developed for artillery projectiles. The resulting screw-on module and ground receiver will significantly increase a projectile's overall delivery accuracy and also be readily applicable to the existing stockpile of 155mm artillery projectiles. In-house efforts are accomplished by Armament Research Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Major contractors include: Alliant Tech Systems, Minneapolis, MN; Science Applications International Corp. (SAIC), McLean, VA; LTV Aerospace, Dallas, TX; Textron Defense Systems, Wilmington, MA; Ferrulmatic, Inc., Totowa, NJ; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; and Olin-Flinchbaugh, Red Lion, PA.

FY 1997 Accomplishments:

- 1842 - Demonstrated functioning of candidate 120mm kinetic energy precursor penetrators in a 30mm environment.
- 1774 - Demonstrated formation of two explosively formed penetrators for increased armor defeat against explosive reactive armor (ERA).
- 1852 - Fabricated prototype LCCM auto-registration system for FY 1998 flight testing; refined and tested Global Positioning System (GPS) translator components.

Total 5468

FY 1998 Planned Program:

- 4372 - Complete DFL ATD precursor integrated concept demonstrations
  - Downselect precursor technology to achieve optimum defeat capability of ERA targets.
  - Demonstrate feasibility to improve flight dynamics of KE penetrators to achieve 70% probability of hit improvement at 3 kilometers and perform armor tests for 120mm tank ammunition.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT D232

FY 1998 Planned Program: (continued)

•	1817	- Evaluate extended range munitions concepts and develop detailed system designs.
•	4704	- Complete full-up real time system demonstration of LCCM auto-registration system; develop hardware and software interfaces with Paladin, M198 and M109A5 self-propelled howitzer platforms; develop fire control system hardware and software changes to accommodate auto-registration system. - Demonstrate Integrated Acoustic System (IAS) for the Rapid Force Projection Initiative (RFPI), a target detection system to support early entry forces' "stand off killer" concepts and will also support Army After Next strategies of information dominance.
•	474	- Competitively buy long stand-off warhead candidate for Government testing in FY 1999.
•	282	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	11649	

FY 1999 Planned Program:

•	5257	- Complete DFL ATD precursor penetrator integrated cartridge design. - Conduct technology maturation demonstrations for optimum novel penetrator function and armor penetration utilizing tactical composite sabot and propulsion system
•	3515	- Complete extended range munitions design, downselect, and conduct critical subsystem demonstrations.
•	2829	- Conduct tests of downselected warheads from FY 1998 and develop as candidate for counter active protection system.
Total	11601	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5652	12021	11544
Appropriated Value	5652	12021	
Adjustments to Appropriated Value	-184	-372	
FY 1999 President's Budget	5468	11649	11601

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

PROJECT: D233

COST (In Thousands)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D233 Trajectory Correctable Munitions Development	0	5815	0	0	0	0	0	0	5815

A. **Mission Description and Budget Item Justification:** This project funds a Congressionally mandated trajectory correctable munition (TCM) program called the XM982 Extended Range Artillery projectile. This munition will provide the Army with a versatile projectile with unprecedented range and accuracy and will significantly extend the capabilities of both current and developmental 155mm artillery platforms. Program management is conducted by the Project Manager for Sense and Destroy Armor (SADARM) and in house efforts are primarily conducted by the Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

FY 1997 Accomplishments: Program not funded in FY 1997 under this project; however, FY 1997 Congressional support for the XM982 Extended Range Artillery Projectile program was provided under Project D43A.

FY 1998 Planned Program:

•	5669	- Conduct source selection and award XM982 EMD contract. - As part of EMD program, conduct systems engineering activities to develop an extended range, trajectory-corrected 155mm artillery munition which carries Dual Purpose, Improved Conventional Munitions (DPICM) as cargo. - Complete first year phase of EMD for the XM982 trajectory correctable munition.
•	146	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	5815	

FY 1999 Planned Program: Program not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value		6000	
Adjustments to Appropriated Value		-185	
FY 1999 President's Budget	0	5815	0

Change Summary Explanation: Funding: FY 1998 Congressional increase (6000) for Trajectory Correctable Munitions; undistributed Congressional reductions (-185).

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	28160	40796	54435	89083	99907	59235	62586	Continuing	Continuing
DC62 DC62	3120	15435	17072	20542	18288	16000	0	0	50457
DC66 DC66	0	0	0	1006	1002	997	996	Continuing	Continuing
D221 Combat Vehicle Survivability	4541	669	694	842	973	973	14190	Continuing	Continuing
D440 Advanced Combat Vehicle Technology	12803	6063	24452	54642	68852	29534	29716	Continuing	Continuing
D441 Combat Vehicle Mobility Technology	4026	2858	4840	3387	4776	5173	11090	Continuing	Continuing
D497 Combat Vehicle Electronics	1764	5983	7377	8664	6016	6558	6594	Continuing	Continuing
D502 HAECO II	1906	0	0	0	0	0	0	0	1906
D506 Aluminum Metal Matrix Composite (NAC)	0	6299	0	0	0	0	0	0	6299
D507 PLS Commercial Engine (NAC)	0	3489	0	0	0	0	0	0	3489

Mission Description and Budget Item Justification: This Program Element (PE) integrates and demonstrates the operational potential of advanced combat vehicle component technologies which can contribute to upgrades of fielded combat vehicles and future advanced ground combat vehicle systems. It places emphasis on solutions to post-Cold War deficiencies, providing opportunities for more affordable, deployable, survivable, horizontally integrated and lethal power projection capabilities than are currently available. The technology areas supported by this program element include: vehicle survivability, mobility, intra-vehicular digital electronics, and integration of diverse vehicle technologies developed by the Army, other DoD laboratories and industry. These technologies are demonstrated to and experimented by various Army warfighter organizations through a series of vehicle component and system level technology demonstrations. Work in this program element is consistent with the Army Science and Technology Master Plan, Science and Technology Objectives, Army Modernization Plan, and the Ground and Sea Vehicle Defense Technology Area Plan (DTAP). This program is managed primarily by the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC). This program 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 and fully coordinated with PE 0602601A (Combat Vehicle and Automotive Technology) and contains no unwarranted duplication of effort among the Military Departments. Furthermore, the project is coordinated with the Marine Corps office within the Naval Surface Warfare

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology

Center, the Naval Research Lab, Air Force Armaments Command, and ground vehicle developers within the Departments of Energy, Commerce and Transportation, and the Defense Advanced Research Projects Agency (DARPA). This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore properly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D221

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D221 Combat Vehicle Survivability	4541	669	694	842	973	973	14190	Continuing	Continuing

A. Mission Description and Justification: This project demonstrates advanced technologies for protection against smart, precision guided and other munitions threats to ground combat vehicles. A battlefield operational effectiveness analysis (Project Guardian) identified the highest payoff sensors and countermeasures to focus the Hit Avoidance (HA) Advanced Technology Demonstration (ATD). The HAATD completion has been delayed into FY 98 to facilitate the rapid transition of survivability technology into the Bradley A3. The ATDs demonstrated technical feasibility and developed system specifications for a low cost, active protection system for the physical disruption of non-gun tube fired, horizontal attack, hit-to-kill, chemical energy (CE) threat munitions and transferred hardware/software of a commander's decision aid (CDA) to engineering development for current systems. The CDA will provide the "brains" to interpret and fuse sensor input data, select and activate appropriate countermeasures, manage expendable inventory and increase situational awareness. This project is developing and field testing a Congressionally directed vehicle self-protection system capable of close-in detection of high velocity, low front end radar cross-section kinetic energy (KE) threat munitions. This project provided hardware performance and modeling predictions for a cost effective, operationally optimal suite of threat sensors and countermeasure devices. Coupled with other combat vehicles assets, force protection and increased situational awareness capabilities could then be realized. This enhanced vehicle survivability will extend the fighting life of the vehicle and result in a force multiplying effect and greater life cycle savings for the vehicle fleet. Survivability technologies that are integrated and demonstrated under this project include those transitioned from the following exploratory developmental programs; active protection countermeasure technology development PE 0601102A (Defense Research Sciences)/ Project AH43 and BH57; sensors and countermeasures PE 0602270A (Electronic Warfare Technology)/ Project A442. This project also supports a classified program. Major contractors include: United Defense LP. of San Jose (prime), CA; Sanders, a Lockheed Martin Company in Nashua, NH.; TRW of Redondo Beach, CA.; Dynetics, Inc. in Huntsville, AL; Hughes Danbury, Danbury Conn.; Chang Industries, LaVerne, CA.

FY 1997 Accomplishments:

•	3991	- Performed a field demonstration of a low cost active protection system to defeat non-gun tube fired, horizontal attack, hit-to-kill, chemical energy (CE) threat munitions, developed system specifications for this system. - Designed and fabricated a self-protection system capable of close in detection of high velocity, low front-end radar cross-section kinetic energy (KE) threat munitions. - Demonstrated the Phase II CDA and initiated its transfer along with system specifications including software and necessary documentation to PM Ground Systems Integration (GSI) for potential engineering and manufacturing development (EMD) applications. - Updated operational effectiveness analysis to complete affordability assessment with validated threat sensor and countermeasure performance data.
•	550	- Classified program support.
Total	4541	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology
	PROJECT D221

FY 1998 Planned Program:

•	669	- Classified program support.
Total	669	

FY 1999 Planned Program:

•	694	- Classified program support.
Total	694	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4659	690	690
Appropriated Value	4758	690	
Adjustments to Appropriated Value	-217	-21	
FY 1999 President's Budget	4541	669	694

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D440

COST (In Thousands)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D440 Advanced Combat Vehicle Technology	12803	6063	24452	54642	68852	29534	29716	Continuing	Continuing

A. **Mission Description and Justification:** This project demonstrates the operational potential, technical feasibility and maturity of advanced combat vehicle technologies for potential product improvements to currently fielded and next generation combat vehicles. The objectives are to demonstrate innovative combat vehicle configurations, technologies and integration techniques through Integrated Product and Process Development (IPPD) yielding hardware technology demonstrations, computer simulations and full-scale demonstrations, to accomplish a more rapid and seamless transition of advanced technologies to systems applications. All demonstrations include user and developer teaming in field and/or laboratory environments. This project concludes a major initiative, the Composite Armored Vehicle (CAV) ATD, which examines technologies applicable to lighter weight and more survivable systems that offer significantly improved deployability over currently fielded combat vehicles. The CAV ATD will demonstrate a vehicle structure made of composite materials with advanced lightweight armor technology which can significantly reduce weight while improving survivability. The CAV program addresses issues, such as automotive durability, ability to withstand weapon firing shock, manufacturing methods and technology, repairability, ballistic performance, and nondestructive testing, to be resolved before composite technology can be transitioned to ground combat vehicle systems. Coordination with ground vehicle program managers (PMs) has resulted in active interest by PM Crusader in transitioning composite technology into the Crusader design. The Future Scout and Cavalry System (FSCS) ATD is another major initiative that transitions from applied research PE 0602601A (Combat Vehicle and Automotive Technology) to this project in FY98. This program will integrate advanced technologies, including sensors, signature management, survivability, advanced mobility technologies and communications in the selected scout platform. The FSCS ATD will then undergo technical and user evaluations. Plans are in process for a joint United States/United Kingdom FSCS/Tactical Reconnaissance Armored Combat Equipment Requirement (TRACER) program. Other vehicles supported by this PE with advanced component concepts and technologies include Abrams tank upgrades, the M2/M3 Bradley and Crusader. United Defense, Limited Partnership, San Jose, CA is the prime contractor for the CAV ATD.

FY 1997 Accomplishments:

•	12803	- Validated 35% structure/armor weight reduction completing fabrication & assembly of the CAV ATD. - Validated CAV ATD structural integrity of composite hull/turret structure under large caliber cannon shock and vibration loading, high performance of vulnerability-reduction technologies, completed automotive validations over rough terrain and obstacles. - Commenced 6000 mile durability testing of full-up CAV ATD. - Revised CAV ATD contract scope on planned 2nd hull activities to perform scale-up studies to Crusader self propelled howitzer turret design requirements.
Total	12803	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology
	PROJECT D440

FY 1998 Planned Program:

•	1344	- Complete CAV ATD 6000 mile durability testing, final report and close contract.
•	2000	- Electric drive integration into CAV vehicle.
•		- Composite technology transfer.
•	2628	- Develop and allocate FSCS ATD design tradeoffs down to subsystems for affordability trade-off studies. - Negotiate and finalize FSCS MOU with UK. - Harmonize joint UK/US system specification for Request for Proposal (RFP), issue RFP, conduct source selection and award FSCS ATD contracts to two US/UK consortia. - Contractors to initiate trade studies and concept designs.
•	91	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	6063	

FY 1999 Planned Program:

•	24452	- Contractors to complete FSCS preliminary design and interface control, initiate detail design, develop manufacturing concepts, vehicle concepts and tools for engineering models, begin development of FSCS ATD hardware and software, perform weapon systems trade-off studies and begin weapon systems development and begin design, development and integration of FSCS signature management system for the FSCS ATD. - Transition and implementation of vehicle electronics (VETRONICS) open systems architecture (VOSA) to the FCS ATD contractors. - Begin development of electronic interfaces between major subsystems of FSCS (e.g., target acquisition, communication, crew control and displays, etc.) by contractors. - Incorporate sensor suite, crew station, and electronic interface into contractors design/systems integration laboratory (SIL) for FSCS ATD.
Total	24452	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	13101	4256	20325
Appropriated Value	13507	6256	
Adjustments to Appropriated Value	-704	-193	
FY 1999 President's Budget	12803	6063	24452

Change Summary Explanation: Funding: FY 1998 Funding increased (+1499) to complete testing of Composite Armored Vehicle. FY 1999 increased for FSCS program adjustment.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D441

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D441 Combat Vehicle Mobility Technology	4026	2858	4840	3387	4776	5173	11090	Continuing	Continuing

A. **Mission Description and Justification:** This project demonstrates mobility technologies (suspension , track, engines, transmissions, and auxiliaries) vital for lighter, more agile, more deployable ground combat vehicles. It funds an advanced mobility technology demonstration comprised of several independent demonstrations. The principal elements of the mobility demonstration are semi-active suspension, electric drive, and light weight track. Military requirements for vehicle mobility are unique because of (1) a need for a stable, smooth ride at high speeds (greater than 20 mph) over rough, cross country terrain, (2) a need for the mobility components to be as small and as light as possible in order not to detract from the vehicle's primary, war-fighting mission, and (3) a need for armor and signature management, which complicate the design of engine air intake and exhaust systems. High speed is required to accomplish the maneuver-dominant warfare envisioned in the Air-Land battle doctrine. A smooth ride is necessary for weapon targeting on the move and for crew comfort and endurance, which are features embedded in the doctrine. The lighter and smaller vehicles are necessary for enhancing deployability and lessening the logistics burden (fuel), but lighter vehicles will have significantly degraded ride performance and mobility limits compared to larger, heavier vehicles without new mobility technology advances. For the next decade, the mobility thrusts required to compensate for smaller and lighter systems are: electric drive (small internal propulsion size and weight), active suspension (increased vehicle stability and higher speed on rough terrain), compact efficient transmissions and light weight track (reduced system weight and track noise). Electric drive offers unique new capabilities, such as high torque and quiet operation; however, it presents new challenges, especially in cooling of electronic components and is being closely coordinated with DARPA's electric drive program and Combat Hybrid Power System Program. In-house efforts are accomplished by the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Other government agencies include: Waterways Experiment Station, Vicksburg, MS; Army Research Laboratory, Adelphi MD. Major contractors include: General Dynamics Land Systems Muskegon Operations, Muskegon, MI; Pentastar Huntsville, AL; United Defense Limited Partnership, San Jose, CA; Michigan Technological University, Houghton MI; General Electric, Schenectady, NY; Cadillac Gage Textron, New Orleans, LA.

FY 1997 Accomplishments:

•	4026	- Installed 30 ton weight class semiactive suspension and performed shakedown testing. - Tested Band Track System on light weight class of vehicles. - In coordination with DARPA, completed propulsion components for 30 ton hybrid electric demonstrator.
Total	4026	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology
	PROJECT D441

FY 1998 Planned Program:

•	2818	- Develop and install active suspension preview sensor and algorithms.
		- Performance test semiactive suspension in support of FSCS ATD.
		- Durability/Performance testing Band Track System in support of FSCS ATD.
		- In coordination with DARPA, demonstrate and conduct test & evaluation on 30 ton hybrid electric demonstrator.
		- Design compact high efficiency mechanical transmission.
	40	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	2858	

FY 1999 Planned Program:

•	4840	- In coordination with DARPA and Army Research Laboratory (ARL), test & Evaluate SIC Power Devices for Motor Drive Controller.
		- Field test active suspension preview sensor and algorithms.
		- Test track tensioning system for heavy combat vehicle application.
		- Fabricate compact high efficiency mechanical transmission.
Total	4840	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4115	2949	4816
Appropriated Value	4203	2949	
Adjustments to Appropriated Value	-177	-91	
FY 1999 President's Budget	4026	2858	4840

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D497

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D497 Combat Vehicle Electronics	1764	5983	7377	8664	6016	6558	6594	Continuing	Continuing

A. **Mission Description and Justification:** This project develops and demonstrates a set of technologies that will yield increased crew efficiencies, reduced costs per line of code, increased system performance and reduction in the cost ratio of electronics/software upgrades to overall system upgrades. This program will be conducted in three phases and will leverage the Future Scout and Cavalry System (FSCS) ATD to accomplish its' goals. The first phase will be conducted to provide input to the FSCS at contract award. The second phase will be conducted under the FSCS ATD and will culminate in a SIL demonstration. The third phase will harmonize the competing ATD approaches and provide demonstration of the goals to be inserted into the FSCS engineering and manufacturing development (EMD). The program will demonstrate an open systems approach to increase the ability of combat vehicles to handle massive amounts of new digital information being generated on the future battlefield, reduced operating and support costs of electronic systems and reduced costs and time to integrate upgraded and modular subsystems. This project also funds improvements in ground vehicle soldier machine interfaces (SMI) by designing advanced crew station configurations for current combat vehicle upgrades and advanced vehicle designs with a 50% crew workload reduction. This project leverages technologies developed under the Crewman's Associate ATD for preliminary design of a FSCS crewstation and systems upgrades to Abrams, Bradley, and other ground combat vehicles. Laboratory experiments are used to allow the Army warfighter to continuously influence and evaluate the capabilities of the crew station design and to refine overall system requirements prior to building more extensive hardware prototypes and vehicles. Experiments on a vehicle testbed are then used to allow the Army warfighter to evaluate the technologies under realistic field conditions. This interactive crew station design work ensures that future crew stations are designed to optimize the interface for the warfighter, allowing him to take maximum advantage of the digitized battlefield, not be overburdened by it. This project is an evolvable ground vehicle architecture/software baseline that will enable continuing software reuse. This will be a nonproprietary open systems electronics integration architecture based on commercially available standards and components. This architecture improves upon the current state-of-the-art ground vehicle integration architectures providing a 50% reduction in the cost per developed source line of software code while gaining a 10X improvement in system performance per hardware module. This architecture is critical to the integration of advanced sensors and countermeasures, advanced target acquisition technologies and digital communications into modern combat vehicles and is critical to the soldier's effective use of these technologies. Both the crew station work and architecture work are required to support Program Executive Office Ground Combat and Support Systems (PEO GCSS) preplanned product improvement (P3I) opportunities for the existing fleet (e.g., Abrams, Bradley), contribute to Crusader development, and support other vehicle development programs such as the FSCS ATD and Future Combat System.

FY 1997 Accomplishments:

•	1764	- Defined a US/UK harmonized electronic architecture baseline Developed FSCS software architecture application program interface (API) reuse and performance baseline for the FSCS ATD; defined US/UK harmonized FSCS crew task list. - Simulated a conceptual FSCS crew station and defined the crew station simulator design. that will help reduce the overall FSCS cost. - Developed a hierarchy of hardware and software technical reference models to enable reuse and simplify open systems integration. - Transitioned Crewman's Associate principles/interfaces to FSCS mission.
Total	1764	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology
	PROJECT D497

FY 1998 Planned Program:

•	3000	- FSCS Contract (see Project D440).
•	2855	- Evaluate FSCS ATD electronics architecture concepts, evaluate FSCS ATD contractors crew station concepts, provide FSCS ATD contractors 40% of crew station simulation software as reuse. - Demonstrate and deliver FSCS conceptual crew station simulator to DCD, Ft Knox; demonstrate FSCS crew task list baseline for user evaluation. - Demonstrate core voice recognition and three-dimensional audio technologies in crew station simulator. - Demonstrate embedded map server with reusable interface for potential use in FSCS or other vehicle applications.
•	128	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	5983	

FY 1999 Planned Program:

•	7377	- Optimize electronic architectures of competing contractors FSCS ATD; define optimized FSCS crew station design and simulation; modify FSCS crew station simulator for advanced functionality demonstration and user evaluation. - Define ground vehicle domain electronics architecture; begin fabrication of a ground vehicle domain electronic architecture SIL. - Demonstrate indirect vision, voice recognition and three-dimensional audio technologies in vehicle testbed.
Total	7377	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1780	6174	7341
Appropriated Value	1818	6174	
Adjustments to Appropriated Value	-54	-191	
FY 1999 President's Budget	1764	5983	7377

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D502

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D502 HAECO II	1906	0	0	0	0	0	0	0	1906

A. Mission Description and Budget Item Justification: This Congressionally-directed project, originally funded in FY95 and funded again in FY97, calls for the further continued development and Army testing of the combined diesel/turbine engine program. The Army has contracted with the Hope-Anderson Engine Company (HAECO) to complete development of one engine in the 300 to 600 horsepower range for delivery to the Army for testing at the U.S. Army Tank-Automotive and Armaments Command. The contractor is HAECO Partners Ltd., Hillsboro, Ohio. Due to late release of funds (May 97) this project carryed over into FY98.

FY 1997 Accomplishments:

•	1906	- Tested two end cylinders of an eight cylinder engine to improve scavenging and optimize the division of combustion and internal cooling air flow. Once a satisfactory design is achieved, reconfigure the design and fabricate parts for the upgraded final engine configuration for a multi-cylinder engine with the objective to demonstrate 300 horsepower. - Completed design, simulation, air flow tests and engine component fabrication. - Tested demonstrator engine (September 98) at the contractor facility prior to delivery to the Government for 10 hours of performance tests.
Total	1906	

FY 1998 Planned Program: Project not funded in FY98

FY 1999 Planned Program: Project not funded in FY99

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1958	0	0
Appropriated Value	2000		
Adjustments to Appropriated Value	-94		
FY 1999 President's Budget	1906	0	0

Change Summary Explanation: Funding: FY 1997-Funding provided by Congress (+2000) to conduct testing of the combined diesel/turbine engine program.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D506

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D506 Aluminum Metal Matrix Composite (NAC)	0	6299	0	0	0	0	0	0	6299

A. Mission Description and Budget Item Justification: This Congressionally directed effort will manufacture prototype ground vehicle track components for weight and life cycle cost reductions. Silicon reinforced aluminum metal matrix composites have applicability to a wide range of intricate parts that currently require steel forgings, castings and machinings. Cost and weight reductions of 50% are possible in some applications.

FY 1997 Accomplishments: Project not funded in FY 97.

FY 1998 Planned Program:

•	6141	- Manufacture prototype ground vehicle track components. The work will provide for the fabrication and test of a single pin aluminum metal matrix track for the Bradley Fighting Vehicle.
•	158	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	6299	

FY 1999 Planned Program: Project not funded in FY 99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value	0	6500	
Adjustments to Appropriated Value		-201	
FY 1999 President's Budget	0	6299	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D507

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D507 PLS Commercial Engine (NAC)	0	3489	0	0	0	0	0	0	3489

A. Mission Description and Budget Item Justification: This Congressionally directed effort supports the Program Manager for Heavy Tactical Vehicles (PM HTV), who will solicit for the HEMTT/PLS future pre-production contract(s) in 2002 and production contract(s) in 2004. These vehicles will require advanced propulsion technologies which leverage and utilize commercial markets. This effort is being initiated to assure a complementary blend of propulsion capabilities and engine configurations based on both commercial market forces and military requirements is achieved.

FY 1997 Accomplishments: Project not funded in FY 97.

FY 1998 Planned Program:

•	3401	- Through competitive solicitation, initiate cooperative agreements with at least two major heavy diesel engine manufacturers to develop high horsepower, EPA certified engines for the Heavy Tactical fleet with applicability to medium combat vehicles.
•	88	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	3489	

FY 1999 Planned Program: Project not funded in FY 99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value	0	3600	
Adjustments to Appropriated Value		-111	
FY 1999 President's Budget	0	3489	0

Change Summary Explanation: FY1998: Project is a Congressional add.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	29627	25708	20109	19538	19008	22691	23413	Continuing	Continuing
D247 Tactical C4 Technology Integration	8100	7772	12617	10535	9821	12395	13342	Continuing	Continuing
D257 Digital Battlefield Communications	11313	8371	5031	4820	4904	5909	5565	Continuing	Continuing
D592 Space Applications Technology	3543	2782	2461	4183	4283	4387	4506	Continuing	Continuing
D596 Field Laser Radar Demo	4765	4845	0	0	0	0	0	0	9630
D597 Wave Net Technology	1906	1938	0	0	0	0	0	0	3844

Mission Description and Budget Item Justification: This program element consists of projects that will advance command, control, and communications (C3) technology to provide the soldier with high quality real-time battlefield information and integrate space technologies into Army tactical applications. The tactical C4 technology integration project provides software application development demonstrations, communications system integration and prototype products for distributed, mobile, secure, fully automated spread spectrum radio networks with measures to enhance the survivability and efficiency of Army tactical command, control, communications and computer (C4) systems. This program specifically addresses joint service demonstrations coordinated through the joint directors of laboratories technology panel for C4, and provides key demonstrations of systems integration across the Army's battlefield functional areas. Work in this PE will provide multimedia inter networked communications while on-the-move with commercial standard gateway connectivity to both high-speed and legacy communications assets. This program also tests and evaluates net radio, common user, and distributed communications equipment and automated spectrum management aids which have potential to solve user needs; tests and evaluates equipment deficiencies; and provides critical future capabilities and supports new radio development and evaluation, in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the Air Force (AF). The digital battlefield communications project will support the Army's battlefield digitization effort by demonstrating technology to integrate communications hardware and software capable of providing seamless communications for the digitized battlefield to meet emerging requirements for high-capacity/on-the-move information exchange and leading to a battlefield information transmission system for Force XXI. The space applications technology project will demonstrate novel applications of space assets for Army missions and support space technology integration. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. Work in this program element is related to and fully coordinated with efforts in PE 0602782A (Command, Control and Communications Technology), PE 0203740A (Maneuver Control System), PE 0203726A (Advanced Field Artillery Tactical Data System), 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) in accordance with the ongoing Reliance Joint planning process. Efforts under Projects D247 (Tactical C3 Technology Integration) and D257 (Digital Battlefield Communications) are performed primarily by the US Army Communications-Electronics Research,

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology

Development and Engineering Center (CERDEC), Space and Terrestrial Communications Directorate, Fort Monmouth, NJ. Contractors include: SRI International, Menlo Park, CA; Mitre Corporation and Booze-Allen and Hamilton, Eatontown, NJ; AT&T, Holmdel, NJ; GTE, Taunton, MA; Hazeltine, Greenlawn, NY; Rockwell International, Richardson, TX; and Jet Propulsion Laboratories, Pasadena, CA. Work under D592 (Space Applications Technology) is managed primarily by the U.S. Army Space and Strategic Defense Command (USASSDC), Huntsville, AL. Work in this program element is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is correctly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology

PROJECT: D247

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D247 Tactical C4 Technology Integration	8100	7772	12617	10535	9821	12395	13342	Continuing	Continuing

A. **Mission Description and Justification:** This project develops computer and communications technology options using commercial standard hardware and software to support mission planning and battlefield decision making. These efforts supports the Digital Battlefield Communications (DBC) advanced technology demonstration (ATD) via automated, real-time, digital information transfer, and the development and demonstration of communication systems needed for the Force XXI integrated digital battlefield. This project also supports the Tactical Command and Control Protect (TC2P) ATD by providing protection technologies for tactical internet command and control information systems, components and data, against modern network attacks. This project also performs development on-the-move ultra-high frequency satellite communications technology, interfaces mobile ultra-high frequency satellite communications radios to combat net radio technology using commercial standard data packet protocols, and is developing multiband, multimode radio technologies as part of a Joint Service program with the Air Force and the Defense Advanced Research Projects Agency (DARPA).

FY 1997 Accomplishments:

•	3972	– Developed technology options for development of an optically controlled phased array antenna to meet future DBC ATD on-the-move communications requirements. – Developed on-the-move surrogate direct broadcast satellite (DBS) capability that provides DBS like capability to areas and situations without regard to satellite access limitations for both stationary and moving platforms. – Developed an initial prototype of a conformal phased array antenna to meet future on-the-move radio access point communications requirements. – Leveraged commercial personal communication systems (PCS) technology to develop a tactical, secure PCS capability for the Army's warfighter information network proof of concept. – Conducted field tests of the wideband packet surrogate digital radio in the Task Force XXI advanced warfighting experiment (AWE). – Developed tactical end-to-end encryption device security requirements for future digital battlefield communications technologies and demonstrated encryption device technologies in the Task Force XXI AWE.
•	1000	– Investigated and evaluated TC2P ATD protection technologies for tactical internet command and control, focusing on protection and detection of network attacks to the tactical internet.
•	3128	– Continued development of an open system architecture for a software reprogrammable simultaneous four-channel multiband multimode radio (MBMMR) which allows rapid change of wave forms, frequency bands (2-2000MHz), inter-networking protocols (cross channel), voice/data modes, and information security algorithms, leading to an Army demonstration in a tactical vehicle configuration.
Total	8100	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology
	PROJECT D247

FY 1998 Planned Program:

•	2806	– Complete development of an integrated phased array antenna that can track multiple airborne relay systems from a mobile radio access point and allow robust on-the-move communications in support of the DBC ATD. – Complete laboratory testing and evaluation of enhanced commercial terrestrial PCS hardware for integration into the Army's warfighter information network proof of concept. Investigate and evaluate digital network radio technology to support the requirements for the Army's future digital radio. – Demonstrate narrow band, high frequency communications technology with tactical internet access. – Develop an initial prototype of a photonically controlled phased array antenna to reduce size, weight and power requirements to meet future on-the move communications requirements. – Demonstrate on-the-move surrogate direct broadcast satellite (DBS) capability.
•	2732	– Integrate wideband radio networking testbed and associated commercial software development environment tools into the digital integrated laboratory to facilitate development, test, evaluation and demonstration of new unique wideband networked waveforms and protocols program – Develop wideband waveforms and advanced networking protocols.
•	2061	– Integrate and demonstrate end-to-end super high frequency surrogate satellite communications capability for range extension. Begin satellite communications terminal enhancements to reduce size and weight increasing throughput and mobility. – Develop unmanned aerial vehicle based battlefield paging capability.
•	173	– Small Business Innovative Research/Small Business Technology Transfer Programs
Total	7772	

FY 1999 Planned Program:

•	3143	– Continue development and evaluation of wideband waveforms and advanced networking protocols, and conduct high information transfer rate experiments in the digital integrated laboratory wideband radio networking testbed.
	5432	– Demonstrate integrated DBC ATD technologies in support of high-capacity digitized communications and split-based operations. – Integrate and demonstrate enhanced commercial terrestrial PCS capability in the Army's warfighter information network proof of concept. – Demonstrate integrated phased array antenna to meet on-the-move radio access point communications requirements. – Complete development of photonically controlled phased array antenna to reduce size, weight and power requirements for on-the move communications technologies. – Demonstrate wideband high frequency communications technology, with access to the tactical internet, for transmitting maneuver and intelligence data from long range surveillance units that are beyond line of sight.
•	4042	– Demonstrate unmanned aerial vehicle based battlefield paging. – Complete and demonstrate super high frequency surrogate satellite communications terminal enhancements. – Fully integrate and demonstrate end-to-end unmanned aerial vehicle based surrogate satellite capability.
Total	12617	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology
	PROJECT: D247

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7271	8028	12824
Appropriated Value	7271	8028	
Adjustments to Appropriated Value	829	-256	
FY 1999 President's Budget	8100	7772	12617

Change Summary Explanation: Funding: FY1997 funding reprogrammed (+829) from other sources to address higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology

PROJECT: D257

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D257 Digital Battlefield Communications	11313	8371	5031	4820	4904	5909	5565	Continuing	Continuing

A. **Mission Description and Justification:** The objective of this Digital Battlefield Communications (DBC) advanced technology demonstration (ATD) project is to integrate communications hardware and software capable of providing seamless, multimedia communications for the digitized battlefield and to meet emerging requirements for high capacity, on-the-move information exchange. Force projection and evolving doctrine are expected to require significantly more communications bandwidth, drastically altered traffic patterns, new services (e.g. imagery), and higher mobility, especially at echelons brigade and below, than is currently supported by today's communications systems. This project will develop and demonstrate a series of products, through an evolutionary process, capable of transitioning into field units to support the future digitized brigade, division and corps. The project will build on early system performance models begun under the combined arms command and control program, in order to identify appropriate non-developmental wideband communications systems to supplement the data capacity of existing lower echelon networks. Once data "hot spots" and congestion points are identified in the existing architecture, warfighter demonstrations will be used to demonstrate the warfighter benefit of added capacity at key locations on the digitized battlefield, and to identify and size fieldable deployment packages consisting of wideband digital communications and support devices to supplement existing tactical communications systems. Technology demonstration units of wide-bandwidth digital radios will be required. Laboratory demonstrations and protocol development to permit asynchronous transfer mode traffic to interface with tactical radio/satellite equipment will be conducted. A mobile radio access point consisting of a high capacity, on-the-move trunk radio, powerful portable switch and legacy wide bandwidth digital subscriber networks will be developed and evaluated by troops in the field. The radio access point (RAP) will provide a high bandwidth on-the-move trunk feed in support of combat net radio, single channel radio access, and wideband data subscribers, all communicating on-the-move. Network planning tools and dynamic inter-network management schemes will be exploited for both pre-battle communications planning and dynamic reconfiguration during deployment. Development of on-the-move antennas begun in prior years will be extended to provide fieldable, low profile antennas better suited to on-the-move wideband needs to connect forward mobile elements in split based deployments. Wideband airborne communications relays will be developed and evaluated for warfighter utility in achieving range extension at high data rates. Commercial personal communication systems and direct broadcast satellite will be evaluated for possible tactical exploitation.

FY 1997 Accomplishments:

- 2850 – Supported and conducted Task Force XXI ATM multimedia experimentation in support of DBC ATD.
  – Demonstrated military-unique asynchronous transfer mode (ATM) enhancements (i.e. adaptive forward error correction, ATM signaling over tactical circuits, ATM over wireless networks) over legacy communication systems (e.g. mobile subscriber equipment to allow for better use of available bandwidth).
  – Demonstrated capability of terrestrial personal communications system (PCS) technology for military use with the Army's mobile subscriber equipment (MSE).
  – Evaluated communications satellite PCS technology to determine responsiveness to Army needs.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D257

FY 1997 Accomplishments: (continued)

- 3198 – Demonstrated commercial standard multimedia and communications (e.g. ATM, IP, narrow band integrated service digital network) protocols for application to DBC ATD high capacity, on-the-move radio's RAP.
  – Demonstrated radio access point function that provided integrated mobile internet protocol and survivable hand-off capability.
- 3442 – Investigated and evaluated high capacity trunk radio technology options aimed at providing an on-the-move throughput (up to 45 Mbps) for use in the DBC ATD's radio access point .
  – Developed airborne relay communications payload to support 45 megabits per second (Mbps) on the move communications.
  – Developed an initial prototype of a conformal phased array antenna to enable on-the-move reception/transmission of high capacity trunk radio for radio access point communications.
- 1823 – Developed, inserted and integrated wideband trunk radio technology with throughput up to 10 Mbps into DBC ATD's Division XXI digital communications system for use as an enhanced MSE backbone.
  – Inserted and integrated upgraded ATM technology into Division XXI digital communications system.
  – Conducted user tests of advanced digital battlefield communications products in Task Force XXI and other user demonstrations. Provided technical/engineering support and on-site field support for digital battlefield communications technologies in Task Force XXI and in preparation for Division XXI.

Total 11313

FY 1998 Planned Program:

- 3231 – Integrate the DBC ATD radio access point prototype into the digital integrated laboratory to demonstrate connectivity with MSE and enhanced position location reporting system in a static environment.
  – Integrate real time internet protocol (IP) with mobile IP for tactical multinet gateway ATM to support radio access point with low bit rate video teleconferencing.
- 2473 – Integrate and demonstrate dual band (X-band and Ku-band) airborne communications relay package capable of supporting 45 Mbps communications in support of DBC ATD.
  – Complete development of a high capacity trunk radio capable of operating at a data rate up to 45 Mbps while on the move.
- 2457 – Continue evaluation of the DBC ATD application and unique architectural needs to apply emerging commercial satellite PCS technology to battlefield communications.
  – Complete laboratory integration of enhanced commercial terrestrial PCS hardware for integration into the Army's warfighter information proof of concept.
  – Demonstrate ATM benefits of a high bandwidth MSE backbone and interface ATM technology to the high capacity trunk radio in Division XXI.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D257

FY 1998 Planned Program: (continued)

– Continue development of military-unique ATM enhancements (i.e. integrated voice, tactical adapter, forward error correction) to support operation in a tactical environment.
– Conduct user tests of digital battlefield communications technologies in Division XXI and other user demonstrations. Provide technical/engineering and on-site field support for digital battlefield communications technologies in Division XXI.

•	210	Small Business Innovative Research/Small Business Technology Transfer Program
Total	8371	

FY 1999 Planned Program:

•	2975	– Demonstrate mobile radio access point. Integrate and demonstrate DBC ATD radio access point with on-the-move high capacity trunk radio and phased array antenna capable of mobile operation. – Integrate on-the-move high capacity trunk radio and mobile phased array antenna into the radio access point . – Develop, evaluate and demonstrate dual band airborne communications relay antenna improvements to provide consistent gain across the coverage area for improved range extension communications. – Demonstrate a dual band airborne communications relay package capable of supporting 45-Mbps communications
•	2056	– Integrate and demonstrate secure tactical PCS capability into the warfighter information proof of concept in support of the DBC ATD. – Insert and evaluate digital battlefield communications technologies in the joint warfighter interoperability demonstration. – Integrate and demonstrate enhanced ATM features into the radio access point and the Army's warfighter information proof of concept. – Demonstrate Army application of satellite PCS technology to provide a highly mobile, handheld, worldwide communications capability.
Total	5031	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	11620	8645	5365
Appropriated Value	11620	8645	
Adjustments to Appropriated Value	-307	-274	
FY 1999 President's Budget	11313	8371	5031

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology

PROJECT: D592

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D592 Space Applications Technology	3543	2782	2461	4183	4283	4387	4506	Continuing	Continuing

A. **Mission Description and Justification:** The objective of this project is to optimize Army utilization of space based systems. The project involves: (a) space technology development and demonstrations for evaluating technology feasibility, determining Army utility, and refining requirements, and (b) space technology integration into battlefield operating systems. The project also addresses: defining Army requirements for space platforms; demonstrating advanced, compact space hardware; developing algorithms that optimally process space data; integrating satellite direct down link to ground systems; and providing an advanced technology base for the Army space exploitation demonstration program, the Tri-Service DoD space test program, and the exploitation of commercial space capabilities. The project focus is on space force enhancement (communications, intelligence, position/navigation, reconnaissance, surveillance, target acquisition, weather/terrain, missile warning) to improve warfighting capabilities and operations other than war.

FY 1997 Accomplishments:

- 1390 – Demonstrated laser boresight calibration for space-based infrared (IR) sensors to improve joint tactical ground station (JTAGS) performance.
- 632 – Modified existing BMDO terminals; developed acquisition and tracking software; designed the portable ground unit for laser communications. Completed laser communication utility study and integrated low-altitude lab/field test results.
- 548 – Completed field test and demonstrate acousto-optic tunable filter utility to provide spectral data from airborne platform.
- 973 – Completed technical feasibility sensor test and analysis for battlefield ordnance awareness concept.

Total 3543

FY 1998 Planned Program:

- 642 – Develop a unmanned aerial vehicle (UAV) and space based design for spectral sensor technology with direct downlink capability.
- 1488 – Demonstrate near real-time processing of ordnance data.
- 586 – Demonstrate air to surface laser communications; assemble and test prototype portable ground unit; integrate prototype portable ground unit into satellite to ground laser communications architecture.
- 66 – Small Business Innovative Research/Small Business Technology Transfer Programs.

Total 2782

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D592

FY 1999 Planned Program:

- 633 – Demonstrate onboard processing of spectral data baseline sensor package and configuration.
- 1378 – Develop a space qualifiable battlefield ordnance awareness sensor design with near real-time, onboard processing.
- 450 – Demonstrate combined tactical and laser communications capabilities to warfighting community.

Total 2461

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3635	3015	2722
Appropriated Value	3635	3015	
Adjustments to Appropriated Value	-92	-233	
FY 1999 President's Budget	3543	2782	2461

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology

PROJECT: D596

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D596 Field Laser Radar Demo	4765	4845	0	0	0	0	0	0	9630

A. Mission Description and Justification: The objective of this Congressional special interest project is to provide data reduction and analysis of field experiments data to evaluate the utility of the Field Laser Radar for Army applications. The Field Laser Radar is an imaging carbon dioxide (CO_2) laser radar (ladar). This ladar transmits a waveform capable of high resolution measurements in both range and velocity. Potential applications to be investigated include theater ballistic missile defense or cruise missile defense. In addition, the equipment can provide long range, coherent remote sensing of chemical warfare agents.

FY 1997 Accomplishments:

•	2050	– Conducted chemical warfare agent detection experiments. – Conducted static ground tests on cruise missiles. – Defined TALD airdrop tracking tests.
•	2465	– Developed data products fusion and algorithms. – Analyzed precision and active angle tracking. – Developed multi-dimensional imaging capability.
•	250	– Supported development of discrimination algorithm.
Total	4765	

FY 1998 Planned Program:

•	2500	– Conduct chemical warfare agent detection experiments.
•	150	– Design/Develop Target Mount.
•	1773	– Refine tracking and imaging algorithms.
•	200	– Develop discrimination algorithms.
•	100	– Conduct chemical warfare agent detection experiments.
•	122	Small Business Innovative Research/Small Business Technology Transfer Program
Total	4845	

FY 1999 Planned Program: Project not funded in FY 1999

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology

PROJECT: D596

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4895	0	0
Appropriated Value	4895	5000	
Adjustments to Appropriated Value	-130	-155	
FY 1999 President's Budget	4765	4845	0

Change Summary Explanation: FY1998 program is a Congressional add.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology

PROJECT: D597

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D597 Wave Net Technology	1906	1938	0	0	0	0	0	0	3844

A. Mission Description and Justification: The objective of this Congressional special interest project is to develop and evaluate a Wave Net circuit to perform image compression and decompression. Wave Net is an application-specific integrated circuit that utilizes a neural network architecture to efficiently perform low loss image compression. Potential applications include compression of imagery for battlefield situation awareness, aerial surveillance sensor downlinks, and image based target hand-off.

FY 1997 Accomplishments:

•	1906	– Completed development and testing of prototype wave net circuit card to investigate the potential of the algorithms to increase communications bandwidth utilization.
Total	1906	

FY 1998 Planned Program:

•	1889	– Design, fabricate, and test a Wave Net system to satisfy an Army video transmission objective utilizing previous year's prototype hardware and algorithm developments. – Explore program transitions by providing Wave Net system and integration services
•	49	Small Business Innovative Research/Small Business Technology Transfer Program
Total	1938	

FY 1999 Planned Program: Project not funded FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1958	0	0
Appropriated Value	1958	2000	
Adjustments to Appropriated Value	-52	-62	
FY 1999 President's Budget	1906	1938	0

Change Summary Explanation: Funding: FY 1998 funding provided by Congress (+2000) to develop and evaluate a Wave Net circuit to perform image compression and decompression.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603007A Manpower, Personnel and Training Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4289	2910	3021	3034	3044	3050	3064	Continuing	Continuing
A792 Personnel Performance and Training	1352	2910	3021	3034	3044	3050	3064	Continuing	Continuing
A793 Training Systems and Education	2937	0	0	0	0	0	0	0	2937

Mission Description and Budget Item Justification: The objective of this program is to develop and demonstrate soldier-oriented technologies to enhance soldier and unit performance. Affordability goals include the reduction of training and other personnel costs through the development of effective training strategies that incorporate appropriate mixes of live, virtual, and constructive simulations. Research efforts include designing new ways to efficiently develop collective training; developing and demonstrating prototype training methods and programs that improve mission performance, devising training strategies using distributed training technology to conduct multi-service, multi-site training, assessment, and feedback; and evaluating the effectiveness of a compressed gunnery training strategy for the Reserve Component. Work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. These projects are dedicated to conducting proof of principal field demonstrations and tests of technologies to meet specific military needs and are therefore correctly placed in Budget Activity 3. This PE is managed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603007A Manpower, Personnel and Training Advanced Technology

PROJECT: A792

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A792 Personnel Performance and Training	1352	2910	3021	3034	3044	3050	3064	Continuing	Continuing

A. Mission Description and Justification: This project demonstrates soldier-oriented technologies that will lead to improved Army personnel utilization. The research will demonstrate new methods for identifying high quality male and female enlistees, for assigning them to Military Occupational Specialties (MOS) that maximize total force readiness, and for retaining the most effective performers. It also develops and demonstrates behavioral science-based methods to achieve optimized design of Army decision-making staff organizations. Other efforts will design innovative methods and technologies to develop effective leaders for small-team operations and for developing Battle Commanders for the digitized battlefield. This program supports the Manpower and Personnel Defense Technology Area. Work in this program element is coordinated with the Deputy Chief of Staff for Personnel (DCSPER) and the Training and Doctrine Command (TRADOC) Battle Laboratories, and demonstration projects are integrated into the Battle Labs' Advanced Warfighting Experiments. Beginning FY98, this project includes training systems and education research.

FY 1997 Accomplishments:

•	1352	- Completed a detailed summary of five years of Special Forces research including recommendations for applying this research to other Army units.
		- Demonstrated utility of Battle Commander development tools and techniques.
		- Provided findings on the post-deployment effects of peacekeeping on family issues, such as, soldier and spouse marital stability, financial well-being, and commitment to the Army (Active and Reserves).
		- Developed peer and supervisor ratings of Special Forces leadership potential to improve selection and assessment of leaders for small, highly specialized units.
Total	1352	

FY 1998 Planned Program:

•	2837	- Assess the effectiveness and efficiency of time-compressed tank gunnery training strategies for Army National Guard to maximize training within resource limitations.
		- Develop and pilot test performance measures for fire support training in joint environments.
		- Complete guidelines for managing and sustaining the quality of structured, simulation-based training programs.
		- Identify the factors that facilitate effective Special Forces team performance.
		- Complete algorithms for cognitive modeling and situational awareness behaviors for command entity computer generated forces
		- Assess the overall command climate in the Army.
•		
•	73	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	2910	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603007A Manpower, Personnel and Training Advanced Technology
	PROJECT A792

FY 1999 Planned Program:

- 3021 - Develop and demonstrate training feedback methods for multi-site, multi-Service, multi-echelon exercises.
  - Develop and pre-test scenarios and role plays designed to help leaders assess, train, and develop team members of the Special Operations Forces.
  - Develop and evaluate methods that assess unit command climate, and analyze trends related to soldier, training, quality of life, and readiness issues.
  - Identify techniques and tools appropriate for the transfer of training methods and products from institutions to units and vice versa.
  - Identify and develop Reserve Component performance measures for Forces Command (FORSCOM) Small Arms Strategies.

Total 3021

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1389	3003	3006
Appropriated Value	1389	3003	
Adjustments to Appropriated Value	-37	-93	
FY 1999 President's Budget	1352	2910	3021

Change Summary Explanation: As a result of ARI restructuring, Manpower and Personnel Research (project A792) and Training Systems and Education Research (project A793) are combined into project A792, renamed Personnel Performance and Training, beginning in FY1998.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603007A Manpower, Personnel and Training Advanced Technology

PROJECT: A793

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A793 Training Systems and Education	2937	0	0	0	0	0	0	0	2937

A. **Mission Description and Justification:** The objective of this project is to demonstrate empirically-based cost-effective training strategies, with particular emphasis on how to best use distributed interactive simulation (DIS) training environments. This program is predicated on research showing that the effectiveness of training aids, devices, simulations, and simulators (TADSS) is largely a function of how they are used in training, including the adequacy of performance measurement techniques and performance feedback methods. Training strategies will be developed to integrate all three types of simulation (live, virtual and constructive) into a seamless training environment that will enhance training quality, relevancy and efficiency for warfighting missions and for stability operations. This research supports the TRADOC Battle Labs. Beginning in FY1998, this research is combined with project A792, Personnel Performance and Training.

FY 1997 Accomplishments:

•	2937	- Validated brigade-level and multi-service training strategies and performance assessment methodologies.
		- Developed recommendations for the frequency and sequencing of training for the Combined Arms Tactical Trainer (CATT) training management system.
		- Designed prototype, structured company-level Close Combat Tactical Trainer (CCTT) training program.
Total	2937	

FY 1998 Planned Program: Program combined with project A792.

FY 1999 Planned Program: Program combined with project A792.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3017	0	0
Appropriated Value	3017		
Adjustments to Appropriated Value	-80		
FY 1999 President's Budget	2937	0	0

Change Summary Explanation: As a result of ARI restructuring, Manpower and Personnel Research and Training Systems and Education Research (previously projects A792 and A793, respectively) are combined into project A792, Personnel Performance and Training, beginning in FY1998.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603105A Military Human Immunodeficiency Virus (HIV) Research

PROJECT: DH29

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DH29 Military HIV	17080	2629	5710	5651	5548	5506	5537	Continuing	Continuing

A. Mission Description and Budget Item Justification: This program element supports research to provide concept exploration of candidate prevention vaccines to include safety and efficacy in model systems to prepare and conduct clinical studies. It funds Congressionally directed Acquired Immune Deficiency Syndrome (AIDS) research to control the infection in military environments, protect the military blood supply and protect military personnel from unusual risks associated with infection. AIDS research is focused on the following thrust areas: diagnosis, natural history, epidemiology, and vaccine development. Efforts are directed to answer militarily unique questions affecting manning, mobilization, and deployment. This program is managed primarily by the U.S. Army Medical Research and Materiel Command. The major contractor is Henry M. Jackson Foundation for the Advancement of Military Medicine, Rockville, MD. Additional AIDS related research is conducted within the following projects: 0601102A, project S17, 0602787A, project 873, 0603105A, project H29, 0603807A, project 811 and 0604807A, project 812. This program is dedicated to conducting proof of principle demonstrations and tests of non-system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

FY 1997 Accomplishments:

- 1890 Continued field site preparation for candidate vaccine clinical trials.
- 952 Completed safety and immunogenicity Phase I and Phase II trials of multiple candidate vaccines.
- 7120 Congressional special interest. Conducted studies to develop a vaccine to prevent HIV: characterized protective epitopes, evaluated vaccine candidates in animal models, identified cohorts for vaccine trials, developed and maintained international and domestic laboratories to support HIV trials, and assessed the feasibility of a killed whole virus vaccine.
- 1614 Congressional special interest. Conducted national and international surveillance of HIV genotypes and selected the most promising strains for vaccine development.
- 5504 Congressional special interest. Conducted studies on HIV-specific immune reconstitution, natural history of HIV infection, role of cell receptors in infectivity and pathogenicity, and preliminary studies on rapid diagnosis of HIV infection.

Total 17080

FY 1998 Planned Program:

- 1090 Prepare field site for candidate vaccine clinical trials.
- 810 Conduct safety and immunogenicity Phase I and Phase II trials of promising candidate vaccines.
- 663 Analyze possible correlates of immunity of vaccines and controls that participated in these trials.
- 66 Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 2629

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603105A Military Human Immunodeficiency Virus (HIV) Research PROJECT DH29

FY 1999 Planned Program:

•	1253	Conduct field site preparation for candidate vaccine clinical trials.
•	3715	Complete safety and immunogenicity Phase I and Phase II trials of candidate vaccines.
•	742	Examine possible immune responses from these vaccine trials.
Total	5710	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	17544	2713	3162
Appropriated Value	17544	2713	
Adjustments to Appropriated Value	-464	-84	
FY 1999 President's Budget	17080	2629	5710

Change Summary Explanation: Funding: FY 1999: Funding increased to allow further product development.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238A Air Defense/Precision Strike Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	19291	12773	9973	19003	22383	18329	15819	Continuing	Continuing
D177 Joint Air/Land/Sea Precision Strike Demonstration	13280	7521	9520	19003	22383	18329	15819	Continuing	Continuing
D546 Synthetic Aperture Radar Target Recognition and Location System	6011	5252	453	0	0	0	0	0	11859

Mission Description and Budget Item Justification: Overall Joint Precision Strike Demonstration (JPSD) program goals are to reduce sensor-to-shooter timelines from hours to minutes as well as to achieve quantifiable improvements in target location and identification, weapons systems responsiveness and kill capability, and accurate damage assessment through such techniques as near-real-time sensor cueing, near-real-time data dissemination, seamless sensor-to-shooter node communication, dynamic re-targeting, improved weapons system accuracy and precision guided munitions. This program provides for the integration of new, high-payoff technologies, architectural and operational concepts, along with existing and emerging systems to demonstrate enhanced precision strike and counterfire capabilities for targets at deep and extended ranges. The JPSD objectives are: to locate, identify, and kill high-value, time-critical targets and to assess damage within tactically meaningful timelines. The program conducts building block demonstrations to identify technical and operational barriers to an adverse weather, day/night, end-to-end, sensor-to-shooter precision strike capability and to demonstrate and experiment with potential solutions to these barriers. This program element also funds development activities for a high resolution Synthetic Aperture Radar Target Recognition and Location System (STARLOS) with real-time Aided Target Recognition (AiTR). The work in this program element is closely coordinated with the Joint Staff, other services, the Army's combat development community, TRADOC Battle Labs, and appropriate materiel developers to conduct field demonstrations and experiments to assess specific technologies for military needs and is therefore placed in Budget Activity 3. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan, the Army Modernization Plan, and the Joint Warfare Science and Technology Plan. The work also supports Force XXI and the Army Warfighting Experiments (AWEs).

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238A Air Defense/Precision Strike Technology

PROJECT: D177

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D177 Joint Air/Land/Sea Precision Strike Demonstration	13280	7521	9520	19003	22383	18329	15819	Continuing	Continuing

A. **Mission Description and Justification:** Through a series of building block demonstrations, the Joint Air Land Sea Precision Strike (JT ALS PS) Demonstration Project has identified barriers to an advanced precision strike capability and assessed candidate solutions to these barriers. The FY95-FY96 Precision/Rapid Counter Multiple Rocket Launcher (P/RC-MRL) Advanced Concept Technology Demonstration (ACTD) was conducted with highly successful demonstrations in September 1995 at Fort Hood, TX, and in September/October 1996 in Korea. The P/RC-MRL ACTD provided U.S. Forces Korea (USFK) with a significantly enhanced capability to locate, track, and defeat the North Korean 240mm MRL threat by delivering and demonstrating Leave Behind prototype systems that include: connectivity between the Korean Combat Operations Information Center and the 2nd Infantry Division (2ID); enhancements to the Firefinder radar system; automation for the 2ID Main Command Post; Automated Weapon Target Pairing software for MLRS battalions; enhancements of Army connectivity to Air Force and Navy command and control systems to provide a joint solution to the 240mm MRL threat; and AiTR capability for the Tactical Endurance Synthetic Aperture Radar (TESAR) sensor on the Predator Unmanned Aerial Vehicle (UAV) along with two years of technical support during FY97-FY98. The Commander in Chief, Combined Forces Command (CINCCFC) requested that the successful methodologies for solving critical precision strike issues be applied at theater level. In response, the concept for a Theater Precision Strike Operations (TPSO) ACTD was formulated in FY97 and formal program approval was achieved in FY98. TPSO is designed to provide a significantly enhanced joint and combined capability for the CINC to plan and conduct Theater Counterfire and Precision Strike Operations through the real time synchronization of US/Coalition assets. Technologies to provide an improved Army capability in these areas will be demonstrated under this project beginning in FY98, to support the needs of the CINCCFC and to serve as the Army's contribution to joint technology and digitization. Efforts in this project are managed by the Director, Joint Precision Strike Demonstration Project Office, Program Executive Officer, Intelligence, Electronic Warfare, and Sensors (PEO-IEW&S), Fort Belvoir, VA. The Prime contractor is Raytheon, Bedford, MA.

FY 1997 Accomplishments:

- 8930 - Completed the P/RC-MRL ACTD demonstration in USFK and demonstrated the new capabilities of the program's integrated command & control, intelligence and fire support systems to significantly affect the combat capability of the US 2ID to defeat the North Korean 240mm MRL threat.
  - Structured "leave behind" systems that automated the 2ID command post and tactical operations functions, enhancing situation awareness, the Intelligence Preparation of the Battlefield (IPB) function, communications and target processing timelines.
  - Demonstrated the value of conducting warfighting experimentation on the virtual battlefield with entity-level forces that evaluated the effectiveness of new systems, alternate system architectures and associated methodologies of employment Tactics, Techniques and Procedures (TTPs).
  - Demonstrated a Joint strike capability through the increased effectiveness of Close Air Support (CAS) and Naval Fire Support by using timely target information via enhanced digital communications.
  - Continued the refinement of the Automated Weapons Target Pairing (AWTP) software for the Multiple Launch Rocket System (MLRS) Battalion and successfully demonstrated its capability to significantly reduce target processing bottlenecks.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D177

FY 1997 Accomplishments: (continued)

- 4100 - Provided In-Country maintenance support and quarterly training for Leave Behind systems.
  - Provided "surge support" teams to assist the 2ID during key training exercises.
  - Completed a comprehensive report on the lessons learned and warfighting value added of the "leave behind" systems and demonstrated concepts.
  - Demonstrated the ability to generate a seamless, large area coverage tactical Infra-Red (IR) image from discrete line scan inputs improving target detection.
  - Accomplished integration of P/RC-MRL functionality into Army fielded systems.
  - Established a baseline capability at the Eighth U.S. Army deep operations coordination cell (DOCC) to enhance execution of deep operations.
  - Integrated AiTR technology into the Mobile Test Facility and demonstrated its ability to identify threat 240mm MRL launchers from the TESAR sensor system.
- 250 - Integrated prototype sensor-to-shooter capabilities into the JPSD Integration & Evaluation Center (IEC). Evaluated relevant target systems and interfaces for integration to establish a joint demonstration architecture.
  - Developed the concept for the TPSO ACTD and conducted initial planning/coordination.

Total 13280

FY 1998 Planned Program:

- 4820 - Complete the transition and functionalities of P/RC-MRL ACTD leave behinds to 2ID and Army fielded systems, respectively.
  - Continue leave behind systems support for the P/RC-MRL ACTD.
  - Publish a comprehensive lessons learned P/RC-MRL ACTD report.
  - Continue assessment of P/RC-MRL product applicability to other Army/Joint Precision Strike requirements.
  - Continue technical growth, as required, of IEC capabilities.
  - Conduct a flight demonstration of the RISTA II sensor on a UAV.
- 2515 - Continue planning for TPSO ACTD. Identify and prioritize warfighter requirements to be developed in software enhancements. Assess functionality resident in current Army baseline systems. In coordination with responsible PEOs, refine lists of functions to be completed/accelerated/added to future versions of software.
  - Exploit and improve the rapid software prototyping capabilities and network connectivity with the Central Tech Support Facility (Ft Hood), Depth and Simultaneous Attack Battle Lab (D&SABL), Ft. Sill, and at the Integration & Evaluation Center (IEC) at Fort Belvoir.
  - Initiate cooperative software development and integration efforts with the USAF, USN and USMC required to support synchronized Joint/Combined deep operations and precision strike. Purchase necessary HW/SW to replicate a "joint lab" environment from which integration efforts will be conducted.
- 186 - Small Business Innovative Research/Small Business Technology Transfer Programs.

Total 7521

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D177

FY 1999 Planned Program:

•	9520	- Conduct technical reviews and demonstrations to assess the contribution of emerging technologies to Theater Precision Strike Operations. - Demonstrate for Republic of Korea Army leadership the utility of networking AN/TPQ-37 radars to provide an indication of enemy intent and volumes of fire. - Participate in USFK warfighting exercises documenting warfighting functional requirements and integrating emerging technologies/capabilities. -Continue to expand on and improve the rapid prototyping capabilities at the Central Tech Support Facility (Ft Hood), D&SABL and the IEC at Fort Belvoir. -Continue cooperative development and integration efforts with the USAF, USN and USMC required to support synchronized Joint/Combined deep operations and precision strike. - Provide USFK with enhanced Command, Control, Communications, Computers, Intelligence (C4I) technical capabilities for conduct of synchronized Joint/Combined deep operations and precision strikes. -Continue to build and expand the threat database at the IEC and to integrate joint systems into the simulation environment required to support TPSO evaluations. Begin development and testing to start the transition to High Level Architecture (HLA) environment to stimulate Man in the Loop (MITL) for FY00 demonstration. -Continue to refire the IEC analytical capability to measure performance and effectiveness so that objective conclusions can be made regarding the military utility of the demonstrated technologies and concepts. - Develop demonstration plan for FY00 unreinforced scenario exercise. Assess the communications infrastructure necessary to conduct the demonstration.
Total	9520	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	13997	6066	1473
Appropriated Value	13997	8066	
Adjustments to Appropriated Value	-717	-545	
FY 1999 President's Budget	13280	7521	9520

Change Summary Explanation:. Funding: FY98 (+2000) Congressional Plus up for TPSO ACTD
FY99 (+3000) Funds realigned from 0603238.D546 (STARLOS) and (+5000) from other sources to support TPSO ACTD, (+47) Inflation Adjustment

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238A Air Defense/Precision Strike Technology

PROJECT: D546

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D546 Synthetic Aperture Radar Target Recognition and Location System	6011	5252	453	0	0	0	0	0	11859

A. **Mission Description and Justification:** This project demonstrates the feasibility of locating and identifying high value targets from an Army designated aerial platform. The focus of the program is on Aided Target Recognition (AiTR) of short range ballistic missiles, surface-to-air missile launchers, rocket launchers and other designated military targets of interest. The targets are located and identified by means of a high resolution synthetic aperture radar (SAR) with a real-time AiTR system. In FY 97, the STARLOS AiTR effort for the Joint Precision Strike Demonstration (JPSD) Precision/Rapid counter Multiple Rocker Launcher (MRL) ACTD was completed. This AiTR capability was successfully integrated in a ground control station and was successfully demonstrated against the North Korean 240 MRL threat. The STARLOS program is now actively involved in the adaptation of the STARLOS technology with the next generation SAR sensor being procured for the Tactical Unmanned Aerial Vehicle (TUAV) program. The program direction is to utilize STARLOS technology to provide AiTR aids and processing capabilities that will enhance the Human Machine Interface and will alleviate the analytic requirements of the TUAV operator. This program is managed by Program Executive Officer-Intelligence, Electronic Warfare & Sensors, PM Tactical Endurance Synthetic Aperture Radar, with matrix support from Army Research Laboratory, Adelphi, MD and Night Vision and Electronic Sensors Directorate, CECOM RDEC, Fort Monmouth, NJ.

FY 1997 Accomplishments:

•	4687	- Completed development of AiTR algorithms for the Predator GCS for the JPSD P/RC-MRL ACTD Interim Leave Behind. - Conducted an AiTR Interim Leave Behind demonstration for P/RC-MRL ACTD and other demonstrations and experiments with the multi-sensor testbed (MSTB). - Awarded contracts, in support of the Korean mission with the Predator UAV, to selected DARPA research and development technology contractors that included interactive AiTR, image registration, object level change detection and terrain delimitation.
•	1324	- Conducted data collection on the Korean target (240mm MRL) using the MSTB and implemented effort to construct an additional surrogate Korean target of interest. - Demonstrated real-time AiTR capability using COTS hardware and demonstrated limited cross cueing of SAR, SAR enhancements and Moving Target Indicator in the MSTB.
Total	6011	

FY 1998 Planned Program:

•	2519	- Continue adaptation and integration of the AiTR capabilities into the MSTB system for experiments/demonstrations with the TSM UAV and Battle Labs.
•	1275	- Upgrade MSTB and perform data collections on the TUAV scenario target set.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D546

FY 1998 Planned Program: (continued)

•	950	- Conduct experiments/demonstrations with TSM UAV and Battle Labs on the incorporation of the AiTR capability into the TUAV system.
•	381	- Implement trade off studies to determine the optimum approach on how to integrate AiTR technology with upcoming TUAV subsystems, i.e. the Multi-Mission Common Modular Sensor ATD SAR, the Tactical Control Station and the Data Link Programs.
•	127	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	5252	

FY 1999 Planned Program:

•	303	- Continue experiments/demonstrations with TSM UAV and Battle Labs on the incorporation of the AiTR capability into the TUAV system.
•	150	- Complete AiTR trade off studies and provide AiTR recommendations for the Multi-Mission Common Modular ATD and the TUAV programs.
Total	453	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	8012	5598	3453
Appropriated Value	8012	5598	
Adjustments to Appropriated Value	-2001	-346	
FY 1999 President's Budget	6011	5252	453

Change Summary Explanation: Funding: FY97 (-1793) Funds reprogrammed mainly to JPSD, (-208) Congressional rescissions.
FY99 (-3000) Funds realigned to project 0603238.177 (JT ALS Demo) to support TPSO ACTD.
Technical: Focus of AiTR development has shifted from an AF Predator platform application to an Army Tactical UAV application.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270A Electronic Warfare (EW) Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	6480	7929	11508	16744	18118	16042	17915	Continuing	Continuing
DK15 Advanced Communications Electronics Countermeasures Demonstration	2776	2794	2832	7102	7555	8391	9481	Continuing	Continuing
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	3704	5135	8676	9642	10563	7651	8434	Continuing	Continuing

Mission Description and Budget Item Justification: This program element funds two projects that provide technology options for current and future electronic warfare (EW) systems. The Advanced Communications Electronics Countermeasures Demonstration (DK15) provides technology demonstrations in communications countermeasures (CM), information collection and reporting for transition to Army intelligence, and electronic warfare (IEW) systems through the block improvement process. The effective use of specific components, software and hardware for multiple applications will enable the Army to collect intelligence from modern modulation threat electronic systems in order to disrupt their operation, denying the enemy use of their command, control and communication (C3) assets. This project also supports demonstrations of automatic fusion of intelligence data from multiple sources. Non-Communications Electronic Countermeasures Technology Demonstration (DK16) demonstrates the feasibility and effectiveness of non-communications electronic warfare countermeasures and electronic support/electronic intelligence (ES/ELINT) for self protection from radar, electro-optical, and infrared guided anti-aircraft artillery, surface-to-air missiles, artillery, and top attack weapons, and provides precise targeting information on non-communications emitters. Area protection technology from radar threats is also developed. Work in these projects will lead to technology applications which will significantly contribute to winning the battlefield information war by controlling the electromagnetic spectrum. Work in this program element (PE) supports the multispectral countermeasures advanced technology demonstration, and provides component technology for the hit avoidance technology demonstration. Work in this program element adheres to tri-service Reliance agreements on electronic warfare. Work in this program element is related to and fully coordinated with efforts in PE 0602270A (Electronic Warfare Technology), and various Navy and Air Force program elements in accordance with the on-going Reliance joint planning process. Navy developments are conducted in PEs 0604755N (Ship Self Defense), 0204575N (Electronic Warfare Support), and 0604573N (Shipboard Electronic Warfare Improvements). Air Force developments are conducted in PEs 0604738F (Protective Systems), 0604793F (Tactical Protective Systems) and 0604710F (Reconnaissance Electronics Warfare Systems). Coordination is effected between the Services and Defense Advanced Research Projects Agency (DARPA) to eliminate duplication of effort and ensure the interchange of technical data. This program is managed primarily by Communications-Electronics Command Research, Development and Engineering Center (CERDEC), Ft. Monmouth, NJ. It is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270A Electronic Warfare (EW) Technology

PROJECT: DK15

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK15 Advanced Communications Electronics Countermeasures Demonstration	2776	2794	2832	7102	7555	8391	9481	Continuing	Continuing

A. Mission Description and Justification: This project demonstrates communication countermeasures technology for the Army's use to exploit, corrupt or destroy an adversary's information system while preserving the integrity of one's own systems during critical periods of tactical transmission. It emphasizes specific components, hardware and software necessary to perform technology demonstrations which will lead to providing flexible systems with the capability of disrupting modern modulation signals which support high mobility forces. This project also demonstrates the technology products that enable, enhance and protect the commander's decision and execution cycle while influencing an opponent's. The fusing of multiple intelligence data inputs with one output will allow the commander to quickly assess the battlefield situation.

FY 1997 Accomplishments:

- 1526 - Conducted successful demonstration at Task Force XXI Advanced Warfighting Experiments (AWE) 104th Military Intelligence Brigade.
  -Integrated wide band receiver and developments from joint receiver programs for demonstration of receivers used in the exploitation of modern communications signals.
  -Completed IEW asset management, terrain management and overlay reasoning demonstration and provided technology options for all source analysis system (ASAS).
  -Demonstrated techniques to exploit several complex communications formats.
- 1250 - Continued demonstration of the tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms. Focus was on the ASAS/Warlord and intelligence and electronic warfare common sensor (IEWCS) interface supporting the Task Force XXI AWE.
  -Conducted field evaluation of signal intelligence (SIGINT)/moving target indicator (MTI) templating, tacking, cross-cueing and situation display techniques.
  - Successfully field tested battle damage assessment prototype with 18th Airborne Corps
  -Continued consolidation and testing of IEW airborne asset management tools prior to demonstration with (IEWCS).
  -Successfully tested wide bandwidth SIGINT electronic support system on a short-range unmanned aerial vehicle (SR-UAV) demonstrating the capability to intercept beyond range and low level signals.

Total 2776

FY 1998 Planned Program:

- 1313 -Perform field evaluation/demonstration of jamming techniques against modern communication signals.
  -Integrate and validate hardware/software solutions to the Tactical Internet addressing exploitable vulnerabilities.
- 846 -Demonstrate operational effectiveness of a wide bandwidth SIGINT electronic support package on a SR-UAV platform operating in conjunction with a ground base IEWCS.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology
	PROJECT DK15

FY 1998 Planned Program: (continued)

•	565	-Complete prototype using smart agents to support effective tasking and reporting of multi-intelligence sensor data integrated into ASAS Block II and IEWCS. -Develop initial prototype of terrain reasoning and SIGINT templating capability. -Continue to upgrade airborne asset management prototype. -Transition full Military Intelligence (MI) sensor asset management tools and techniques into ASAS and IEWCS.
•	70	-Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	2794	

FY 1999 Planned Program:

•	2080	-Conduct demonstration against modern communication signals using the field programmable gate array analysis/control system. -Perform laboratory and field evaluation of capabilities against more complex modern communication signals. -Integrate and demonstrate command and control (C2) operational protect capabilities for deployed information systems. -Evaluate SIGINT payloads for UAVs. -Transition Electronic /Electronic Attack techniques to IEWCS.
•	752	-Complete airborne asset management prototype. Transition product to IEWCS and ASAS. -Complete advanced terrain reasoning prototype. Upgrade IEWCS and ASAS with this capability. -Complete SIGINT templating prototype. Upgrade IEWCS and ASAS with this capability. -Perform laboratory evaluation of technology to enhance Intelligence, Surveillance, and Reconnaissance at the Brigade level.
Total	2832	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	2852	2883	3121
Appropriated Value	2852	2883	
Adjustments to Appropriated Value	-76	-89	
FY 1999 President's Budget	2776	2794	2832

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270A Electronic Warfare (EW) Technology

PROJECT: DK16

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	3704	5135	8676	9642	10563	7651	8434	Continuing	Continuing

A. **Mission Description and Justification:** This program demonstrates the feasibility and effectiveness of non-communication electronic warfare hardware and software CM technology for self protection against radar, optical, electro-optical and infrared (IR) threats. The multispectral countermeasures advanced technology demonstration (MSCM ATD) provides technology options for product improvements to the suite of integrated infrared countermeasures/common missile warning system (SIIRCM/CMWS), which provides the primary protection to Army helicopters against infrared seeker missiles. Specifically, advancements in laser technology will provide a multi line laser for improved self protection, advancements in fiber optic technology for improved transmission to the SIIRCM jamhead, and the evaluation of infrared CM techniques versus IR imaging missiles.

FY 1997 Accomplishments:

•	3704	- Developed interfaces between laser modules and multispectral countermeasures test bed hardware in support of the MSCM ATD. - Evaluated candidate fiber optic cables and jamming waveforms to increase jam to signal ratios - Evaluated Air Force Lincoln Labs diode pumped, long pulse laser technology and defense advanced projects agency (DARPA) solid state multiline, short pulse lasers, to quantify jamming effectiveness by the two alternative technologies. - Continuing Tri-service jamming effects testing.
Total	3704	

FY 1998 Planned Program:

•	3277	-Complete integration of laser modules with multispectral countermeasures test bed, and begin integration of mid infrared fiber optic cable in support of the MSCM ATD.
•	1735	-Collect missile signature data to support improved detection algorithm developments; Develop warning and countermeasures against far IR laser beam rider threats.
•	123	-Small Business Innovation Research/Small Business Technology Transfer Programs
Total	5135	

FY 1999 Planned Program:

•	7000	– Complete test bed for MSCM ATD. – Conduct system integration lab tests and live fire cable car tests against advanced pseudo imaging and imaging surface to air missiles.
•		– Demonstrate detection and countermeasures against guided missiles that can engage both rotary wing aircraft and ground vehicles.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology
PROJECT DK16	

FY 1999 Planned Program: (continued)

•		– Transition alternative laser technologies, jamming waveforms, fiber optic cable and missile detection algorithms as technology options for SIIRCM product improvement.
•	1043	-Continue development of laser beam rider detection and jamming demonstrator using SIIRCM as core demonstration system; Integrate digital and hardware-in-the-loop models into the Communications Electronics Command (CECOM) system integration laboratory (SIL).
•	633	- Integrate digital and hardware in the loop jamming effectively models of IR surface to air missiles (SAMs), anti tank guided missiles (ATGMs), and radio frequency (RF) SAM systems into the CECOM SIL.
Total	8676	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	3799	5299	8633
Appropriated Value	3799	5299	
Adjustments to Appropriated Value	-95	-164	
FY 1999 President's Budget	3704	5135	8676

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	97239	90468	86096	52466	30567	23563	30045	Continuing	Continuing
D206 Missile Simulation	1	2920	2451	3715	3719	3757	4088	Continuing	Continuing
D263 Future Missile Technology Integration (FMTI)	9323	3918	1507	6572	4573	9651	20750	Continuing	Continuing
D380 Multi-Platform Launcher	12883	12047	8423	8390	7519	7139	0	0	59983
D387 Multi-Purpose Individual Munition	609	0	0	0	0	0	0	0	5516
D486 Rapid Force Projection Simulation	7453	8075	5136	0	0	0	0	0	26291
D493 Rapid Force Projection Demonstration	28190	28347	27909	13660	7350	0	0	0	111993
D496 Enhanced Fiber Optic Guided Missile (EFOG-M)*	35279	30464	35780	15111	3852	0	0	0	176062
D549 2.75 Inch Anti-Air Technology Demonstration (TD)	0	2815	2684	0	0	0	0	0	5499
D550 Counter Active Protection System	1	1882	2206	0	0	0	0	0	4089
D567 Low Cost Precision Kill (LCPK) for 2.75 Inch Rockets	0	0	0	5018	3554	0	0	0	8572
D655 Hypervelocity Technology Demonstration (TD)	0	0	0	0	0	3016	5207	0	8223
D703 Hydra-70 Rocket Product Improvement Program (PIP)	3500	0	0	0	0	0	0	0	3500

*FY 1997 R-1 exhibit contains an administrative error. Funding shown here is correct.

Mission Description and Budget Item Justification: This program element demonstrates application of mature advanced missile technologies to enhance U. S. Army force structure capabilities and existing assets. Major objectives for investigation are system deployability, lethality, survivability, flexibility and affordability. Work in this program element addresses the full spectrum of missile tactical missile roles and missions and is focused on upgrades to current missile systems. Efforts are conducted through system simulation/virtual prototyping, system design, hardware development and test, and demonstration in laboratory and operational scenarios. This program

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology

element provides for the demonstration of advanced tactical missile enhancements and includes real-time hardware-in-the-loop simulation technology, multi-role fire-and-forget seeker technologies capable of locating targets in clutter, lightweight launcher improvements and enhanced rocket accuracy, advanced technologies for missile guidance, missile warheads, and hypervelocity missile technologies. This program element also provides full integration of battlefield technologies including hunters (forward sensors) and killers (weapons) integrated through advanced command and control. These components demonstrate a system of systems approach under the umbrella of the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) which addresses enhanced survivability and lethality for light, early-entry U.S. forces in a contingency role. The RFPI ACTD is supported by the Dismounted Battlespace Battle Lab (DBBL) with participation from the 18th Airborne Corps. This program element also includes demonstration of the Enhanced Fiber Optic Guided Missile (EFOG-M). In the RFPI ACTD, EFOG-M fire units and missiles (with a limited manrating) will participate in the RFPI ACTD field experiment and extended user evaluation. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, Project Reliance, and supports multiple Defense Technology Objectives. This program element supports the U.S. Army Training and Doctrine Command (TRADOC) Battle Labs. Work in this program element is related to and fully coordinated with efforts in PE 0601104A (University and Industry Research Centers), PE 0602303A (Missile Technology), PE 0603238A (Air Defense/Precision Strike Technology), and PE 0603363F in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. These projects include proof of principle field demonstrations and tests of technologies to meet specific military needs and are therefore properly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D206

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D206 Missile Simulation	1	2920	2451	3715	3719	3757	4088	Continuing	Continuing

A. Mission Description and Justification: This project supports three separate but related tasks: (a) development, expansion, and improvement of hardware-in-the-loop (HWIL) simulation capabilities applicable to the evaluation of tactical missiles guided by signals in radio frequency (RF), millimeter wave (MMW), electro-optical (EO), and infrared (IR) electromagnetic spectral regions. Evaluation by means of HWIL provides cost effective support to missile development throughout weapon system life cycles and permits a reduction in the number of flight tests actually performed. HWIL simulation employs actual missile guidance and control hardware operating in real-time in a non-destructive laboratory environment; (b) Distributed Interactive Simulation (DIS) via a node to the Defense Advanced Research Projects Agency (DARPA) Defense Simulation Internet; and (c) battlefield distributed simulation, which provides an all-analytical simulation of a weapon system engaging multiple targets in a simulated battlefield environment, including the effects of natural and battle-caused obscurants and disturbances. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. Major contractors are Boeing Defense and Space Group, Seattle, WA; and Nichols Research Corporation, Huntsville, AL.

FY 1997 Accomplishments:

•	1	- Planned FY98 program.
Total	1	

FY 1998 Planned Program:

• 1910 - Complete development of computer-controlled precision signal measurement instrumentation for microwave and MMW radar HWIL simulation capabilities (LONGBOW, PAC-3).
- Initiate development of technology which supports HWIL simulation of dual-spectrum (infrared and millimeter wave radar) guided and sensor-fuzed tactical missiles and submunitions (BAT Pre-Planned Product Improvement (P3I) and Sense and Destroy Armor (SADARM) P3I).
- Extend infrared target and background scene projector technology by increasing pixel dimensions and frame rates and by improving non-uniformity correction algorithms (Theater High Altitude Air Defense (THAAD), EFOG-M, Follow-On to Tube Launched Optically-Tracked Wire-Guided (TOW) (FOTT), BAT-P3I).
- Investigate infrared scene projector "leap ahead" technology in an effort to overcome limitations of present scene projector technologies.
- Continue development of hardware/software based on commercial off-the-shelf products for real-time target scene generation for driving electro-optical scene projectors (THAAD, EFOG-M, FOTT, BAT-P3I).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D206

FY 1998 Planned Program (Continued):

	955	- Continue the modernization and reconfiguration of the Electro-Optical Simulation System to support HWIL simulation of EFOG-M, FMTI, and FOTT missile systems. - Upgrade AMCOM Distributed Interactive Simulation (DIS) Center real-time data processing and display support essential virtual prototype simulator development and exercise operations. Support conversion to high level architecture (HLA) compliance. - Upgrade battlefield test bed capabilities to support DIS exercises integrating live, virtual, and constructive forces into a seamless environment. Support conversion to HLA compliance.
	55	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	2920	

FY 1999 Planned Program:

•	1601	- Continue the development of a HWIL simulation capability for dual-spectrum (passive IR and MMW radar) guided and sensor-fuzed tactical missiles and sub-munitions to support development of BAT P3I, SADARM PI, their successors, and other dual mode guided weapons. - Upgrade infrared scene projection capability by improving the laser diode projector performance and fabricating electronics for a resistive element chip of at least 512x512 pixel dimensions. Upgrade realtime target scene generator performance (frame rate and resolution) by adapting commercial off-the-shelf hardware and improved software to provide acquisition support to EFOG-M, FOTT, THAAD, and other infrared guided weapons. - Continue development of "leap ahead" infrared scene projector technology to overcome disadvantages of present laser diode and resistive element projector systems. This technology will support all development and T&E for all infrared guided missiles and submunitions.
•	850	- Provide upgraded virtual prototype and real-time computer generated forces capability for the DIS Center, including improved accuracy and lower cost to meet R&D needs. Support conversion to HLA compliance. - Implement upgraded battlefield distributed simulation test bed capability to provide improved control, integration, operation, data collection and analysis. - Upgrade battlefield distributed simulation environmental models to support engineering evaluation of enhanced weapon system seekers/sensors. Support conversion to HLA compliance.
Total	2451	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1	3013	3434
Appropriated Value	1	3013	
Adjustments to Appropriated Value		-93	
FY 1999 President's Budget	1	2920	2451

Change Summary Explanation: Funding: FY1999 – Funds reprogrammed (-983) to other high priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D263

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D263 Future Missile Technology Integration (FMTI)	9323	3918	1507	6572	4573	9651	20750	Continuing	Continuing

A. **Mission Description Justification:** This project provides for the demonstration of advanced tactical missile technologies including seekers, propulsion, airframes, warheads, and guidance and control. The project will demonstrate lightweight multi-role missile technology in support of ground-to-ground, ground-to-air, air-to-air and air-to-ground missions. Combined flexible capability allows one system or variants of one system to replace many, realizing potential extensive savings in development costs, logistics, training, etc. Particular attention will be given to the development of infrared (IR) seeker technology capable of long range lock-on and defeat of helicopters buried in cluttered backgrounds, variable thrust propulsion allowing system range extension and thus standoff and high survivability, and the innovative use of radio frequency (RF) data links for identification friend or foe, and the attack of targets masked from the launch platform. The missile system demonstration includes the integration of guidance, control, propulsion, airframe and warhead technologies capable of performing in high clutter/obscurants, adverse weather environments and under countermeasure conditions. Missile control and guidance system technology will explore capabilities such as lock-on before/lock-on after launch, fire and forget, command guidance, imaging infrared signal and image processing, and wide band secure data links. Affordable dual mode seeker technology will be demonstrated to satisfy user requirements for Modernized HELLFIRE. Demonstrated missile system performance (i.e., weight, range, kill ratio, speed, lethality) will be optimized to exceed current baseline parameters of ground-to-ground tube launched optically-tracked wire-guided (TOW), ground-to-air Stinger, air-to-air Stinger, and Air-to-Ground Missile System (AGMS) in a size compatible with the TOW launcher. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. Major contractors are Raytheon Company, Electronic Systems, Tewksbury, MA; TRW Space Electronics Group, Redondo Beach, CA; Loral Communications Systems, Salt Lake City, UT.

FY 1997 Accomplishments:

•	9323	- Demonstrated imaging IR seeker extended range detection performance in captive flight tests. - Demonstrated performance of high bandwidth RF data link brassboard in tower testing. - Completed fabrication and integration testing of system components to support missile flight tests including Gunner's Console/Computer, Launch Control Unit, Land Navigation Unit, Automatic Target Recognition (ATR) processor, Bradley launch vehicle, and "Shop Queen" missile.
Total	9323	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D263

FY 1998 Planned Program:

•	3855	- Complete technology demonstration flight tests. - Transition final demonstration documentation to technology transition database. - Complete final report. - Call for Request for Information (RFI) submittals from industry concerning system/technology concepts applicable to Modernized HELLFIRE.
	63	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	3918	

FY 1999 Planned Program:

•	1507	- Conduct Best Technical Approach (BTA) to investigate various system concepts and technologies that will fulfill the Modernized HELLFIRE requirements with factors for evaluation to include technical, cost, logistics and operations. - Evaluate Request for Information (RFI) submittals from industry to support BTA efforts. - Develop acquisition strategy for technology risk reduction program.
Total	1507	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9541	1043	19
Appropriated Value	9541	4043	
Adjustments to Appropriated Value	-218	-125	
FY 1999 President's Budget	9323	3918	1507

Change Summary Explanation: Funding: FY1998 – Congressional add (+3000) for use of composite materials and structures in future missiles; undistributed Congressional reductions (-125).
Funding – FY1999 Program restructured (+1488) to demonstrate dual mode seeker for Modernized HELLFIRE.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D380

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D380 Multi-Platform Launcher	12883	12047	8423	8390	7519	7139	0	0	59983

A. Mission Description and Justification: The Multi-Platform Launcher (MPL) program explores and implements technologies to improve the deployability and lethality of the Multiple Launch Rocket System (MLRS) for counter battery, counter armor, and critical target missions. The first phase of the MPL program designs, develops, and flight tests a low cost guidance and control system for the MLRS free-flight rocket, thereby substantially improving its delivery accuracy, reducing the number of rockets required to defeat the target, and expanding the set of MLRS targets to include precision targets. The guidance system will make use of inertial and Global Positioning System (GPS) low cost component technologies. A more accurate rocket results in both a more lethal force and a reduced logistics burden, which is especially important for early entry. The second phase of the program supports the design and testing of the High Mobility Artillery Rocket System (HIMARS), a C-130 transportable MLRS launcher, in the RFPI ACTD. The third phase of this program will demonstrate the technical feasibility of two submunition candidates for submunition dispense from the MLRS Guided Rocket to achieve a precision strike capability for artillery rockets. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. The major contractor is Lockheed Martin Vought Systems, Dallas, TX.

FY 1997 Accomplishments:

- 5105
  - Performed software integration and testing.
  - Performed system integration and hardware-in-the-loop testing.
  - Performed navigation/autopilot/guidance analysis.
  - Developed and tested telemetry system.
  - Developed and tested roll-control bearing.
  - Developed and tested missile electronic unit.
- 1730
  - Developed and tested GPS components (receiver and antenna).
  - Developed GPS guidance algorithms, receiver, and antenna.
- 2926
  - Conducted risk reduction pre-Engineering and Manufacturing Development (EMD) design on safe and arm, electronics miniaturization, warhead packaging, and launcher operations.
- 3122
  - Initiated safety qualification and man rating evaluations of HIMARS.
  - Integrated HIMARS into RFPI simulation evaluations.

Total 12883

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D380

FY 1998 Planned Program:

•	5131	- Build one prototype and five flight missiles.
		- Conduct qualification test and flight acceptance test on 6 missiles.
		- Perform three Guided MLRS flight tests with inertial measurement unit (IMU) guidance at White Sands Missile Range (WSMR), NM.
		- Perform two Guided MLRS flight tests with GPS aided IMU guidance at WSMR, NM.
		- Transfer Guided MLRS technology to EMD.
•	6614	- Complete HIMARS design.
		- Fabricate HIMARS residual hardware.
		- Test HIMARS hardware prior to firings, including electromagnetic testing, road tests, and man rating.
		- Test firings of HIMARS at WSMR, including range costs.
•	302	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	12047	

FY 1999 Planned Program:

•	5923	- Provide maintenance, spares, replacements, and repairs for HIMARS residuals, to be evaluated by the user as a part of the Rapid Force Projection Initiative.
		- Provide Improved Position Determining System (IPDS) retrofit kits for residual hardware.
		- Provide government furnished equipment to contractor.
		- Provide support for interim HIMARS maintenance facility.
•	2500	- Conduct MSTAR requirements analysis.
•		- Initiate submunition side-by-side captive flight tests.
Total	8423	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	13232	12431	8780
Appropriated Value	13232	12431	
Adjustments to Appropriated Value	-349	-384	
FY 1999 President's Budget	12883	12047	8423

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D387

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D387 Multi-Purpose Individual Munition	609	0	0	0	0	0	0	0	5516

A. Mission Description and Justification: This project provides for demonstration of a lightweight, shoulder fired, multiple purpose weapon. It provides the Army with one weapon capable of defeating enemy forces in buildings, bunkers, and lightly armored vehicles. The Multiple Purpose Individual Munition/Short Range Anti-tank Weapon (MPIM/SRAW) is capable of being fired from its carrying configuration and can be safely fired from an enclosure for the close battle. The MPIM/SRAW demonstration integrates warhead technology developed by the Army with the United States Marine Corps (USMC) propulsion system developed for SRAW. It will replace the AT4 system, which was only designed to defeat light armor. The system developed will have significantly improved lethality over the AT4, as well as being multiple target capable, which is particularly important in contingency operations. In FY 97 producibility efforts were initiated to reduce the cost of guidance hardware to reduce unit costs of the system. The technology transitioned to the MPIM development program in PE 0604802A, Weapons and Munitions Engineering Development, at the end of FY 97. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. The major contractor is Loral Aeroneutronic, Rancho Santa Margarita, CA.

FY 1997 Accomplishments:

•	609	- Issued Request For Proposal (RFP) for low-cost guidance. - Conducted a study to identify high cost items to address producibility. - Transitioned to Engineering and Manufacturing Development.
Total	609	

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	625	0	0
Appropriated Value	625		
Adjustments to Appropriated Value	-16		
FY 1999 President's Budget	609	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D486

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D486 Rapid Force Projection Simulation	7453	8075	5136	0	0	0	0	0	26291

A. Mission Description and Justification: The Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) Simulation Support Plan and the RFPI Study Plan provide a detailed description of the simulation and analysis efforts underway to support the RFPI program. Scenario development, force-on-force modeling, and simulation are currently supported by detailed engineering models, preliminary system performance estimates/data, and other system models and simulations provided by the RFPI program and the individual Advanced Technology Demonstrations/ Technology Demonstrations (ATDs/TDs). All simulations and analyses will be performed under the guidance and supervision of the Integrated Battlefield Simulation and Analysis Team (IBSAT). Simulations and analyses will support the determination of value-added proposed technologies for the RFPI ACTD and will be utilized to determine the mix and number of developmental sensors to be used in the Advanced Warfighting Experiment (AWE) and subsequently to determine residual quantities and support requirements. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. Major contractors are Computer Science Corporation, Huntsville, AL, and Nichols Research Corporation, Huntsville, AL.

FY 1997 Accomplishments:

•	7453	- Documented results of the BEWSS, CASTFOREM, and JANUS simulation runs.
		- Performed BEWSS record runs Command and Control (C2) simulations.
		- Executed ACTD and prepare for Battle Lab Warfighting Experiment (BLWE) virtual exercise.
		- Performed final predictions for ACTD Model-Test-Model.
Total	7453	

FY 1998 Planned Program:

•	1238	- Modify draft Ft. Benning scenarios for virtual rehearsal experiment to accommodate field elements.
		- Refine Ft. Benning terrain database.
		- Perform post-rehearsal model-experiment-model runs and analysis.
•	1802	- Perform final modifications to manned simulations.
		- Use manned simulators and semi-automated forces to provide rehearsal of ACTD experiment.
•	1689	- Perform final real/virtual hardware integration.
•	2816	- Integrate, prepare and execute ACTD experiment.
•	328	- Perform CASTFOREM tradeoff runs.
•	202	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	8075	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D486

FY 1999 Planned Program:

•	1000	- Provide virtual simulation resources to support real/virtual experiments during the residual period.
•	1600	- Apply RFPI technologies to excursion scenarios to include urban, varying terrain, weather, and countermeasures.
		- Perform post ACTD model-experiment-model runs and analysis.
		- Perform excursion runs and analysis.
•	1800	- Provide support for manned simulator residual.
•	736	- Perform final cost and operational effectiveness analysis (COEA).
Total	5136	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	7656	8390	5111
Appropriated Value	7656	8390	
Adjustments to Appropriated Value	-203	-315	
FY 1999 President's Budget	7453	8075	5136

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D493

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D493 Rapid Force Projection Demonstration	28190	28347	27909	13660	7350	0	0	0	111993

A. **Mission Description and Justification:** The integrated system of systems concept of this Advanced Concept Technology Demonstration (ACTD) provides lightweight, responsive precision fires to destroy threat armor forces during day, night, and adverse weather. The ACTD evaluates the value added by the insertion of these new technologies into the force structure of an existing light unit in a lift constrained environment. The inserted systems consist of forward sensors (hunters), advanced C2, and a suite of standoff killers. The mix of forward sensors used to complement and enhance existing unit assets includes both manned and unmanned air and ground systems. The sensor architecture is based on the unit equipment, as documented in the U.S. Army Intelligence Master Plan and the U.S. Army Modernization Plan, and is augmented with other sensors and processors, as required, to ensure forward sensors are properly cued. Tactical sensors (organic and advanced) receive cueing information from these sensors to rapidly focus them on targets. The mix of standoff killers complements and extends the capabilities of current systems. The EFOG-M, a Brigade asset, is a lightweight, man-in-loop non-line of sight guided missile which is lethal to a variety of high priority targets, including heavy armor. Howitzers are organic to the Division and Corps artillery and operate in direct and general support of the Maneuver Brigade. The lightweight and Highly Mobile Artillery Rocket and Missile System (HIMARS) rocket firing platform, which uses a wheeled chassis, will be a Corps asset which is attached to the Maneuver Brigade. The deployability of the 2nd Brigade of the 101st Airborne Division (Air Assault) will not be affected throughout the evaluation of the systems. The ACTD includes both simulation and field demonstration phases, and encourages user exploration of excursions from the baseline Tactics, Techniques, and Procedures (TTPs) to optimize utility of the standoff killers, forward sensors, and advanced C2 for the light forces. The RFPI ACTD field experiment completes in 4QFY98 followed by an extended user evaluation of residual quantities. Integrated demonstration work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. Major contractors are Nichols Research Corporation, Huntsville, AL; and Computer Sciences Corporation, Huntsville, AL.

FY 1997 Accomplishments:

- 6700 - Continued HIMARS design.
  - Initiated developmental testing of HIMARS.
  - Continued fabrication of HIMARS prototypes/surrogates.
- 5480 - Developed RFPI Demonstration & Evaluation Master Plan
  - Developed RFPI ACTD test & evaluation strategy
  - Developed system-of-systems network architecture
- 10710 - Prepared integration facility
  - Developed prototype Wide Area Network (WAN) controller using RFPI Integration Package (RIP) and Very High Speed Integrated Circuit (VHSIC) Enhanced Position Location Reporting System (VEPLRS)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D493

FY 1997 Accomplishments (Continued):

		- Restructured RFPI integration effort to conform to new requirement for C4I enhancements
	5300	- Developed system architecture and software
		- Designed and installed Tactical Operations Center (TOC) hardware.
		- Supported TOC during field experiments
Total	28190	

FY 1998 Planned Program:

•	8495	- Provide RFPI and Opposition Forces (OPFOR) instrumentation and support, including targets.
		- Provide communications support for experiment, including equipment spares/TAC radios.
		- Provide additional sensors and sensor support equipment.
•	11173	- Develop hardware and software for special test instrumentation.
		- Conduct user training and perform installation and checkout of System-of-Systems experiment instrumentation.
		- Conduct large scale field experiment.
		- Prepare for residual support.
•	7968	- Provide logistics support for ACTD.
		- Provide support for training and troops.
		- Provide support for residual hardware.
		- Provide support for program evaluation and integration.
•	711	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	28347	

FY 1999 Planned Program:

•	7085	- Provide maintenance, replacement parts, and spares in direct support of user units.
		- Provide spare batteries, cables, and other replacement parts for communications equipment.
		- Provide RFPI integrated logistics support, personnel, analysis, and training.
•	14768	- Provide training on residual equipment for experiment units.
		- Provide residual support for EFOG-M.
		- Provide residual support for hunter/killer systems and integrated acoustic system.
•	6056	- Provide analysis and red team support including countermeasure/counter-countermeasure analysis and preparation for possible milestone review.
Total	27909	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D493

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	23737	29682	27772
Appropriated Value	23737	29682	
Adjustments to Appropriated Value	+4453	-1335	
FY 1999 President's Budget	28190	28347	27909

Change Summary Explanation: Funding – FY 1997: Funds added in RFPI ACTD to incorporate command, control, communications, computers and intelligence (C4I) enhancements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D496

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D496 Enhanced Fiber Optic Guided Missile (EFOG-M)*	35279	30464	35780	15111	3852	0	0	0	176062

*FY 1997 database contains an administrative error. Funding shown here is correct.

A. <u>Mission Description and Budget Item Justification</u>: **Project D496 - Enhanced Fiber Optic Guided Missile (EFOGM):** EFOGM is the primary "killer" within the Office of the Secretary Defense (OSD) approved Rapid Force Projection Initiative (RFPI) ACTD. The EFOGM system is a multi-purpose, precision kill weapon system. The primary mission of the EFOGM is to engage and defeat threat armored combat vehicles, other high value ground targets, and hovering or moving rotary wing aircraft that may be masked from line of sight direct fire weapon systems. EFOGM is a day/night, adverse weather capable system that allows the maneuver commander to extend the battle space beyond line of sight to ranges up to 15 kilometers, thus reducing the exposure of the gunner and allowing targets to be taken out of the battle early. The system consists of a gunner's station, a tactical missile, and a fiber optic data link plus command vehicles. The missile can navigate to the target area automatically, and the gunner can intervene at any time to lock on and engage any detected targets. This gunner in the loop capability enhances the target acquisition process and minimizes fratricide and collateral damage. The gunner views the flight path and target via a seeker on the missile linked to the gunner's video console. The missile incorporates an IR imaging seeker and a variety of advanced targeting functionalities. The RFPI ACTD field exercise will demonstrate airlift constrained, enhanced power projection capabilities through the development and evaluation of new technologies and tactics for early entry forces. This ACTD field exercise will demonstrate a semi-automated target transfer from forward sensors (hunters) to an EFOGM weapon system (killer) using C3 integration and provide gunners and platoon leaders situational awareness not previously available. It will fully explore the capability to expand the brigade level battlespace through the use of simulation, TRADOC Battle Lab warfighting experiments and demonstrations. The ACTD will demonstrate the ability to conduct essential targeting and intelligence collection using forward sensors and real-time communications to provide for precision engagements against a variety of high priority targets, including armored vehicles. The EFOGM weapon system will be tested and qualified for sling load (UH-60L and CH-47D) to support all XVIII Airborne Corps light forces and low velocity airdrop qualified to support the 82nd Airborne Division.

FY 1997 Accomplishments:

- 21524 - Delivered fire unit components, software, fire unit test stands, and 3 of the 44 developmental missiles (1 inert and 2 slug flight test missiles).
  - Conducted missile stability and frequency response testing, flight worthiness testing, and slug missile flight tests.
  - Procured subcontractor components and facilitize all-up missile manufacturing facility.
  - Initiated manufacturing of additional hardware consisting of 4 tactical fire units, 1 platoon leader vehicle, and 256 missiles to be delivered and fielded to the XVIII Airborne Corps in FY99.
- 6318 - Conducted seeker performance simulations and engineering analyses, platoon operations simulations, fiber research and manufacturing, software verification, producibility analysis, manufacturing flow analysis, and manufacturing facility requirements analysis to mitigate development risks.
- 2198 - Performed test planning and provide test facility and range resources for missile stability and frequency response testing, flight worthiness testing, and slug missile flight tests. Develop training and maintenance support plans.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D496

FY 1997 Accomplishments: (continued)

•	5239	- Programmatic and technical integrated product team support for engineering design, developmental test planning and conduct, cost and schedule control, affordability and producibility analyses, and risk management and mitigation efforts.
Total	35279	

FY 1998 Planned Program:

•	8076	- Deliver 8 fire units, 2 platoon leader vehicles, 2 upgraded stationary simulators, and the remaining 41 of 44 developmental missiles (3 inert and 2 slug flight test missiles, 22 developmental flight missiles, and 14 missile component sets) for developmental testing and ACTD demonstration. - Conduct environmental tests, simulated missile flight operations, and live developmental missile flight tests. - Participate in the RFPI ACTD field exercise and conduct 3 ACTD missile flights and fire unit operations. - Initiate upgrade of the residual ACTD assets (8 fire units and 2 platoon leader vehicles) after completion of the ACTD field exercise. - Continue to manufacture the additional hardware (4 tactical fire units, 1 platoon leader vehicle, and 64 missiles) and initiate environmental screening and acceptance testing of the hardware.
•	9784	- Perform test planning, test facility/range operations, test data reduction, and provide targets and target support for simulated missile flights, developmental missile flight tests, and ACTD missile flight and fire unit operations. - Develop and conduct soldier training courses using tactical fire units, stationary simulators, and missile mass simulators, deliver operator equipment manuals, and conduct planning for hardware delivery and deployment. - Provide spares and repair parts and maintain hardware and software during testing, soldier training, and conduct of the RFPI ACTD field exercise.
•	5230	- Support RFPI deployment testing and early entry lethality analyses. - Provide engineering analyses support of hardware manufacturing and acceptance test. Support hardware upgrade engineering analyses and design.
•	6634	- Programmatic and technical integrated product team support for engineering design, developmental test planning and conduct, cost and schedule control, affordability and producibility analyses, and risk management and mitigation efforts.
•	740	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	30464	

FY 1999 Planned Program:

•	20867	- Continue systems support for ACTD hardware for the XVIII Airborne Corps. - Initiate a twenty-four month extended user evaluation (EUE) to prove out tactics, techniques, and procedures and validate war fighting operations and firing doctrine.
•	8415	- Provide engineering support to ACTD fire unit upgrades and refurbishment, extended user evaluation test planning and training, and the extended user evaluation field exercises. - Conduct platoon operation demonstrations and battlefield simulations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D496

FY 1999 Planned Program (Continued):

•	6498	- Programmatic and technical integrated product team support for hardware manufacturing and delivery, extended user evaluation test planning and conduct, cost and schedule control, affordability and producibility analyses, and risk management and mitigation efforts.
Total	35780	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	36214	57734	36605
Appropriated Value	36214	31434	
Adjustments to Appropriated Value	-935	-970	
FY 1999 President's Budget	35279	30464	35780

Change Summary Explanation: Funding – FY 1998: Budget request of 57734 was reduced 26300 by Congress. 13300 of that reduction was returned to the EFOGM program in FY 1998 as procurement funding (SSN is H03100).

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D549

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D549 2.75 Inch Anti-Air Technology Demonstration (TD)	0	2815	2684	0	0	0	0	0	5499

A. Mission Description and Justification: The objective of this project is to demonstrate the technology for a comprehensive upgrade to the STINGER missile system through the incorporation of an advanced imaging infrared (IR) seeker to enable the engagement of hostile helicopters in clutter at extended ranges (2-3x). This project will demonstrate the ability to package the previously developed commercial breadboard signal processing electronics in a 2.75 inch diameter seeker. In addition, signal processing algorithms for target detection, tracking, and IR counter-countermeasures (IRCCM) will be developed and demonstrated via hardware in the loop simulations, ground tests, and captive carry tests. This seeker will maintain computability with existing STINGER launchers and retain STINGER's excellent capability against fixed wing aircraft. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

FY 1997 Accomplishments: Project not funded in FY 97.

FY 1998 Planned Program:

•	1630	- Complete form-factored seeker electronics.
		- Develop endgame and IRCCM signal processing algorithms.
•	1114	- Develop Hardware-In-the-Loop (HWIL) simulation.
		- Perform acquisition and tracking tests.
		- Perform IRCCM tracking tests.
	71	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	2815	

FY 1999 Planned Program:

•	1500	- Complete endgame and IRCCM signal processing algorithms.
		- Develop missile guidance algorithms.
•	1184	- Develop platform/launcher interfaces.
		- Perform HWIL missile flight simulations.
		- Perform captive carry air-to-air tests.
Total	2684	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D549

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	2905	2896
Appropriated Value		2905	
Adjustments to Appropriated Value		-90	
FY 1999 President's Budget	0	2815	2684

Change Summary Explanation: Funding – FY 1999: Funds reprogrammed (-212) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D550

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D550 Counter Active Protection System	1	1882	2206	0	0	0	0	0	4089

A. **Mission Description and Justification:** This project will develop and demonstrate technologies which can be applied to Anti Tank Guided Weapons (ATGW) for improving their effectiveness against threat armor equipped with active protection systems (APS). Current technology development is concentrated in the following areas: radio frequency (RF) countermeasure (RFCM) technology for jamming or deceiving APS sensors used for detection, acquisition, and tracking; warhead integration and ballistic hardening of ATGW to reduce vulnerability to fragment impact.

FY 1997 Accomplishments:

•	1	- Planned FY98 program.
Total	1	

FY 1998 Planned Program:

•	1834	- Complete CAPS dynamic field test apparatus (Rocketball). - Fabricate and test 2nd generation prototype jammer. - Design 2nd generation testbed APS and buy long lead items for fabrication of test bed radar. - Complete integration of Soft Kill into midterm APS models.
•	48	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	1882	

FY 1999 Planned Program:

•	2206	- Complete 2nd generation test bed APS radar. - Fabricate, integrate, and test 2nd generation jammer flight prototypes.
Total	2206	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D550

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1	1941	4408
Appropriated Value	1	1941	
Adjustments to Appropriated Value		-59	
FY 1999 President's Budget	1	1882	2206

Change Summary Explanation: Funding – FY1999: Funds reprogrammed (-2202) for higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D703

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D703 Hydra-70 Rocket Product Improvement Program (PIP)	3500	0	0	0	0	0	0	0	3500

A. **Mission Description and Justification:** This is a Congressionally mandated program. The objective of this project is to demonstrate and qualify a new rocket motor for the Hydra-70 free flight rocket weapon system. The following conditions on this qualification program were mandated by Congress:

1. The rocket motor shall utilize composite propellant.
2. The rocket motor shall be a non-developmental item (NDI).
3. A Technical Data Package (TDP) detailing the design of the rocket motor shall be delivered.
4. The rocket motor shall be a form-fit-function replacement for MK-66 motor that is currently in production.
5. The rocket motor shall be certified for air worthiness on the AH-64 Apache Helicopter.

To fully comply with the Congressional Direction, the program will be executed in three self-contained and distinct phases which are described as follows: Phase I consists primarily of source selection activities. Under this effort, a Request for Proposals (RFP) was issued which included a performance specification that was consistent with the program objectives and constraints. Utilizing this RFP, multiple contracts (4) were awarded to prospective rocket motor manufacturers. Under the Phase I effort each contractor was required to deliver 25 rocket motors each. The government conducts a limited qualification evaluation on each of the four motors designs, including environmental and static performance testing. The results of this limited test program are utilized to select a single vendor for the remainder of the qualification effort. Phase II is full ground qualification of the single down-selected rocket motor design. This effort includes a complete series of environmental, insensitive munitions, and static performance tests. Also included are a complete series of flight tests from a ground launcher that shall determine flight performance and launcher compatibility. Approximately 500 rocket motor firings will be conducted (150 static and 350 flights). Phase III is flight qualification on the AH-64 Apache. Approximately 2000 rocket motors will be launched off the Apache to demonstrate full compatibility with the launch platform. With the conclusion of Phase III, the rocket motor will be fully qualified for air worthiness on the AH-64.

FY 1997 Accomplishments:

•	375	Procured 200 non-developmental Item (NDI) rocket motors for qualification testing.
•	366	Acquired AH-64 helicopter test articles and associated test hardware.
•	2759	Conducted Phase II ground qualification testing.
Total	3500	

FY 1998 Planned Program: Project not funded in FY 98.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D703

FY 1999 Planned Program: Project not funded in FY 99.

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	8812	0	0
Appropriated Value	8812		
Adjustments to Appropriated Value	-5312		
FY 1999 President's Budget	3500	0	0

Change Summary Explanation: Funding: FY1997 – Funds reprogrammed with congressional approval (5312) for higher priority requirements.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603606A Landmine Warfare and Barrier Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	26899	31581	21944	36044	19559	20880	21582	Continuing	Continuing
D608 Countermine & Barrier Development	22134	21018	21944	36044	19559	20880	21582	Continuing	Continuing
D624 Ground Penetrating Radar Technology	4765	3779	0	0	0	0	0	0	8544
D674 Airborne Standoff Minefield Detection System	0	6784	0	0	0	0	0	0	6784

Mission Description and Budget Item Justification: This program element provides for the development and demonstration of countermine technologies. Advanced technology demonstrations (ATDs), advanced warfighting experiments, and modeling and simulation will be conducted to verify the system of systems approach, providing support for the shallow water/beach/land assault phase (Demo 1) of the Navy, Army, and USMC joint countermine advanced concept technology demonstration (ACTD). The specific efforts include remote detection of minefields, detection of individual mines from moving vehicles and advanced hand held detectors, all of which must work against both traditional (metallic) mines and mines made from advanced materials. Breaching techniques will be developed for both conventional and electronically activated mines that can act at a distance. Operation Desert Storm and the humanitarian operations in Somalia have highlighted the need for new equipment to detect and neutralize land mines. The Army's highest priority requirements are in-stride detection and breaching, and man-portable stand-off and close-in detection and neutralization of landmines. Multi-sensor fusion will be used in vehicle-mounted mine detectors and airborne multispectral/hyperspectral minefield detectors to sense surface-laid and buried mines. The Army has focused its resources and is expediting these programs in coordination with the US Marine Corps. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on conventional air/surface weapons and ground vehicles. Work in this program element is related to and fully coordinated with PE 0603691A (Landmine Warfare and Barrier Advanced Development), PE 0602784A (Military Engineering Technology), PE 0602712A (Countermine Technology), and PE 0602709A (Night Vision and Electro-Optics Technology). This program is managed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program is dedicated to conducting proof of principle field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603606A Landmine Warfare and Barrier Advanced Technology

PROJECT: D608

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D608 Countermine & Barrier Development	22134	21018	21944	36044	19559	20880	21582	Continuing	Continuing

A. **Mission Description and Justification:** This project provides advanced technology demonstrations of countermine capabilities. The specific efforts include remote detection of minefields, detection of individual mines from moving vehicles and advanced hand held detectors, all of which must work against both traditional (metallic) mines and mines made from advanced materials. Multi-sensor fusion will be used in the vehicle-mounted mine detector ATD and airborne multispectral/hyperspectral minefield detector to sense surface-laid and buried mines. A new generation of stand-off sensors and explosive/directed energy mine neutralization technologies will be integrated in a Mine Hunter/Killer ATD. The Mine Hunter/Killer will be capable of detecting and destroying mines at maneuver speeds. This project supports advanced warfighting experiments and modeling and simulation that are key elements of the shallow water/beach/land assault phase of the Navy, Army, and USMC joint countermine advanced concept technology demonstration (ACTD).

FY 1997 Accomplishments:

- 8525 – Conducted successful joint countermine ACTD demonstration I at Camp Lejeune, NC in conjunction with United States Atlantic Command (USACOM) forces.
  - Completed simulation, analysis, and pre-demonstration exercises of countermine command, control, communications, computers, and intelligence (C4I) architecture;
  - Conducted "movement to contact" countermine modeling and simulation studies and small scale countermine field experiments.
- 5905 – Completed development of forward looking infrared and down looking ground penetrating radar sensors for vehicular mounted mine detector.
  - Continued evaluation of alternative multisensor approaches for vehicular mounted mine detector.
- 7704 – Continued development efforts to improve maturity of vehicular mounted mine detector prototypes.
  - Integrated forward looking sensor to one prototype in order to provide three systems with comparable capabilities.
  - Implemented sensor fusion of forward looking and down looking sensors on all three prototypes.

Total 22134

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology PROJECT D608

FY 1998 Planned Program:

•	8064	– Analyze data from joint countermine ACTD demo I, apply lessons learned to demo II planning, and execute demo II.
		– Assess contribution of new countermine technology to survivability of convoy/rear area assets, in battle lab experiment.
		– Add fidelity to joint countermine ACTD novel system models and conduct sensitivity studies; complete modeling of false targets for detection systems and transition to joint countermine operational simulation. Continue validation and verification activities.
•	3000	– Complete development of three vehicular mounted mine detector prototypes with alternative multisensor fusion design approaches, conduct comparative performance testing, and select system(s) for final Vehicular Mounted Mine Detector (VMMD) ATD.
		– Complete VMMD ATD and transition program design and test documentation to ground stand-off mine detection system engineering and manufacturing development program.
•	6727	– Complete fabrication of precision mine location, aimpoint estimator, fire control, and neutralization technologies for the mine hunter/killer and complete plans for mine hunter/killer ATD execution.
		– Complete development of advanced stand-off ground penetrating radar (GPR) sensor to allow greater standoff mine detection distances and faster forward speeds. Fabricate prototype stand-off GPR for integration with mine hunter/killer demonstrator.
•	2700	– Standardize three vehicular mounted mine detector prototypes by incorporating electronic marking capability, common platforms, and GPS capabilities.
•	527	– Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	21018	

FY 1999 Planned Program:

•	4962	– Develop models and simulations for joint countermine ACTD technologies and integrate into service models with new architecture, continue verification and validation.
		– Analyze data from joint countermine ACTD demo II, apply lessons learned to technology programs and provide support for residual hardware. Receive final user report on novel system military suitability.
		– Conduct assault on objective battle lab experiment and assess contribution of new countermine technology to survivability and mobility of assault forces.
•	9085	– Integrate prototype detection and neutralization technologies into mine hunter/killer ATD.
		– Complete contractor testing on mine hunter/killer platform.
		– Complete site preparation for the mine hunter/killer ATD.
•	5731	– Complete requirements analysis, definition of aircraft constraints and interfaces, and technology trade-offs for lightweight imaging multispectral airborne minefield detection technology.
		– Collect mine signature data to support finalization of phenomenology studies and automatic mine detection algorithm development.
		– Initiate fabrication of critical components.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology PROJECT D608

FY 1999 Planned Program: (continued)

- 2166 – Complete mine signature collection using spectrographs and other available sensors.
  - Finalize study to define exploitable phenomena from hyperspectral technology.
  - Complete hyperspectral sensor specifications for mine detection.
  - Initiate fabrication of hyperspectral sensor(s).

Total 21944

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	22734	19332	19778
Appropriated Value	22734	22032	0
Adjustments to Appropriated Value	-600	-1014	0
FY 1999 President's Budget	22134	21018	21944

Change Summary Explanation: FY 1998- Congressional increase for VMMD (+2700); Undistributed Congressional reductions (-1014).
FY 1999 - Funding increased (+2166) to address high priority requirements to develop a hyperspectral airborne minefield detection capability.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603606A Landmine Warfare and Barrier Advanced Technology

PROJECT: D624

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D624 Ground Penetrating Radar Technology	4765	3779	0	0	0	0	0	0	8544

A. Mission Description and Justification: This Congressional special interest program provided for the development and evaluation of stand-off ground penetrating radar (GPR) technologies for mine detection.

FY 1997 Accomplishments:

•	4765	– Transitioned stand-off GPR technologies to Mine Hunter/Killer ATD.
		– Tested and evaluated detection algorithm enhancements and developed improved transmitter/receiver and waveform for stand-off GPR.
Total	4765	

FY 1998 Planned Program:

•	3658	– Using detection algorithm test results, complete efforts to enhance GPR detection algorithm performance.
		– Conduct additional testing and evaluate stand-off GPR detector performance
•	121	– Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	3779	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	4895	0	0
Appropriated Value	4895	3900	
Adjustments to Appropriated Value	-130	-121	
FY 1999 President's Budget	4765	3779	0

Change Summary Explanation: FY 1998 Funding provided by Congress to support development of stand-off GPR technologies.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603606A Landmine Warfare and Barrier Advanced Technology

PROJECT: D674

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D674 Airborne Standoff Minefield Detection System	0	6784	0	0	0	0	0	0	6784

A. Mission Description and Justification: This Congressional special interest program provided for the development and evaluation of airborne minefield detection capabilities. Project D608 will continue to develop hyperspectral mine detection capability in FY99.

FY 1997 Accomplishments: Program not funded in FY 1997.

FY 1998 Planned Program:

•	6614	– Continue airborne mine and minefield data collection using infrared and multispectral/hyperspectral sensors to support development and refinement of robust mine detection algorithms.
		– Develop, integrate, and evaluate enhanced airborne mine detection algorithms; These enhanced algorithms will be capable of exploiting data from single color infrared sensors, as well as, multispectral/hyperspectral imaging sensors.
		– Continue efforts to improve sensor imaging resolution and sensitivity, and continue performance testing using airborne mine detection sensor testbed.
•	170	– Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	6784	

FY 1999 Planned Program: Program not funded in FY 1999.

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value	0	7000	
Adjustments to Appropriated Value	0	-216	
FY 1999 President's Budget	0	6784	0

Change Summary Explanation: Funding: FY 1998 funding provided by Congress (+7000) to support development of airborne minefield detection capabilities

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603607A Joint Service Small Arms Program

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	8825	9015	5173	5031	5691	6074	6207	Continuing	Continuing
D627 Joint Service Small Arms Program (JSSAP)	7872	7515	5173	5031	5691	6074	6207	Continuing	Continuing
D664 Advanced Lightweight Anti-Armor Weapon Sys	953	1500	0	0	0	0	0	0	2453

Mission Description and Budget Item Justification: The objective of this Program Element (PE) is to demonstrate key technologies leading to more effective small arms weapons and munitions for all Services. The Joint Services Small Arms Program (JSSAP) is designed to overcome the technological barriers associated with small arms/munitions/fire control for individual and crew-served weapons. The goal is to achieve substantial improvements in threat defeat under all environmental conditions while reducing the soldier's load. All JSSAP efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP), and approved Joint Service Science and Technology Objectives (JSSTO), plus Mission Needs Statements and Operational Requirements Documents of the Services. The work in this PE is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. These programs are primarily managed by the U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Work in this PE is related to and fully coordinated with efforts in PE 0602623A (Joint Service Small Arms Program), PE 0602624A (Weapons and Munitions Technology), and transitions to JSSAP efforts conducted in PE 0604802A (Weapons and Munitions-Engineering Development) and PE 0604601A (Objective Crew Served Weapon-Engineering Development). Additional transition paths have been established in coordination with Product Manager (PM) Small Arms, USMC Program Manager (PM) Ground Weapons and US Special Operations Command (SOCOM). This program is dedicated to conducting proof of principle field demonstrations and tests of system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603607A Joint Service Small Arms Program

PROJECT: D627

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D627 Joint Service Small Arms Program (JSSAP)	7872	7515	5173	5031	5691	6074	6207	Continuing	Continuing

A. Mission Description and Justification: This project funds several efforts: (1) Objective Individual Combat Weapon (OICW) Advanced Technology Demonstration (ATD), DTO and STO which will provide a 300% to 500% increase in hit probability, the ability to defeat defilade or non-visible targets, and increase effective range to 1000 meters; (2) Objective Crew Served Weapon (OCSW) which will demonstrate the next generation crew-served weapon to replace selected M2 machine guns and MK19 grenade machine guns (GMG), a two-soldier portable system that provides substantial improvements in system effectiveness including the ability to defeat defilade or non-visible targets while featuring a 60-75% weight reduction; (3) controlled penetration ammunition, intended to minimize collateral damage in confined operational environments; and (4) a new Joint service combat shotgun meeting the requirements of all the Services, increasing versatility, and reducing logistics burden.

FY 1997 Accomplishments:

•	7423	- Refined/built/tested/qualified/exercised simulator for the OICW.
		- Completed design of modifications for the OICW safety/technical test range.
		- Performed preliminary OICW integration tests
		- Completed design of OICW demonstrator weapons by two competitive contractor teams and began sub-system technology demonstrations.
•	182	- Verified low collateral rifle ammunition performance and prepared final report.
		- Completed technical tests of candidate hardware for a Joint combat shotgun; no candidate meets existing requirements.
•	267	- Completed plans for OCSW system design refinement phase.
Total	7872	

FY 1998 Planned Program:

•	7141	- Complete OICW technology demonstration by two competitive contractor teams to provide data for downselection process; downselect to a single OICW contractor team
		- Fabricate initial hardware for OICW Advanced Technology Demonstration (ATD).
•	200	- Update Joint combat shotgun requirements; obtain, evaluate and downselect candidate hardware.
•	174	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	7515	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603607A Joint Service Small Arms Program
	PROJECT D627

FY 1999 Planned Program:

•	4368	- Complete hardware build for OICW ATD.
		- Conduct OICW live fire simulation/field test.
•	805	- Integrate initial system design refinements into OCSW prototype weapon.
Total	5173	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	8070	4754	5148
Appropriated Value	8070	7754	
Adjustments to Appropriated Value	-198	-239	
FY 1999 President's Budget	7872	7515	5173

Change Summary Explanation: Funding: FY 1998 Congressional increase of 3000 for Objective Individual Combat Weapon.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603607A Joint Service Small Arms Program

PROJECT: D664

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D664 Advanced Lightweight Anti-Armor Weapon Sys	953	1500	0	0	0	0	0	0	2453

A. **Mission Description and Justification:** This Congressionally directed project calls for demonstration and evaluation of advanced warhead technologies that would significantly increase the individual soldier capability to attack light armored vehicles. The Army competitively awarded a contract to develop and demonstrate 25mm anti-armor munitions suitable for use in the Objective Crew Served Weapon (OCSW).

FY 1997 Accomplishments:

•	953	- Provided comparative data on shaped charge and explosively formed projectile warheads in order to assess the potential of meeting light armor penetration goals of the OCSW.
Total	953	

FY 1998 Planned Program:

•	1500	- Integrate optimal armor penetration warhead into OCSW cartridge design. - Complete armor penetration cartridge firing test
Total	1500	

FY 1999 Planned Program: Project not funded in FY 1999

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	979	0	0
Appropriated Value	979	1500	
Adjustments to Appropriated Value	-26		
FY 1999 President's Budget	953	1500	0

Change Summary Explanation: Funding: FY 1998 Congressional increase of 1500 for Advanced Lightweight Anti-Armor Weapon System.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603654A Line-of-Sight Technology Demonstration

PROJECT: D460

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D460 LOSAT Technology Demonstration	9533	4845	20099	40435	55886	61193	28482	13740	387372

A. Mission Description and Budget Item Justification: Project D460-LOSAT Technology Demonstration: This program focuses on integration of the Line-of-Sight Anti-Tank (LOSAT) weapon system into an air mobile configuration in order to help remedy the early entry force lethality shortfall against heavy armor. LOSAT is a mobile, direct fire, antitank system and provides overwhelming lethality with a high rate of kill at long range. The LOSAT weapon system consists of a kinetic energy (KE) missile launcher mounted on a Heavy High Mobility Multi-purpose Wheeled Vehicle (HMMWV) chassis. The current program provides for the conduct of a Technology Demonstration on the HMMWV platform and will involve flight tests and early soldier evaluations of the program. Project objectives include transitioning from a Technology Demonstration program in FY 1998 to an Advanced Concept Technology Demonstration (ACTD) program to position the technology for future acquisition decisions; demonstrate subsystem capabilities in flight tests and dirty battlefield environment; evaluate the utility of the LOSAT technology for the early entry forces; demonstrate an integrated HMMWV based LOSAT system in flight test and advanced warfighting experiments; and evaluate affordability issues. The ACTD program is a cost-effective means to assess the utility of LOSAT to the early entry force. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan and Project Reliance. This program is dedicated to conducting proof of principal field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3. Work on this program is conducted through the CCAWS Project Office in Huntsville, AL. The prime contractor is Lockheed Martin-Vought Systems in Dallas, TX.

Acquisition Strategy: The LOSAT weapon system provides the Army's early entry force an air mobile, leap-ahead technology, anti-tank weapon system providing overmatching armor lethality with no known countermeasures. The LOSAT KE missile and associated fire control system utilizes unique and innovative technologies and resulted in a sole source development contract awarded to prime contractor Lockheed Martin-Vought Systems in Dallas, Texas. Funding in FY 1998 supports the completion of the Technology Demonstration effort and the beginning of the ACTD program.

FY 1997 Accomplishments:

•	157	- Conducted LOSAT/HMMWV early soldier evaluation at Fort Benning, GA (Infantry School) .
•	1722	- Developed LOSAT Weapon System Performance Requirements.
•	4085	- Defined requirements/initiated missile electronics design/test including Inertial Measurement Unit (IMU).
•	1151	- Prepared/conducted missile software requirements definition and analysis.
•	996	- Updated LOSAT systems simulation pertaining to the new missile guidance electronics.
•	1422	- Defined requirements/initiated design of Fire Unit.
Total	9533	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603654A Line-of-Sight Technology Demonstration PROJECT D460

FY 1998 Planned Program:

•	1775	- Develop/test missile software.
•	2610	- Design/fabricate, missile prototype electronic hardware and IMU, and conduct Hardware-in-the-loop tests.
•	338	- Initiate Fire Unit software development.
•	122	- Small Business Innovative Research/Small Business Technology Transfer Program.
Total	4845	

FY 1999 Planned Program:

•	7425	- Continue development and test of Fire Unit and missile software.
•	5514	- Finalize missile mechanical design/test, and initiate ACTD prototype material purchases to be used in testing.
•	4735	- Begin Fire Unit design mechanical, test, and initiate ACTD prototype material purchases to be used in testing.
•	1971	- Continue Hardware-in-the-loop/closed loop simulation evaluation/verification of new hardware/software design.
	454	- Initiate design/fabrication of prototype tooling and test equipment.
Total	20099	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9791	13000	20000
Appropriated Value	9791	5000	
Adjustments to Appropriated Value	-258	-155	
FY 1999 Pres Bud Request	9533	4845	20099

Change Summary Explanation: Funding: FY 1998 RDT&E funding reduced by Congress (-8000).

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	28584	18705	23960	33487	31553	34244	33268	Continuing	Continuing
DK70 Night Vision Advanced Technology	12208	4673	9699	12601	13381	13726	13974	Continuing	Continuing
DK86 Night Vision, Airborne Systems	4832	8079	11861	13932	10128	9782	8873	Continuing	Continuing
DK87 Night Vision, Combat Vehicles	9423	4711	0	4454	5544	7736	7394	Continuing	Continuing
DC63 DC63	2121	1242	0	0	0	0	0	0	3958
DC65 DC65	0	0	2400	2500	2500	3000	3027	Continuing	Continuing

Mission Description and Budget Item Justification: This program element (PE) develops new and improved tactical night vision and electronic sensor technologies for surveillance, target acquisition, air defense, pilotage, and driving to meet future Army requirements and applications. This technology will provide the capability to acquire and engage hostile targets at extended ranges during day/night, smoke, obscured weather and battlefield conditions, significantly enhancing the warfighting capability and survivability of US forces. Multisensor target acquisition suites will be demonstrated to provide rapid automatic acquisition of targets and battlefield intelligence data to allow US forces to operate and react well within the operational timelines of threat forces. Multispectral and hyperspectral sensors will provide the capability to detect obscured, concealed, and reduced signature threats. Efforts are also directed toward technology for wide field-of-view (FOV) sensors to support dismounted soldier mobility and day/night nap-of-the-earth pilotage at high speeds. Technology advances achieved under this PE have tri-service applications. Work in this program element is consistent with the resource-constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance agreements on sensors and electronic devices with oversight and coordination provided by the Joint Directors of Laboratories. This work 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). Work in this PE is primarily managed by the US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Ft. Monmouth, NJ. Contractors include: Texas Instruments, Inc., Dallas, TX; Hughes Aircraft Co., El Segundo, CA; Fibertek, Herndon, VA; Questech, Falls Church, VA; Northrop-Grumman, Linthicum, MD; Lockheed-Martin Corp., Orlando, FL; Lockheed-Martin, Lexington, MA; Alliant, Hopkins, MN; EOIR, Spotsylvania, VA; Booze-Allen, McLean, VA; Omar McCall, Beltsville, MD. This project includes advanced technology demonstrations and tests of technologies to meet specific military needs and is therefore appropriately placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology

PROJECT: DK70

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK70 Night Vision Advanced Technology	12208	4673	9699	12601	13381	13726	13974	Continuing	Continuing

A. Mission Description and Justification: This project will develop and demonstrate high performance, sensor/multisensor technology to provide affordable approaches of increasing the probability of detection, extending the ranges and reducing the timelines of target acquisitions systems. Hunter sensor suite advanced technology demonstration (ATD) demonstrated the feasibility of a lightweight, deployable and survivable vehicle platform with an advanced, low observable, long range hunter sensor suite and is participating in the Rapid Force Projection Initiative advanced concept technology demonstration (RFPI ACTD). The hunter sensor suite combines second generation thermal imaging, day TV, eye safe laser rangefinder, embedded aided target recognition, and image compression/transfer technology. Multi-function staring sensor suite (MFS3) ATD will demonstrate a modular reconfigurable sensor suite that integrates multiple advanced sensor components including large format staring infrared arrays, multi-function laser and acoustic arrays. This technology demonstration will provide ground combat and amphibious assault vehicles with compact affordable sensor options for long range non-cooperative target recognition, mortar/sniper fire location, air defense against low signature unmanned aerial vehicles and long range helicopters.

FY 1997 Accomplishments:

- 12208
  - Integrated hunter sensor suite ATD aided target recognition (ATR) and automated target handoff processing hardware/software with baseline sensor suite and vehicle.
  - Developed mounting structure, modified Hunter vehicle and installed/integrated advanced passive signature management appliqué.
  - Integrated remote sentry with Rapid Force Projection Initiative (RFPI) command and control (C2) network and weapons
  - Integrated digital C2 components, conducted digital integration laboratory (DIL) testing and began installation of C2 system into vehicle.
  - Conducted engineering tests to verify ATR and command and control performance.

Total 12208

FY 1998 Planned Program:

- 4606
  - Develop performance and design requirements for the (MFS3) ATD to provide scout and reconnaissance forces with high speed, panoramic surveillance, long range detection and identification of low signature targets, and mortar/sniper fire detection.
  - Demonstrate and evaluate a large format staring mid wave infrared sensor with an ultra narrow field of view to quantify long range identification performance
  - Develop multifunction sensor suite virtual prototype to facilitate design/performance trade-offs, user evaluations of operational modes, and man-machine interfaces.
  - Develop reconfigurable, open architecture sensor backplane that fully integrates aperture, power, and signal processing requirements for infrared, radar, laser, and acoustic sensor components

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology / PROJECT: DK70

FY 1998 Planned Program: (continued)

•	67	– Small Business Innovation Research/Small Business Technology Transfer Programs
Total	4673	

FY 1999 Planned Program:

•	9699	– Continue development and risk reduction efforts for multifunction staring sensor suite ATDs' infrared, radar, and laser sensor components
		– Complete design trade-offs and evaluations of large format mid wave and long wave staring infrared sensor technologies
		– Develop large format, high speed focal plane array which can be reconfigured/reprogrammed between mid wave or long wave infrared operation to optimize performance in varying condition.
		– Fabricate optical and signal processing backplane, and sensor gimbal and stabilization assembly.
Total	9699	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	11186	4821	9652
Appropriated Value	11425	4821	
Adjustments to Appropriated Value	+783	-148	
FY 1999 President's Budget	12208	4673	9699

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology

PROJECT: DK86

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK86 Night Vision, Airborne Systems	4832	8079	11861	13932	10128	9782	8873	Continuing	Continuing

A. Mission Description and Justification: This project develops and demonstrates surveillance, reconnaissance, and pilotage technology for Army airborne platforms. Specific technology efforts focus on improved night pilotage sensors, high resolution head's up displays, and automated obstacle warning technology to enhance the operational effectiveness and survivability of currently fielded and future attack, scout, cargo and utility helicopters. This technology will significantly enhance the survivability of Army aviation assets by permitting rotorcraft to fly at nap-of-the-earth altitudes and avoid obstacles in day/night/adverse weather conditions, and reduce exposure to air defense artillery, surveillance systems, and smart missiles. Advanced helicopter pilotage (AHP) demonstration will provide a high-quality dual-spectral pilotage sensor and the displays needed to provide this imagery to the pilot. An aerial scout sensor suite demonstration will evaluate airborne sensors for improved non-line-of-sight targeting for weapons systems in the RFPI ACTD. Multi-mission, unmanned aerial vehicle (UAV) sensor ATD will demonstrate infrared and hyperspectral sensors to provide upgrade options for airborne surveillance applications, including future tactical and short range UAVs. The air/land enhanced reconnaissance and targeting (ALERT) ATD continues efforts to develop a robust, affordable aided target recognition (ATR) capability for scout and attack helicopters and will demonstrate search on-the-move aided target acquisition using a forward looking infrared (FLIR)/laser sensor suite for future aviation assets. Technology developed under this project is also directly applicable to the night flying requirements of the other services and Special Operations Command's rotary wing aircraft.

FY 1997 Accomplishments:

- 4832 – Demonstrated 30 X 50 degree field of view night pilotage system consisting of high resolution helmet mounted display system and a head tracked, turret mounted, dual spectrum (near infrared and far infrared) sensor.
  - Completed evaluation of candidate aerial scout sensors and began integration on aerial platform.

Total 4832

FY 1998 Planned Program:

- 4933 – Complete helmet mounted display of fused near infrared and far infrared pilotage sensor data to provide a significant reduction in pilot cognitive and physical work load during high speed, nap of the earth flight operations.
  - Demonstrate leap ahead ultra-wide field of view (40^{O} X 80^{O}) dual spectrum night pilotage system during real time flight maneuvers for user evaluation and feedback.
  - Complete integration of aerial scout sensor aircraft, complete upgrades to ground station aided target recognition processor; conduct performance testing and deliver to the RFPI ACTD.
- 2971 – Collect target and background data in varying operational environments and establish performance baseline for ALERT ATD on-the-move target detection and recognition.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology
PROJECT DK86	

FY 1998 Planned Program: (continued)

•	175	– Small Business Innovation Research/Small Business Technology Transfer Programs
Total	8079	

FY 1999 Planned Program:

•	3262	– Develop performance and design requirements for Multi-mission UAV sensor ATD payloads for tactical and short range unmanned aerial vehicles.
		– Develop common modular gimbal and housing to accommodate multiple technology payloads
		– Complete preliminary design of lightweight multispectral payload for measurement and signature intelligence and staring infrared sensor for wide area reconnaissance, and precision targeting.
•	8599	– Develop ALERT ATD on-the-move multisensor aided target recognition algorithm that combines laser range mapping and laser target profile data with infrared imagery.
		– Complete modifications to forward looking infrared target acquisition sensor suite, and continue test-fix-test evaluation baseline for on-the-move target detection and recognition performance
		– Modify baseline laser rangefinder/designator to provide the increased pulse repetition rates necessary to operate in range mapping and target profiling modes.
Total	11861	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	5450	8336	9003
Appropriated Value	5566	8336	
Adjustments to Appropriated Value	-734	-257	
FY 1999 President's Budget	4832	8079	11861

Change Summary Explanation: Funding: FY 1997 funding (-734) reprogrammed to support other high priority requirements.
Funding: FY 1999 funding (+2800) reprogrammed to this project to enhance development of on-the-move aided target recognition demonstration.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology

PROJECT: DK87

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK87 Night Vision, Combat Vehicles	9423	4711	0	4454	5544	7736	7394	Continuing	Continuing

A. Mission Description and Justification: This project demonstrates target acquisition sensor technology to meet the stringent requirements of future combat vehicles. The target acquisition (TA) ATD is a sensor suite consisting of a second generation thermal imaging sight with automated wide area search, aided target recognition, low cost millimeter wave (MMW) ground radar, and a multifunction laser that will be demonstrated for future tank, cavalry, and scout vehicles. Multi-function staring sensor suite ATD will demonstrate an advance modular reconfigurable sensor suite that integrates on to multiple combat vehicles.

FY 1997 Accomplishments:

- 9423 – Demonstrated target acquisition ATDs' multifunction laser (MFLS) and automatic target cueing as a potential upgrade to the M1A2, and demonstrated moving target indicator radar to provide long-range, adverse-weather target cueing.
  - Completed radar fabrication, installation and testing and completed integration of multifunction laser with gunner's primary sight.
  - Completed multisensor aided target recognition hardware and software integration.
  - Provided field demonstration support and test data analysis in support of acoustic test program.
  - Completed static demonstrations of alternative passive sensor (acoustic and infrared search and track) technologies to support forward area air defense system upgrades.

Total 9423

FY 1998 Planned Program:

- 3130 – Modify M1A2 commander's independent thermal viewer with multifunction laser and gimbal scan; integrate with millimeter wave ground radar and demonstrate TA ATD multisensor aided target search and acquisition for ground combat and scout vehicles.
  - Conduct concurrent development and evaluation of thin film monolithic ferro-electric device and manufacturing process technologies required to fabricate a new generation of ultra low cost uncooled infrared imagers.
  - Test injection mold manufacturing processes required to fabricate low cost, lightweight composite optics for uncooled infrared sensors.
- 1500 – Define MFS3 ATD requirements and develop reconfigurable, open architecture size/weight/power interfaces to allow future integration of multifunction sensor suite with multiple platforms.
- 81 – Small Business Innovation Research/Small Business Technology Transfer Programs

Total 4711

FY 1999 Planned Program: Project not funded in FY 1999

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology

PROJECT: DK87

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	10947	4861	0
Appropriated Value	11182	4861	
Adjustments to Appropriated Value	-1759	-150	
FY 1999 President's Budget	9423	4711	0

Change Summary Explanation: Funding: FY 1997 funding (-1759) reprogrammed to support other high priority requirements.

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	19678	19574	13564	15020	4906	4401	3075	Continuing	Continuing
DT08 Combat Engineering Systems	1388	9462	269	3568	4906	4401	3075	Continuing	Continuing
DT10 Total Distribution Advanced Technology Demonstration	9136	0	0	0	0	0	0	0	21598
DT12 Rapid Terrain Visualization	9154	10112	13295	11452	0	0	0	0	46844

Mission Description and Budget Item Justification: This program encompasses demonstrations of technologies that provide the capabilities required for the engineer and logistician to successfully plan, rehearse and execute missions in support of the commander and the force projection Army. Critical deficiencies exist in the Army's ability to rapidly acquire, update, maintain and distribute terrain data in support of both terrain and battlefield visualization; to apply physics-based reasoning to planning and executing mobility, counter-mobility, survivability, and general engineering missions; to conduct logistics-over-the-shore operations in adverse sea states; to establish in-transit visibility of materiel and supplies; and to manage logistics distribution and logistics automation. The demonstration projects in this program element focus on the technologies required correcting these critical deficiencies. Capabilities demonstrated will be applicable to missions at all echelons within the force structure during either combat operations or operations other than war. Demonstrations are integral components of Army Advanced Warfighting Experiments, Advanced Concept Technology Demonstrations, other Advanced Technology Demonstrations, and joint field training exercises. Emphasis is placed on rapid transition of technologies into Command and Control (C2) systems, combat/war models and simulations or simulators. This provides shared situational awareness, common representation of terrain and consistent predictions or assessments of mobility, counter-mobility, survivability, and logistics missions in the linkage of C2 systems, models, and simulations being developed by the Army to exploit information technologies. The work in this program element is consistent with the Army Science and Technology Master Plan, the Training and Doctrine Command (TRADOC) Battlefield Visualization Concept, the Office of the Deputy Chief of Staff, Operations (ODCSOPS) Battlefield Visualization Objectives, the Army Modernization Plan, and Project Reliance. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is properly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology

PROJECT: DT08

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DT08 Combat Engineering Systems	1388	9462	269	3568	4906	4401	3075	Continuing	Continuing

A. **Mission Description and Justification:** This project will demonstrate decision support applications for mobility, countermobility and survivability that support multiple battlefield operating systems, including maneuver, command and control, and mobility and survivability. An integrated obstacle planning and simplified survivability assessment system will be demonstrated in brigade and division level exercises. This software suite will enable the engineer to rapidly generate engineer assessments, conduct course-of-action analyses, provide engineer force level information to commanders and other staff/functional elements, and provide the engineer with the ability to effectively execute command and control of the complex battlefield missions of countermobility and survivability. This project will also demonstrate at full scale a capability to conduct logistics-over-the-shore (LOTS) operations at sea-state 3; this will greatly increase LOTS throughput of equipment and supplies from ship to shore, and significantly reduce the time and materials required to establish linkages between LOTS sites and the inland transportation infrastructure. Present LOTS operations are limited to sea-state 2 or less; this is an unacceptable limitation to force projection. A complete engineering design of a full-scale Rapidly Installed Breakwater System (RIBS) will be developed based on detailed engineering analyses, and laboratory and ¼-scale field tests. A full-scale demonstration of RIBS that reduces waves conditions from the lower range of sea-state 4 by 50 percent will be performed. Evaluations of the full-scale deployability, transportability, mooring loads, structural integrity, and potential of RIBS for storm survival will be conducted. The capability to rapidly, and with minimum logistics burdens and reduced engineer equipment, stabilize beach sands and soft soils for roads, material storage areas, heliports, and other horizontal operating surfaces associated with LOTS operations will be demonstrated. Transition targets for the software capabilities that will be integrated and demonstrated under this project include the Army Battle Command System (ABCS) and the Digital Topographic Support System (DTSS). The work is performed by the Cold Regions Research and Engineering Laboratory, Hanover NH, and the Waterways Experiment Station, Vicksburg, MS. Note: Sea-state is a measure of wave height and frequency of maximum wave energy.

FY 1997 Accomplishments:

•	806	- Upgraded mobility and survivability software to version 1.5 through inclusion of wide area munition effectiveness, military hydrology, and excavation in frozen soils algorithms, and initiate implementation of automated obstacle planning.
•	582	- Demonstrated mobility and survivability version 1.5 at Prairie Warrior 97.
Total	1388	

FY 1998 Planned Program:

•	1633	- Provide final verification and integration of engineer algorithms into mobility and survivability battlefield operating system software. - Demonstrate mobility and survivability battlefield operating system software during Ulchi Focus Lens in Korea to verify world-wide planning capabilities. - Conduct demonstrations to validate engineer resource allocation algorithms during Division XXI exercise.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology PROJECT DT08

FY 1998 Planned Program: (continued)

•	3834	- Ocean-scale field evaluation of Rapidly installed Breakwater System (RIBS); full-scale evaluation of RIBS deployment methods; identification, evaluation, and selection of geo-materials for soft soil (beach) stabilization and surfacing.
•	1870	- Design rapid mooring (RMS) for RIBS; conduct field evaluation of RMS.
•	1858	- Tele-engineering: Demonstrate baseline capabilities for providing from CONUS to OCONUS assessments of bridge military load class, transportation network capability and throughput, flooding and river levels, and force vulnerability to vehicle bombs; establish tele-engineering presence on existing communications networks.
•	237	- Small Business Innovative Research/Small Business Technology Transfer Programs
Total	9462	

FY 1999 Planned Program:

•	269	- Determine sea-state 3 mooring requirements for Rapidly Installed Breakwater System (RIBS); finalize design of full-scale RIBS.
Total	269	

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	1426	1663	2988
Appropriated Value	1426	9763	
Adjustments to Appropriated Value	-38	-301	
FY 1999 President's Budget	1388	9462	269

Change Summary Explanation: FY99 (-2719) reprogrammed to higher priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology

PROJECT: DT10

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DT10 Total Distribution Advanced Technology Demonstration	9136	0	0	0	0	0	0	0	21598

A. Mission Description and Justification: Operation Desert Storm showed that the logistics distribution system needed major improvements to increase its efficiency and effectiveness. The Total Distribution Advanced Technology Demonstration (TDATD) was established to demonstrate potential enhancements in logistics situational awareness and course of action (COA) analyses supporting distribution management, in-transit asset visibility and logistics automation and communication. The TDATD demonstrated automated logistics planning tools, computer simulation and modeling techniques, advanced microelectronics, satellite tracking and communications technology to support an advanced objective logistics supply capability. These tools were demonstrated within the context of an integrated suite of logistics data management tools, decision support tools, and collaborative planning tools. The work was performed by: the Communications Electronics Research Development and Engineering Center, Ft. Monmouth, NJ; the Army Research Laboratory, Aberdeen Proving Ground, MD; the Waterways Experimentation Station, Vicksburg, MS; and the Topographic Engineering Center, Alexandria, VA. The TDATD has successfully migrated its Logistics Anchor Desk (LAD) tools into the Combat Service Support Control System (CSSCS) with a first prototype expected for release in Jan 98. Additionally, the TDATD LAD tools formed the baseline for the Joint Logistics Advanced Concept Technology Demonstration (JLACTD) which also completed successfully in Apr 97, and will be the baseline for both the DARPA-lead JL-ACTD Phase II in FY 98 and 99, and the Global Combat Service Support System (GCSSS).

FY 1997 Accomplishments:

- 4675 - Completed development of expanded LAD connectivity to real logistics data sources by incorporating automated data management and other data integrity utilities.
  - Developed enhanced LAD COA and logistics automation and infrastructure assessment capabilities using sensitivity analysis and total COA analysis.
- 4461 - Transitioned advanced LAD capabilities into the CSSCS/AGCCS architecture to provide these systems improved logistics capabilities.
  - Completed insertion of enhanced LAD COA technology into leave-behind logistics automation capabilities that are fully integrated into the AGCCS and the Global Command and Control Systems (GCCS) for the warfighting Commanders in Chief.
  - Demonstrated LAD capabilities integrated within the common architecture in Prairie Warrior and Task Force XXI.

Total 9136

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology PROJECT DT10

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9585	0	0
Appropriated Value	9136		
Adjustments to Appropriated Value			
FY 1999 President's Budget	9136	0	0

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology

PROJECT: DT12

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DT12 Rapid Terrain Visualization	9154	10112	13295	11452	0	0	0	0	46844

A. **Mission Description and Justification:** This project will demonstrate the integration of critical battlefield visualization technologies in support of crisis response and force projection missions to enable the Joint Warfighter to successfully plan, rehearse and execute his mission. Digital Topographic Data (DTD) are the foundation for battlefield visualization and these data are not currently available for most areas where Force XXI units will operate. Methods for rapidly producing DTD to support military operations, particularly early entry, and the optimum resolution and format of digital terrain data for both current and notional systems need to be established. The Rapid Terrain Visualization (RTV) Advanced Concept Technology Demonstration (ACTD) will be conducted to demonstrate capabilities to rapidly collect source data and generate high resolution digital terrain databases to support crisis response and force projection operations within the timelines required by the joint force commander. The RTV ACTD will also demonstrate capabilities for the commander to integrate these terrain databases with current situation data, and manipulate and display the integrated databases to visualize the desired end state, and determine how to achieve his objectives. A capability for rapid collection of high-resolution (up to 1-meter grid spacing) digital terrain elevation data will be demonstrated, and imagery from aircraft and satellite platforms will be used to generate terrain feature data and map backgrounds. The RTV ACTD will provide and leave behind computer workstations and applications software to generate high resolution terrain databases to develop and evaluate courses of action using mission planning and embedded wargaming software, and to support mission rehearsals. This ACTD will also provide a tool for further exploration of emerging warfighting concepts and doctrine. The ACTD will leverage the Defense Advanced Research Projects Agency (DARPA) Battlefield Awareness and Data Dissemination (BADD) ACTD for data dissemination over the global broadcast system and tactical communications, and the Communications and Electronics Command (CECOM) Battlespace Command and Control (BC2) Advanced Technology Demonstration for workstations and applications software. This project is cooperatively executed with and will leverage work in progress by: the Topographic Engineering Center (TEC); National Imagery and Mapping Agency (NIMA); National Reconnaissance Office (NRO); Defense Airborne Reconnaissance Office (DARO); and the Defense Modeling and Simulation Office (DMSO). This project is managed by the Joint Precision Strike Demonstration (JPSD) Program Office, Program Executive Officer, Intelligence, Electronic Warfare and Sensors (PEO-IEW&S), Ft. Belvoir, VA. Contractors include: Raytheon, Bedford, MA; SAIC, Rosslyn, VA; MRJ, Oakton, VA; TASC, McLean, VA; EO-IR Measurements, Spotsylvania, VA; Space Applications Corp, Vienna, VA; and MTC, Shrewsbury, NJ. Participating government laboratories include: Topographic Engineering Center, Alexandria, VA; Army Research Laboratory, Adelphi, MD; Communications and Electronics Research, Development and Engineering Center, Ft. Monmouth, NJ.

FY 1997 Accomplishments:

- 5624 - Established contract with industry to integrate technologies needed to configure a system to acquire and process high-resolution digital terrain elevation data within tactically significant timelines.
  - Generated feature data of XVIII Airborne Corps (ABC) Warfighting Experiment (WFX) and Div XXI Advanced Warfighting Experiment (AWE) Areas Of Interest (AOI) using advanced, semi-automated terrain feature extraction software and created tailored databases for visualization workstations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology PROJECT DT12

FY 1997 Accomplishments: (continued)

- 3530 - Integrated C4I systems (e.g., the All Source Analysis System and the Maneuver Control System) with visualization systems to enable common representation of friendly and threat force location and strength.
- Demonstrated rapid terrain visualization capability in JPSD Integration and Evaluation Center (IEC) and measured effectiveness of various RTV system configurations.
- Evaluated military utility of RTV technologies and developed concepts of operations during Task Force XXI and XVIII ABC WFX.

Total 9154

FY 1998 Planned Program:

- 4717 - Conduct proof-of-concept data collection of high-resolution digital elevation data sets to support the XVIII ABC.
- Merge multi-resolution elevation and feature data into a fully integrated data set using prototype battlefield visualization database generation systems and generate tailored databases for visualization workstations.
- 5142 - Demonstrate baseline semi-automated Featured Extraction Capability using commercial satellite imagery.
- Demonstrate integrated RTV systems in JPSD IEC and obtains data to evaluate measures of effectiveness.
- Participate in WFX within the XVIII ABC and Division XXI AWE.
- Develop and complete the RTV Management Plan.
- 253 - Small Business Innovative Research/Small Business Technology Transfer Programs

Total 10112

FY1999 Planned Program:

- 6155 - Acquire and process high-resolution digital elevation data set in direct support of an XVIII ABC WFX.
- Exploit multi-spectral and radar imagery to accelerate the terrain feature extraction process using the prototype RTV database generation system.
- 7140 - Initiate upgrade of workstations and software at XVIII Airborne Corps to objective configuration and evaluate in WFX.
- Demonstrate end-to-end RTV process in the IEC including results of rapid data collection and live feeds to XVIII Airborne Corps.
- Extend RTV capability from XVIII Corps to selected III Corps elements for further user evaluation.

Total 13295

B. Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	9403	10568	14346
Appropriated Value	9623	10568	
Adjustments to Appropriated Value	-469	-456	
FY 1999 President's Budget	9154	10112	14346

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603772A Advanced Tactical Computer Science and Sensor Technology

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	21692	18886	18456	22411	21214	22006	23056	Continuing	Continuing
D101 Tactical Automation	13451	12180	13116	16299	15667	16042	16972	Continuing	Continuing
D243 Sensors and Signal Processing	937	3744	5340	6112	5547	5964	6084	Continuing	Continuing
D281 Ground Combat Identification Demonstrations	7304	2962	0	0	0	0	0	0	25865

Mission Description and Budget Item Justification: This program element supports projects that provide advanced computer science and technology solutions to command and control (C2), data correlation, tactical surveillance, and combat identification problems. Specifically, this program addresses technologies to provide integrated battlefield situation awareness (SA), synchronization of combined arms forces, synchronization of joint forces, C2 on the move, correlation of intelligence data from airborne and space based sensors, battlefield combat identification (CI), point of engagement identification (ID) approaches to reduce fratricide for ground forces, unmanned air vehicle surveillance, and hostile weapons location. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. It is related to and fully coordinated with efforts in PE 0602783A (Computer and Software Technology), PE 0602782A (Command, Control and Communications Technology), PE 0603006A (Command, Control and Communications Advanced Technology), PE 0602709A (Night Vision Technology), PE 0603710A (Night Vision Advanced Technology), and PE 0602120A (Electronic Surveillance and Fuzing Technology) in accordance with the ongoing Reliance joint planning process. Work is performed primarily by the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Command/Control and Systems Integration Directorate (C2SID), Ft Monmouth, NJ, Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA and Intelligence Electronic Warfare Directorate (IEWD), Ft. Monmouth, NJ. Project D281 is managed by Project Manager, Combat Identification, Fort Monmouth, NJ. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore properly placed in Budget Activity 3.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603772A Advanced Tactical Computer Science and Sensor Technology

PROJECT: D101

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D101 Tactical Automation	13451	12180	13116	16299	15667	16042	16972	Continuing	Continuing

A. **Mission Description and Justification:** This is the Army's major science and technology program to provide the architecture and products to implement the digitized battlefield and establish Information Dominance for US ground forces. It develops advanced computer science and technology solutions to redress Army-unique command and control deficiencies in the area of combined arms operations. Specifically, this project addresses technology solutions for digital information transfer and display of horizontal battlefield situation awareness data, synchronization of Combined and Joint Forces, command and control (C2) on the move, command and control for light forces, and platform C2. Key technologies utilized include: expert system decision support technology, database architecture development, data compression, man-machine interfacing, information filtering, advanced information display technology, digital terrain display and manipulation, and automated navigation/geopositioning. Major program goals include improved force synchronization and fratricide reduction through the development and display of a common battlefield view. The battlespace command and control (BC2) advanced technology demonstration (ATD) will apply technologies for common view of the battlefield to develop prototype software capabilities and architectures supporting the Army digital battle staff requirements for merging situation awareness and battle command with mission planning/rehearsal and battlefield visualization capabilities. Digital command, control and communications (C3) hardware and software technologies will be demonstrated that integrate rapid force projection hunter-and standoff killer elements in a manner that is compatible with Force XXI battlefield operating systems and army tactical command and control system (ATCCS) components. Tri-service interoperability and supporting information architecture will also be determined. Joint developer/user warfighting demonstrations will be conducted in conjunction with the Mounted, Dismounted, and Battle Command Battle Labs. Products will be transitioned to Program Executive Offices (PEOs) (Command, Control and Communications Systems (C3S), Aviation, etc.) for integration within their systems and subsequent fielding.

FY 1997Accomplishments:

- 9451 – Developed, integrated, and evaluated intelligent mission planning software tools to provide consistent battlespace understanding by automating and integrating situation forecasting, battle planning, resource allocation, and force management functions in support of the BC2 ATD.
  – Developed and integrated battlefield management and visualization prototype to execute intelligent mission planning functions.
  – Demonstrated initial commander and battle staff work stations at Task Force XXI advanced warfighting experiment (AWE).
  – Defined and evaluated requirements for division, brigade and battalion command, control, communications, computers and intelligence (C4I) architecture which is interoperable with corps, joint and allied assets.
- 4000 – Delivered prototype Rapid Force Projection Initiative (RFPI) Light Digital Tactical Operations Center (LDTOC) simulator to Dismounted Battlespace Battle Lab Land Warrior testbed.
  – Completed interoperability testing of RFPI LDTOC in the Digital Integration Laboratory.
  – Developed RFPI LDTOC Distributed Command and Control (DC2) and communication processor software.
  – Continued integration of hardware and software for LDTOC.

Total 13451

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology
	PROJECT D101

FY 1998 Planned Program:

•	3838	– Integrate battlefield visualization tools in a composite digital terrain/enemy/friendly visualization display with embedded, linked combat information and conduct collaborative planning experiments.
•	2672	– Develop integrated battlefield visualization tools to improve real time integrated situation awareness, reduce timelines for collaborative planning and rehearsal, and streamline decision support activities in support of the battlefield commander. – Develop automated capability to determine Courses of Action (COAs) and support the analysis of selected COAs in accordance with the doctrinal military decision making process.
•	2711	– Experiment/demonstrate commander/staff battle planning and visualization workstation in Division XXI Advanced Warfighting Experiment. – Provide C2 integration support for experiments and demonstrations supporting the Rapid Terrain Visualization ACTD. – Transition prototype mission planning tools to maneuver control system Block IV development.
•	2674	– Deliver LDTOC for the RFPI Advanced Concept Technology Demonstration (ACTD). – Complete communication processor software. – Complete DC2 software. – Train user on LDTOC, DC2 software and communications processor software and support RFPI ACTD field exercise.
•	285	– Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	12180	

FY 1999 Planned Program:

•	5473	– Define/demonstrate information and data flow requirements, command and control element interfaces, and translational data requirements to provide faster, more accurate, more intuitive mission tailored information to the commander/staff.
•	3473	– Conduct interactive modeling and simulation (wargaming) supporting course of action analysis providing streamlined mission planning and rehearsal timelines and rapid mission order execution.
•	4170	– Conduct systems architecture analyses for multi-echelon command and control functions in a Joint/Allied environment.
Total	13116	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	13430	12745	17317
Appropriated Value	13430	12745	
Adjustments to Appropriated Value	+21	-565	
FY1999 President's Budget	13451	12180	13116

Change Summary Explanation: Funding: FY1999 funding (-4201) reprogrammed to support other high priority requirements.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603772A Advanced Tactical Computer Science and Sensor Technology

PROJECT: D243

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D243 Sensors and Signal Processing	937	3744	5340	6112	5547	5964	6084	Continuing	Continuing

A. Mission Description and Justification: This project provides for advanced development of new radar and signal processing concepts for bistatic radar, low cost tactical aerial vehicle radars, ultra-wideband foliage penetrating radar, and a low cost airborne moving target indicator (MTI)/synthetic aperture radar (SAR). The Multi-Mission unmanned aerial vehicle (UAV) Sensor Suite advanced technology demonstration (ATD) will provide wide area surveillance capability in a modular package adaptable to multiple tactical aerial vehicle applications, including UAV platforms. A new generation of ultra-wideband radars will provide foliage and ground penetrating technology for aerial surveillance and targeting, and enhance minefield and bunker detection capabilities.

FY 1997 Accomplishments:

•	937	– Finalized mission requirements for the multi-mission UAV sensors suite ATD's, low cost airborne MTI/SAR sensor that will provide all-weather enhanced reconnaissance, surveillance, battle damage assessment, and targeting for non-line-of-sight weapons. – Developed detailed MTI/SAR sensor performance and mission payload constraints in conjunction with the UAV joint project office adverse weather integrated product team – Completed market survey on low cost lightweight SAR/MTI sensor technology in preparation for contract award.
Total	937	

FY 1998 Planned Program:

•	3657	– Conduct requirements analysis for application of the multi-mission UAV sensors suite ATD's compact MTI/SAR sensor technology to airborne common sensor. – Design and develop compact MTI/SAR transmitter and receiver components and lightweight composite antenna structure. – Develop and test operational moding and tactical control station software. – Conduct timeline, error rate and bandwidth utilization analyses and partition aided target recognition functions between on-aircraft processing hardware and ground station processing hardware. – Design and develop modular gimbal/payload housing assembly for application to future short range and tactical UAVs.
•	87	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	3744	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology PROJECT D243

FY 1999 Planned Program:

•	5340	– Complete fabrication and testing of the multi-mission UAV sensors suite ATD's compact, affordable MTI/SAR sensor components – Initiate integration of gimbal and housing assembly with aircraft testbed – Finalize design of interfaces between the aircraft sensor, common data link and tactical control station. – Develop detailed sensor performance, advanced waveform, and transmitter requirements for ultra wide band foliage and ground penetrating radar.
Total	5340	

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	955	3863	5762
Appropriated Value	955	3863	
Adjustments to Appropriated Value	-18	-119	
FY1999 President's Budget	937	3744	5340

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603772A Advanced Tactical Computer Science and Sensor Technology

PROJECT: D281

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D281 Ground Combat Identification Demonstrations	7304	2962	0	0	0	0	0	0	25865

A. Mission Description and Budget Item Justification: The objective of this project is to select, develop, and demonstrate techniques that minimize fratricide and increase combat effectiveness during surface-to-surface and air-to-surface engagements, and to demonstrate integration of advanced target identification (ID) and situation awareness (SA) capabilities into the Digitized, Joint battlefield environment and architecture. Selection of candidate approaches for technical and operational field evaluation are made based on results of architecture investigations for the combined arms battlefield. This Battlefield Combat Identification (BCID) advanced technology demonstration (ATD) serves as the foundation for the Joint advanced concept technology demonstration (ACTD) for air-to-surface and surface-to-surface combat ID (CID). The ACTD will utilize the Army's Task Force XXI digitized brigade advanced warfighting experiment (AWE) and other field experiments as a means to assess operational utility of these new capabilities. Information derived from these field experiments will support specification of follow-on engineering and manufacturing development (EMD) efforts.

FY 1997 Accomplishments:

- 7304 – Assessed operational effectiveness of different BCID ATD combat identification architectures through force-on-force simulations.
  – Supported Task Force XXI AWE and assisted in data analysis.
  – Completed user training on Enhanced BCIS and air-to-ground CI equipment, completed Phase I of the Helicopter to Dismounted Soldier ID (HDSID) effort, and evaluated the ability of SA through the Sight (SATTS) to utilize tactical internet data to provide target ID.

Total 7304

FY 1998 Planned Program:

- 2895 – Complete analysis of extended positional accuracy capabilities of E-BCIS based system and other BCID ATD systems.
  – Extend FY 1997 SA through sight field demonstration to include Enhanced Battlefield Combat Identification System (E-BCIS), Appliqué and other acquisition and target ID systems.
- 67 - Small Business Innovation Research/Small Business Technology Transfer Programs.

Total 2962

FY 1999 Planned Program: Program not funded in FY 1999

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology PROJECT D281

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	6897	3362	0
Appropriated Value	6897	3362	
Adjustments to Appropriated Value	+407	-400	
FY 1999 President's Budget	7304	2962	0

Change Summary Explanation: Funding: FY1998 Undistributed Congressional reductions (-400).

THIS PAGE INTENTIONALLY LEFT BLANK

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603780A Strategic Environmental Research and Development Program/Environmental Security Technology*

PROJECT: D852

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D852 SERDP/Environ Security Technology**	0	0	54419	54676	53213	54452	55588	Continuing	Continuing

*On some editions of the R-1 exhibit, this program is erroneously titled Tactical Towed Array Sonar.
**FY 1999 funding level is due to an administrative database error. In FY 1999, the program will be increased $1.2M below threshold to reflect proper funding level of $55.619M.

A. **Mission Description Item Justification:** The Strategic Environmental Research and Development Program (SERDP) was established by Congress in 1990 (10 U.S.C. Section 2901-2904) to address Department of Defense (DoD) and Department of Energy (DOE) environmental concerns. It is conducted as a DoD program, jointly planned and executed by the DoD, DOE, and the Environmental Protection Agency (EPA), with strong participation by other Federal agencies, industry, and academia. SERDP's objective is to improve DoD mission readiness by providing new knowledge, cost effective technologies, and demonstrations in the areas of environmental cleanup, compliance, conservation, and pollution prevention. SERDP does this by (1) addressing high priority, mission- relevant, defense environmental technology needs necessary to enhance military operations, improve military systems' effectiveness, enhance military training/readiness, and help ensure the safety and welfare of military personnel and their dependents; and (2) enhancing pollution prevention capabilities to reduce operational and life-cycle costs, as well as reducing the cost of necessary cleanup actions and compliance with laws and regulations. As a secondary benefit, SERDP helps solve significant national and international environmental problems. The keys to a growing list of SERDP technological successes are the ability to respond aggressively to these priority defense needs; the pursuit of universal, world-class technical excellence; emphasis on constant technology transfer to field use; and sound fiscal management. This program is dedicated to conducting proof of principle field demonstrations and tests on non-system specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3. This work transitions to the Army as executive agent for OSD beginning in FY1999.

FY 1997 Accomplishments: Program was an OSD managed program under PE 0603716.D8Z, Strategic Environmental Research and Development Program. See RDT&E, Defense-wide justification material for an explanation of the FY 1997 program.

FY 1998 Planned Program: Program is an OSD managed program under PE 0603716.D8Z, Strategic Environmental Research and Development Program. See RDT&E, Defense-wide justification material for an explanation of the FY 1998 program.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603780A Strategic Environmental Research and Development Program/Environmental Security Technology*
	PROJECT D852

FY 1999 Planned Program:

- 3500 - Next Generation Fire Suppression Technology Program: This 8 year project, which began in FY 1997, is part of the Next generation Fire Suppression Technology Program (NGFSTP) for the replacement of Halon 1301 in DoD weapon systems. In FY 1999, this project will finalize data on in-flight ullage conditions and complete the development of test methodologies on the toxicity, environmental impact, materials compatibility, and principal degradation products. Projects will be initiated under the New Suppression concepts and Emerging Technology Advancement focus areas and continue projects in all six focus areas.
- 3650 - Unexploded Ordnance (UXO) Detection: Continuing effort to improve UXO detection capability which is the highest priority within the SERDP Cleanup Technology Thrust Area. Represents a collective research initiative for the development and integration of multi-sensors and data fusion software for the location, identification, discrimination, and delineation of UXOs.
- 2250 - Integrated Biotreatment Research Program: From Flask to Field: Continuing umbrella project to be completed in FY 2000. Project represents a collective research initiative by several key government and academic organizations supporting the development of bioremediation treatment technologies. The research objective is to field several biotreatment processes for remediation of predominant DoD contaminants. The project plans to complete bench scale studies for explosives and intermediate scale studies for chlorinated solvents.
- 2240 - DoD National Environmental Technology Test Sites Program: The Program is fully operational and plans to host 15-20 field tests and demonstrations of innovative remedial and site characterization technologies at the four test locations. Many demonstrations will be current SERDP projects; several will be from other funded programs, such as the Advanced Applied Technology Demonstration Facility and the Environmental Security Technology Certification Program.
- 1720 - Minimization of Oily and Non-Oily Shipboard Waste: Continuing OSD FY 1998 project to develop equipment and procedures for the minimization and treatment of shipboard non-oily and oily wastes. Non-oily wastes include sewage, laundry and scullery waters, showers and sink waters. Oily wastes are those derived from lubricants and fuels. The primary benefit of this research will be to ensure compliance with international maritime laws and treaties and will enable DoD ships to operate unrestricted anywhere in the world.
- 1320 - Elimination of Toxic Materials and Solvents From Solid Propellant Components: Continuing project to develop lead free extrudable and castable propellant for minimum smoke missile systems; demonstrate complete and clean, HCl-free combustion of propellant; and develop solventless (liquefied gases and supercritical fluids) methods for manufacturing oxidizers. Project will complete optimization and development of new energetic formulations for replacing lead and HCl and complete the development of a solventless process for clean manufacture of oxidizers.
- 1300 - Aquifer Restoration by Enhanced Source Removal: Project to be completed. Project is providing processes for removal of dense non-aqueous phase liquids (DNAPL) in a variety of geological settings and will develop guidelines for applying these processes to remediate contaminated groundwater. This guidance has addressed the entire remediation effort, including site characterization and support to achieve maximum benefit from the remediation technologies. A series of field demonstrations of enhanced pump-and-treat technologies will be completed. Preliminary test results indicate removal of 80-100% of contaminants.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603780A Strategic Environmental Research and Development Program/Environmental Security Technology*
	PROJECT D852

FY 1999 Planned Program (continued):

- 1100 - Destruction of Energetics: Continuing OSD FY 1998 project to focus on evaluating methods of energetics destruction that are safe, economical, and comply with current and pending regulations.
- 600 - Development and Demonstration of a Risk Assessment Framework for Natural and Cultural Resources on Military Training and Testing Lands: Continuing project to maximize use of DoD available training and testing land areas by developing and demonstrating a consistent, defensible, and easily implemented framework for assessing risks to natural and cultural resources. Most research effort will focus on demonstrating the framework developed in FY 1998.
- 600 - Toxic Elimination From Small Caliber Ammunition: Continuing project will develop tungsten-based materials to replace lead-antimony in projectile cartridge, and develop Metastable Interstitial Composites (MIC) to eliminate heavy metals from primer compositions for small caliber ammunition. Project will complete bio-uptake and environmental studies of improved non-toxic materials for replacing lead-antimony in projectile cartridges, conduct accelerated aging and environmental/climatic storage tests on MIC, and develop an industrial process for MIC primer fabrication and assembly.
- 550 - Analysis and Assessment of Military and non-Military Impacts on Biodiversity: A Framework for Environmental Management on DoD Lands Using Mojave Desert As A Regional Case: Continuing project to provide DoD with capability (including techniques, tools, and training) to most effectively carry out its military mission in the context of regional management of biodiversity and related environmental considerations and to consider them not only within the boundaries of the installations but also in the context of the surrounding stakeholders and the cultural and natural resources they manage. Emphasis will be on defining species-habitat relationships and developing alternative future scenarios.
- 500 - Trapped Vortex Combuster for Jet Engines: Project to be completed and transitioned to Integrated High Performance Turbine Engine Technology (IHPTET) Program. Project will develop design rules and demonstrate the feasibility of a trapped vortex combuster for reducing the nitrous oxides, volatile organic compounds, and carbon monoxide emissions from aircraft, land/marine gas turbine engines by 60%. The trapped vortex combuster is expected to reduce specific fuel consumption by 3%.
- 300 - Pesticides Reduction Using Precision Targeting: Project to be completed. Recommendations, final report, software, and preliminary training documentation will be provided to Armed Forces Pest Management Board. The project will develop techniques to reduce DoD pesticide use and associated risks using "Precision Targeting" in comparative risk assessment and reduction processes. Will develop a standardized system to reduce pesticide use that is comprehensive, verifiable, documentable, and portable.
- 150 - Detection and Identification of Multiple Hazardous Air Pollutants (HAPs) at Extended Distances: Two continuing Proof of Concept projects are addressing the issues of compliance and pollution prevention needs of military installations. One is the development of an ultra broad-band radiation technology for remote detection of HAP emissions at extended distances. The second is a combination infrared spectrometer for gaseous effluents and an induced breakdown spectrometer to monitor VOC and metals emissions, both of which use new laser technologies. Preliminary experiments on chemical identification will be performed.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1998
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603780A Strategic Environmental Research and Development Program/Environmental Security Technology*
	PROJECT D852

FY 1999 Planned Program (continued):

- 34639 The balance of the program includes continuing projects and new starts. All planned new start activities directly respond to the highest priority Defense environmental mission-relevant requirements. Technology thrust areas include:
  - Twelve projects in Restoration will continue. Representative activities may include: demonstrating novel UXO detection sensors, DNAPL remediation technologies, and simulations of cleanup activities.
  - Nine projects in Compliance will continue. Representative activities may include: novel approaches to control air emissions.
  - Eleven projects in Conservation will continue. Representative activities may include: application of novel terrain models to enhance land-use management in training and testing environments, novel methods to inventory, monitor, and assess natural and cultural resources; and development of strategies for noxious species management.
  - Thirteen projects in Pollution Prevention will continue. Representative activities may include: evaluating innovative pollution prevention technologies, processes, and environmental management practices to eliminate wastes, effluents, or emissions at DoD/DOE manufacturing and maintenance activities; applying life cycle analysis and design models that can identify alternatives to hazardous materials in defense process waste streams.

Total 54419

Project Change Summary	FY 1997	FY 1998	FY 1999
FY 1998/1999 President's Budget	0	0	0
Appropriated Value			
Adjustments to Appropriated Value			
FY 1999 President's Budget	0	0	54419

Change Summary Explanation: Funding: FY99 – Program executive agency transferred from OSD to Army.

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

DATE: February 1998

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0604280A Joint Tactical Radio System

PROJECT: D152

COST (*In Thousands*)	FY 1997 Actual	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D152 Joint Tactical Radio System*	0	10000	15600	0	0	0	0	0	0

*This program is a new start in FY 1998. Reprogramming documentation for Congressional approval is in process. The reprogramming will bring FY 1998 funding to $15M. No FY 1998 funds will be obligated until Congressional approval is received. In FY 1999, $3.9M will be moved into the program below threshold, for a total FY 1999 program of $19.5M. Current FY 1999 funding level is due to an administrative database error.

A. Mission Description and Budget Item Justification: The Joint Tactical Radio System (JTRS) is a Research and Development program to develop radio systems to satisfy DOD requirements. This program is a new start in FY 1998. The singular functionality of current radio systems has resulted in a number of unique discrete radio systems which have costly logistics infrastructures. A consolidated systems approach can provide substantial benefits in the overall space, weight, power and cost. JTRS will be a software programmable and hardware configurable digital radio system that provides increased interoperability, flexibility and adaptability to support the varied mission requirements of the warfighters. The system will be capable of simultaneous networked voice, video, and data operations with low probability of intercept over multiple frequency bands. The concept behind JTRS is essential to realizing the goal of a fully digitized battlespace. JTRS lays the foundation for achieving network connectivity across the radio frequency spectrum. The JTRS will provide the operational forces with an upgraded communications capability for more effective battlespace management and interoperability among Command, Control, Communications, Computers and Intelligence (C41) Systems.

Acquisition Strategy: JTRS is a new joint tactical DOD communications system. A FY 1998 prior approval reprogramming document is being prepared for congressional approval of the JTR effort as a FY 1998 new start. The establishment of joint project office and services offices is planned for FY98. The JTRS will support an evolutionary acquisition. A competitive architecture and hardware/software development contract award to multiple vendors is planned for FY98. The JTRS will capitalize on SPEAKeasy, joint combat information terminal (JCIT), programmable modular communication system (PMCS) integrated process team, tactical common data link (TCDL); and establish government/industry teaming.

FY 1997 Accomplishments: Program not funded in FY 1997

FY 1998 Planned Program:

•	3546	Other Government costs (DARPA, JPO OPS, and Tech development labs)
•	6454	Contract for JTRS architecture, hardware/software development, testing and data
Total	10000	

FY 1999 Planned Program:

•	9322	Contract for JTRS hardware/software development, testing and data
•	6278	Other government costs (DARPA, JPO OPS, and tech development labs)
Total	15600	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 1998
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0604280A Joint Tactical Radio System / PROJECT: D152

B. Project Change Summary

	FY 1997	FY 1998	FY 1999
Previous President's Budget	0	0	0
Appropriated Value	0	0	
Adjustments to Appropriated Value	0	10000	
Current Budget Submit/President's Budget	0	10000	15600

Change Summary Explanation: New start in FY 1998. Reprogramming documentation for congressional approval is in process.

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
1	USD (Policy), Pentagon, Room 4B926, Washington, DC 20301-2100
1	DOD Compt, MS, DMI, Pentagon, Room 1B728, Washington, DC 20301-1100
1	OSD, ATTN: DOT&E, Pentagon, Room 3E318, Washington, DC 20301
11	ASD(C3I), Pentagon, Room 3E209, Washington, DC 20301
1	ASD(ISA), Pentagon, Room 4B938, Washington, DC 20301
1	ASD(LA), Pentagon, Room 3D918, Washington, DC 20301
1	USD(P&R), Room 3C980, Washington, DC 20301-4000
1	ASD(PA&E)/GPP/LFD, Pentagon, Room 2B256, Washington, DC 20301
1	ASD (PA&E), Pentagon, Room 2E313, Washington, DC 20301
2	ASD(PA), Pentagon, Room 2D278, Washington, DC 20301
2	JCS(J-8), Pentagon, Room 1E963, Washington, DC 20301
1	HQDA, (SAUS-OR), Pentagon, Room 2E600, Washington, DC 20310
*	HQDA (SAILE), Pentagon, Room 2E614, Washington, DC 20310
*	HQDA (SARD-DEP), Pentagon, Room 2E673, Washington, DC 20310
*	HQDA (SAFM-CAZ-A), 5611 Columbia Pike, Falls Church, VA 22041-5050
*	HQDA (SFIS-API), Hoffman 1, Room 1012, Alexandria, VA 22331-0302
*	HQDA (DACS-DPD), Pentagon, Room 3C738, Washington, DC 20310
*	HQDA (DACS-DPA), Pentagon, Room 1C460, Washington, DC 20310
*	HQDA (SAIS-PPG), Pentagon, Room 1D679, Washington, DC 20310
*	HQDA (DACS-DPA), Pentagon, Room 3C747, Washington, DC 20310
*	HQDA (DACS-DMC), Pentagon, Room 3D631, Washington, DC 20310
1	HQDA (DACS-TE), Pentagon, Room 3C571, Washington, DC 20310
*	HQDA (DAIM-ZR), Pentagon, Room 2B683, Washington, DC 20310

***Distributed electronically**

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
*	HQDA (DAMI-ZXM), Pentagon, Room 2D474, Washington, DC 20310
1	HQDA (DAMI-PBB), Pentagon, Room 2E477, Washington, DC 20310
*	HQDA (DAPE-ZXO), Pentagon, Room 2D735, Washington, DC 20310
*	HQDA (DALO-RMP), Pentagon, Room 1E565, Washington, DC 20310
*	HQDA (DALO-ZA), Pentagon, Room 3E560, Washington, DC 20310
*	HQDA (DAMO-ZR), Pentagon, Room 3D526, Washington, DC 20310
*	HQDA (DAMO-FDR), Pentagon, Room 2D570, Washington, DC 20310
*	HQDA (DAAR-CO), Pentagon, Room 1D432, Washington, DC 20310
*	HQDA (NGB-ZA), Pentagon, Room 2E394, Washington, DC 20310
*	HQDA (DASG-ZA), 5111 Leesburg Pike , Room 638, Falls Church, VA 22041-3258
*	HQDA (DASG-RMZ), 5111 Leesburg Pike, Room 554, Falls Church, VA 22041-3258
*	HQDA (DASG-RDZ), Pentagon, Room 3E368, Washington, DC 20310-2300
*	HQDA (DAIM-ED), Pentagon, Room 1E682, Washington, DC 20310
*	HQDA (DAIM) Pentagon, Room 1E665, Washington, DC 20310
*	HQDA (SAPA), Pentagon, Room 2E641, Washington, DC 20310
*	HQDA (CSSD-RM-W), P.O. Box 15280, Arlington, VA 22215-0150
*	HQDA (SAAG-PRP), Room 1309, 3101 Park Center Drive, Alexandria, VA 22302-1596
*	HQDA (DAMH-ZB), Pulaski Bldg, Room 4229, 20 Massachusetts Avenue, Washington, DC 20314
*	US Army Cost And Economic Analysis Center, ATTN: SFFM-CA-PI, 5611 Columbia Pike, Falls Church, VA 22041-5050
1	BMDO/RM, Pentagon, Room 1E1037, Washington, DC 20310
*	HQDA, (JDRS-PBD), Pentagon, Room 1E610, Washington, DC 20310
*	HQ, PACOM, R&D Requirements (J531), BOX 15, USPACOM Staff, Camp H.M. Smith, HI, 96861
*	Commander, US Army Intelligence and Security Command, ATTN: IARM-PB, Fort Belvoir, VA 22060-5370

***Distributed electronically**

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
*	Commander, US Army Nuclear and Chemical Agency, ATTN: MONA-OPS, Bldg 2073, Backlick Road, Springfield, VA 22150
*	Commander, US Army Medical R&D Command, ATTN: SGRD-RMC, Fort Detrick, Frederick, MD 21701-5012
*	Commander, US Army Medical R&D Command, ATTN: SGRD-PR, Fort Detrick, Frederick, MD 21701-5012
*	Commander, US Army Training and Doctrine Command, ATTN: ATCD-E, Fort Monroe, VA 23651-5000
*	CMDT, Army Field Artillery School, ATTN: ATSF-CSI-P, ATSF-CBL, Ft. Sill, OK 73503-5600
*	CDR, Army Aviation Ctr & Ft. Rucker, ATTN: ATZS-CDI, Ft. Rucker, AL 36362-5000
*	CDR, Army Intelligence Ctr and FT. Huachucha, ATTN: ATZS-CDI-I, ATZS-CDT, Ft. Huachucha, AZ 85613-7000
*	CMDT, U.S. Army Signal Ctr, ATTN: ATZH-CDM, ATZH-BLT, Ft. Gordan, GA 30905-5000
*	Force Design Directorate, ATTN: ATCD-F, 415 Sherman Ave., Ft. Leavenworth, KS 66027-5000
*	CDR, USACHCS, ATTN: ATSC-CD, Ft. Monmouth, NJ 07703-5612
*	CDR, U.S. Army Medical Center & School, ATTN: HSMC-FCM, Ft. Sam Houston, TX 78234
*	CMDT, U.S. Army Air Defense Artillery School, ATTN; ATSA-CDM, Ft. Bliss , TX 79916
*	CMDT, U.S. Army Infantry School, ATTN: ATSH-IWC, ATSH-MLS, Ft. Benning, GA 31905-5400
*	CMDT, U.S. Army Armor School, ATTN: ATZK-CD-ML, ATZK-MW, Ft. Knox, KY 40121-5200
*	CMDT, U.S. Army Engineer School, ATTN: ATSE-CD-M, Ft. Leonard Wood, MO 65473-5000
*	CMDT, U.S. Army Chemical School, ATTN: ATZN-CM-CS, Ft. McClellan, AL 36205-5020
*	CMDT, U.S. Army Military Police School, ATTN: ATZN-MP-CM, Ft. McClellan, AL 36205-5020
*	Commander, US Army Research Institute for the Behavioral and Social Sciences, ATTN: PERI-MB, 5001 Eisenhower Avenue, Alexandria, VA 22333-5600
*	Commander, US Army Operational Test and Evaluation Command, ATTN: CSTE-RMZ, Park Center IV, 4501 Ford Avenue, Alexandria, VA 22302-1458
*	Commander, US Army Materiel Command, ATTN: AMCRD-AB, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001
*	Commander, US Army Materiel Command, ATTN: AMCAE-P, 5001 Eisenhower Avenue, Alexandria, VA 22333
*	Commander, US Army Materiel Command, ATTN: AMCAQ-B-TILO, 5001 Eisenhower Avenue, Alexandria, VA 22333

***Distributed electronically**

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
*	Commander, US Army Communications-Electronics Command, ATTN: AMSEL-CG, Ft. Monmouth, NJ 07703-5000
*	Commander, US Army Communication-Electronics Command, ATTN: AMSEL-ACSB-BT, Ft. Monmouth, NJ 07703-5008
*	Commander, US Army Missile Command, ATTN: AMSMI-AS (Library), Bldg 5250, RMC-147, Redstone Arsenal, AL 35898-5000
*	Commander, US Army Test and Evaluation Command, ATTN: AMSTE-RM, Aberdeen Proving Ground, MD 21005-5055
*	Commander, US Army CECOM, Technical Industrial Liaison Office, ATTN: AMSEL-AC-SP-BL (Sandra Vermont), Ft. Monmouth, NJ 07703-5008
*	Commander, US Army Tank-Automotive Command, ATTN: AMSTA-CG, Warren, MI 48397-5000
*	Commander, US Army Laboratory Command, ATTN: AMSLC-CG, Adelphi, MD 20783-1145
*	Commander, US Army Armament Research, Development and Engineering Center, ATTN: SMCAR-CO, Dover, NJ 07806-5000
*	Commander, Environmental Center, ATTN: SFIM-AEC-RM, Edgewood Area, Aberdeen Proving Ground, MD 21010-5055
*	Commander, US Army Materiel Systems Analysis Activity, ATTN: AMXSY-PB, Aberdeen Proving Ground, MD 21005-5071
*	Commander, US Army Chemical, Biological and Defense Command, ATTN: AMSCB-RR, Aberdeen Proving Ground, MD 21010-5423
*	Commander, US Army Chemical, Biological and Defense Command, ATTN: SCBRD-ASA, Aberdeen Proving Ground, MD 21010-5423
*	Commander, US Army Chemical, Biological and Defense Command, ATTN: AMSCB-EO, Aberdeen Proving Ground, MD 21010-5423
*	Commander, US Army Aviation and Troop Command, ATTN: AMSAT-D-C, 4300 Goodfellow Blvd, St. Louis, MO 63120-1798
*	Program Manager, Instrumentation, Targets and Threat Simulators, ATTN: AMCPM-ITTS, 12350 Research Parkway, Orlando, FL 32826
*	Program Manager, Tank Main Armament Systems, ATTN: AMCPM-TMD PMD, Picatinny Arsenal NJ 07806-5000
*	Program Executive Officer, Missile Defense, ATTN: SFAE-MD-DP-P, Building 5250, Redstone Arsenal, Alabama 35898-5750
*	Program Executive Officer, Field Artillery Systems, ATTN: SFAE-FAS, Building 171, Picatinny Arsenal, Picatinny, NJ 07806-5000
*	Program Executive Officer, Armored Systems Modernization, ATTN: SFAE-HFM-P, Warren, MI 48397-5000
*	Program Executive Officer, Aviation, ATTN: SFAE-AV, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798
*	Program Executive Officer, Tactical Wheeled Vehicles, ATTN: SFAE-TWV, Warren, MI 48397-5000
*	Program Executive Officer, Command and Control Systems, ATTN: SFAE-CC-PMO, Ft. Monmouth, NJ 07703-5000

***Distributed electronically**

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
*	Program Executive Officer, Communication Systems, ATTN: SFAE-COM, Ft. Monmouth, NJ 07703-5000
*	Program Executive Officer, Tactical Missiles, ATTN: SFAE-MSL, Redstone Arsenal, AL 35898-8000
*	Program Executive Officer, Intelligence and Electronic Warfare, ATTN: SFAE-IEW-BM, Ft. Monmouth, NJ 07703
*	Commander, US Army Space and Strategic Defense Command, ATTN: CSSD-RM-BP, P.O. Box 1500, Huntsville, AL 35807-3801
*	Commander, US Army Corps of Engineers, ATTN: CERD-L, Washington, DC 20314
*	Commander, US Army Force Integration Support Agency, ATTN: MOFI-TRED-O, Building 2588, Fort Belvoir, VA 22060-5587
*	Commander, 902d MI Group, ATTN: IAGPA-OPOP, Ft. Meade, MD 20755-5910
*	Commander, HQ US Army Missile & Space Intelligence Center, ATTN: AIAMS-YCC, Redstone Arsenal, AL 35898-5000
*	Commander, US Army Countermeasures/Counter Counter Measures Center, ATTN: AMX-CM-RF, 2800 Powder Mill Rd, Adelpi, MD 2078
*	Commander, US Army Belvoir Research, Development & Engineering Center, ATTN: STRBE-Z, Ft. Belvoir, VA 22060-5606
*	Commander, US Army Research Office, ATTN: SLCRO-AO (Security Officer), P.O. Box 12211, Research Triangle Park, NC 27709
3	Executive Office of the President, Office of Management and Budget, National Security Division, NEOB, Room 10001, Washington, DC 20503
1	Inspector General, ATTN: A&IM/FMD, 400 Army-Navy Drive Arlington, VA 22202-2884
14	US General Accounting Office, ATTN: NSIAD, Room 4103, 441 G Street, NW, Washington, DC 20548
*	HQ USAF/FMBMC, Pentagon, Room 5C129, Washington, DC 20330-5012
*	HQ US Marine Corps, Deputy Chief of Staff for RD&S, Code (MC-RDP-30), Washington, DC 20380
*	Commandant, US Army War College, ATTN: Library, Carlisle Barracks, PA 17013-5050
1	Defense Advanced Research Projects Agency, ATTN: Comptroller, 3701 North Fairfax Drive, Arlington, VA 22203-1714
*	Institute for Defense Analyses, 1801 North Beauregard Street, Alexandria, VA 22311
*	Headquarters, National Aeronautical and Space Administration, Code ID, ATTN: Deputy DOD Affairs, Washington, DC 20546
1	Library of Congress, Rm. LM-208 (202), ATTN: Bruce Krafte, James Madison Library Bldg., 1st Street & Independence Avenue, SE, Washington, DC 20540

***Distributed electronically**

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
1	ACDA/NWC/DPA, Room 5741, 320 21st Street, NW, Washington, DC 20451
2	Pentagon Library, ATTN: Army Studies, Room 1A518, Washington, DC 20310
*	Director, Defense Finance and Accounting Service-Indianapolis Center, ATTN: DFAS-I-PA, Indianapolis, IN 46249
1	Defense Technical Information Center (DTIC), ATTN: Ms. Mawby, Ft. Belvoir Headquarters Complex (FBHC), Suite 0944 8725 John J. Kingman Road, , Ft. Belvoir, VA 22060-6220
1	Defense Technical Information Center (DTIC), ATTN: OCC, Ft. Belvoir Headquarters Complex (FBHC), Suite 0928, 8725 John J. Kingman Road, Ft. Belvoir, VA 22060-6220
11	National Technical Information Service (NTIS), ATTN: Military Publications, 5285 Port Royal Road, Springfield, VA 22161
	HAND DELIVERY
1	DOD(C)(P&S), Room 3A862
3	DOD(C)(INV), Room 4B916
1	DOD(C)(MILCON), Room 3D841
2	DOD(C)(CFO), Room 1B728
27	USD(A) Mailroom, Room 3D139
13	SAFM-BUL, Room 3A652
3	SAFM-BUC-F, Room 3B663
*	SAFM-BUC-I, Room 3A674
*	SAFM-RB, Room 3A720
34	SALL, Room 2C638
16	SAFM-BUI-A, Room 3D400
1	SAFM-BUI-W, Room 3D400

***Distributed electronically**

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
	HAND DELIVERY (continued)
1	SAFM-BUI-O, Room 3D400
1	SARD-TS, Room 3D400
166	Total Print

Any changes to this distribution list should be provided to HQDA (SAFM-BUI-A), Washington, DC 20310, DSN, 223-2687..

***Distributed electronically**