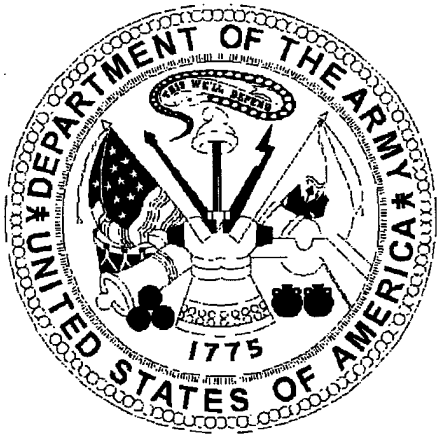
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TOC for Volume 1 only

Supporting Data FY 2001 Budget Estimate
Submitted to Congress - February 2000

DESCRIPTIVE SUMMARIES OF THE



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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)

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VOLUME I

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UNCLASSIFIED

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY FY 2001 FEBRUARY 2000

VOLUME I
Budget Activities 1, 2 and 3

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

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FY 2001 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 (Army RDT&E Budget Item Justification – Program Element level), R-2A (Army RDT&E Budget Item Justification – project level) and R-3 (Army RDT&E Cost Analysis) Exhibits which provide narrative information on all RDT&E program elements and projects for the FY 1999, 2000 and 2001 time period.

2. Relationship of the FY 2001 Budget Submission to the FY 2000/2001 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
0601104A/H59	Institute for Creative Technology	0601104A/J08
0602308A/C90	Modeling & Simulation for Training and Design	0602308A/D02
0602618A/H80	Robotics Technology	0602618A/H03
0602720A/895	Pollution Prevention Technology	0603728A/025
0603005A/440	Future Combat Vehicle	0602601A/HH7
Transfer from OMA	Army Distance Learning Program	0605013A/087
Transfer from OMA	SIDPERS-3	0605013A/099
Transfer from OMA	Transportation Coordinator's Automated Information for Movement System II	0605013A/137
Transfer from OMA	Installation Support Module (ISM)	0605013A/184
Transfer from OMA	Army Recruiting Information Support System	0605013A/185
Transfer from OMA	Medical Communications for Combat Casualty Care	0605013A/193

A. Program Element Restructures. (Continued)

OLD PE/PROJECT	NEW PROJECT TITLE	NEW PE/PROJECT
Transfer from OMA	Horizontal Technology Integration (HTI)	0605013A/196
Transfer from OMA	TACMIS	0605013A/252
Transfer from OMA	PM Global Combat Support System – Army Core	0605013A/286
Transfer from OMA	Joint Computer-Aided Acquisition and Logistics Support (JCALS)	0605013A/299
Transfer from OMA	STACOMP	0605013A/316
0708610A (OMA PE)	Army High Performance Computing	0605803A/731
0604280A/152 (BA 3 – FY 1999 only)	Joint Tactical Radio System	0603280A/155
0604802A/D134	Objective Individual Combat Weapon	0603802A/DAS3
0604802A/695	XM982 Projectile	0604814A/708
0604802A/613	Mortar Systems	0603802A/AS4
0603606A/683	Anti-Personnel Landmine Alternatives	0604808A/434
0604808A/434	Anti-Personnel Landmine Alternative (Mixed Systems)	0604808A/443
Transfer from OMA	Global Combat Support System – Army	0303141A/083

B. FY 2001 Developmental Transitions.

FROM PE/PROJECT	PROJECT TITLE	TO PE/PROJECT
0601104A/H59	Modeling & Simulation for Training and Design	0602308A/D02
0603619A/005	Mine Systems – Engineering Development	0604808A/016

C. Establishment of New FY 2001 Program Elements/Projects. One major system new start is associated with the New Army Transformation and is denoted by a diamond. Minor new initiatives for FY 2001, in addition to Congressionally directed initiatives for FY 2000, are shown below with asterisks. The remaining programs listed are outyear initiatives or restructures beyond FY 2000 or were previously funded from other Defense appropriations.

TITLE	PE/PROJECT
Effects Control System	0203726A/324
Global Combat Support System – Army*	0303141A/083
Information Dominance Center – TIARA*	0305128A/H13
Joint Technology Center System Integration Lab*	0305204A/123
Science Base Emerging Infectious Diseases*	0601102A/S20
Counter Terrorism Program*	0601104A/J07
Institute for Creative Technology*	0601104A/J08
Aero-Propulsion Technology*	0602303A/223
Tactical High Energy Laser Technology	0602307A/042
Future Combat Vehicle	0602601A/HH7
21st Century Truck (T21)*	0602601A/T21
Optical Spectroscopy*	0602622A/556
Corrosion Measurement and Control Project*	0602720A/959
Watervliet Arsenal Pollution Projects*	0602720A/960
Vessel Plating Technology*	0602720A/961
Range Safety Technology Demo*	0602720A/F28
Phyto-Remediation in Arid Lands*	0602720A/F29
Polynitroxylated Hemoglobin*	0602787A/962
National Medical Testbed*	0602787A/963
Informatics-Based Medical Emergency Decision (IMED) Tools*	0602787A/964
Dye Targeted Laser Fusion*	0602787A/967
Eye Research*	0602787A/965
Blood Research*	0602787A/966
Synchronization-Based High Energy Radiation Beam Cancer Detection*	0602787A/968
Emerging Infectious Diseases	0602787A/997
Force Project Logistics	0603001A/545
Biosystems Technology*	0603001A/557
Combat Id for Dismounted Soldiers (CIDS)*	0603001A/J51

C. Establishment of New FY 2001 Program Elements/Projects. (Continued)

TITLE	PE/PROJECT
Telemedicine Testbed	0603002A/800
Alcoholism Research*	0603002A/969
Enzymatic Wound Disinfectant*	0603002A/970
HIV Research*	0603002A/971
Laser Vision Correction*	0603002A/972
Recombinant Vaccine Research*	0603002A/973
Smart Aortic Research*	0603002A/974
Protection Against Emerging Infectious Diseases*	0603002A/975
Warhead and Energetics Center of Excellence*	0603004A/244
Robotic Ground Systems*	0603005A/515
Abrams Engine*	0603005A/532
Technology Transfer Center*	0603005A/533
Mobile Parts Hospital*	0603005A/539
Improved HMMWV Research*	0603005A/540
Breast Cancer Stamp	0603002A/945
Medium Armored Vehicle Development◆	0603653A/C03
Collaborative Telemaintenance*	0603772A/285
Tactical Simulation Interface Unit (TSIU)*	0603308A/979
Shoulder-Launched Multipurpose Assault Weapon*	0603802A/066
Objective Individual Combat Weapon (OICW)	0603802A/AS3
Combat Trauma Patient Simulation*	0603807A/853
Modernized Hellfire	0604329A/013
Lightweight Laser Designator Rangefinder Upgrades	0604710A/L76
Horizontal Technology Integration for Tactical Lasers	0604710A/L77
Embedded Diagnostics/Prognostics Development	0604746A/L66
Tactical Exploitation System (TES) (TIARA)	0604766A/957
Aviation Combined Arms Tactical Trainer – WRAP	0604780A/585
Anti-Personnel Landmine Alternatives*	0604808A/434
Anti-Personnel Landmine Alternative (Mixed Systems)*	0604808A/443
Common Software	0604818A/334
Line-of-Sight Anti-Tank (LOSAT) Missile	0604819A/046
Paladin/FAASV	0604854A/516

Future Direct Support Weapon 0604854A/523

C. Establishment of New FY 2001 Program Elements/Projects. (Continued)

TITLE	PE/PROJECT
Army Distance Learning Program*	0605013A/087
SIDPERS-3*	0605013A/099
Transportation Coordinators' Automated Information for Movement System II*	0605013A/137
Installation Support Modules (ISM)*	0605013A/184
Army Recruiting Information Support System*	0605013A/185
Medical Communications For Combat Casualty Care*	0605013A/193
Horizontal Technology Integration (HTI)*	0605013A/196
TACMIS*	0605013A/252
PM Global Combat Support System-Army Core*	0605013A/286
Joint Computer-Aided Acquisition and Logistics Support (JCALS)*	0605013A/299
STACOMP*	0605013A/316
Force XXI Experimentation	0605326A/312
Army Explosives Safety Management	0605805A/858
Acquisition Pollution Prevention	0605857A/031

D. FY 2001 programs for which funding was shown in the FY 2000/2001 President's Budget Submit (February 1999), but which are no longer funded.

PE/PROJECT	TITLE	BRIEF EXPLANATION
0203726A/2ET	AFATDS Operational Test	ACAT category changed from ACAT I to ACAT II – funds transferred to 0605712A/001
0203802A/689	ATACMS Block IIIB	Program terminated
0602787A/845	Bone Disease Research Program	Program completed
0602308A/636	Army After Next (AAN) Applied Research	Program terminated
0602720A/895	Pollution Prevention	Restructured to PE 0603728A/02
0604802A/134	Objective Individual Combat Weapon	Funds transferred BA 4 PE 0603802A/AS3 to support the PDDR phase rather than EMD.
0603004A/L94	Electric Gun System Demo	Demonstration program delayed until FY 2006
0603313A/380	Multi-Platform Launcher	Program terminated
0603313A/493	Rapid Force Projection Demo	ACTD Completed

D. FY 2001 programs for which funding was shown in the FY 2000/2001 President's Budget Submit (February 1999), but which are no longer funded (continued).

PE/PROJECT	TITLE	BRIEF EXPLANATION
0604321A/2FT	ASAS Operational Test	ACAT category changed from ACAT I to ACAT II – funds transferred to 0605712A/001
0604645A/022	FSV-Engineering Development	Program terminated in support of the Army Transformation
0604649A/G25	M1 Breacher Development	Program terminated in support of the Army Transformation
0604768A/686	ATACMS Block IIA	Program terminated in support of the Army Transformation
0708045A/E31	National Defense Center for Environmental Excellence (NDCEE)	Funds transferred to BA 4 PE 0603779A/035 as per Congressional direction.

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

0203735A/DC64
0203808A
0301359A
0602104A
0602122A
0602601A/C84
0602786A/AC60
0603003A/D391
0603005A/DC62/DC66
0603009A
0603017A
0603020A
0603122A
0603322A
0603710A/DC65/ DC67
0603851A
0604328A

Exhibit R-1

Department of the Army
FY 2001 RDT&E Program

Summary

Date: Feb 2000

Thousands of Dollars

Summary Recap of Budget Activities	FY 1999	FY 2000	FY 2001
Basic Research	176,737	204,407	200,988
Applied Research	612,641	790,919	602,489
Advanced Technology Development	633,601	684,393	490,905
Demonstration and Validation	488,701	475,627	661,451
Engineering and Manufacturing Development	1,247,140	1,503,189	1,770,357
RDT&E Management Support	1,262,886	739,294	696,943
Operational Systems Development	609,064	827,439	837,213
Total Research Development Test & Eval Army	5,030,770	5,225,268	5,260,346

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Department of the Army
FY 2001 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 2000

Line No	Program Element Number	Item	Act	FY 1999	FY 2000	FY 2001
				Thousands of Dollars		
1	0601101A	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	1	12,139	14,119	14,459
2	0601102A	DEFENSE RESEARCH SCIENCES	1	122,255	125,918	132,164
3	0601104A	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	1	42,343	64,370	54,365
	Basic Research			176,737	204,407	200,988
4	0602104A	TRACTOR ROSE	2	0	6,743	0
5	0602105A	MATERIALS TECHNOLOGY	2	12,867	16,266	11,557
6	0602120A	SENSORS AND ELECTRONIC SURVIVABILITY	2	16,334	24,850	20,722
7	0602122A	TRACTOR HIP	2	11,603	9,210	7,226
8	0602211A	AVIATION TECHNOLOGY	2	23,854	30,048	31,080
9	0602270A	EW TECHNOLOGY	2	15,569	17,402	17,310
10	0602303A	MISSILE TECHNOLOGY	2	29,234	47,939	47,183
11	0602307A	ADVANCED WEAPONS TECHNOLOGY	2	0	0	993
12	0602308A	ADVANCED CONCEPTS AND SIMULATION	2	20,917	29,677	30,479
13	0602601A	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	2	38,139	54,776	63,589
14	0602618A	BALLISTICS TECHNOLOGY	2	26,839	42,017	49,750
15	0602622A	CHEMICAL, SMOKE AND EQUIP DEFEATING TECHNOLOG	2	4,660	4,953	3,530
16	0602623A	JOINT SERVICE SMALL ARMS PROGRAM	2	5,008	5,161	5,415
17	0602624A	WEAPONS AND MUNITIONS TECHNOLOGY	2	28,185	36,521	33,761
18	0602705A	ELECTRONICS AND ELECTRONIC DEVICES	2	25,004	36,812	23,869
19	0602709A	NIGHT VISION TECHNOLOGY	2	18,341	20,021	20,465
20	0602712A	COUNTERMINE SYSTEMS DEVELOPMENT	2	10,265	14,380	12,386
21	0602716A	HUMAN FACTORS ENGINEERING TECHNOLOGY	2	16,204	19,681	15,786
22	0602720A	ENVIRONMENTAL QUALITY TECHNOLOGY	2	62,208	78,905	13,994
23	0602782A	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	2	21,597	19,519	23,314
24	0602783A	COMPUTER AND SOFTWARE TECHNOLOGY	2	3,777	5,173	3,987
25	0602784A	MILITARY ENGINEERING TECHNOLOGY	2	51,203	47,639	42,344
26	0602785A	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	2	8,249	12,005	11,869
27	0602786A	WARFIGHTER TECHNOLOGY	2	18,075	25,831	24,659
28	0602787A	MEDICAL TECHNOLOGY	2	134,002	174,199	75,729
29	0602789A	ARMY ARTIFICIAL INTELLIGENCE TECHNOLOGY	2	1,119	1,267	1,338
30	0602805A	DUAL USE SCIENCE & TECHNOLOGY PROGRAM	2	9,388	9,924	10,154
	Applied Research			612,641	790,919	602,489

Department of the Army
FY 2001 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 2000

Line No	Program Element Number	Item	Act	FY 1999	FY 2000	FY 2001
				Thousands of Dollars		
31	0603001A	WARFIGHTER ADVANCED TECHNOLOGY	3	30,322	44,831	15,469
32	0603002A	MEDICAL ADVANCED TECHNOLOGY	3	223,999	73,252	16,512
33	0603003A	AVIATION ADVANCED TECHNOLOGY	3	43,509	33,921	28,810
34	0603004A	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	3	24,049	58,042	29,738
35	0603005A	COMBAT VEHICLE AND AUTOMATIVE ADVANCED TECH	3	58,706	130,525	148,114
36	0603006A	COMMAND, CONTROL, COMM ADVANCED TECHNOLOGY	3	22,892	27,612	21,505
37	0603007A	MANPOWER, PERSONNEL AND TRAINING ADV TECH	3	2,869	4,981	3,072
38	0603009A	TRACTOR HIKE	3	10,391	12,469	12,217
39	0603013A	TRACTOR DIRT	3	40	0	0
40	0603017A	TRACTOR RED	3	4,420	4,549	984
41	0603020A	TRACTOR ROSE	3	2,427	11,070	10,892
42	0603105A	MILITARY HIV RESEARCH	3	5,497	5,931	5,889
43	0603122A	TRACTOR HIP	3	0	2,414	980
44	0603238A	AIR DEFENSE/PRECISION STRIKE TECHNOLOGY	3	10,236	24,435	21,307
45	0603270A	EW TECHNOLOGY	3	10,911	16,060	15,359
46	0603280A	JOINT TACTICAL RADIO SYSTEM	3	9,405	0	0
47	0603313A	MISSILE AND ROCKET ADVANCED TECHNOLOGY	3	59,366	51,188	25,107
48	0603322A	TRACTOR GEM	3	4,175	2,648	3,083
49	0603606A	LANDMINE WARFARE AND BARRIER ADV TECHNOLOGY	3	22,651	47,117	20,894
50	0603607A	JOINT SERVICE SMALL ARMS PROGRAM	3	12,532	8,760	4,469
51	0603654A	LINE-OF-SIGHT TECHNOLOGY DEMO	3	15,126	37,845	50,727
52	0603710A	NIGHT VISION ADVANCED TECHNOLOGY	3	25,402	42,262	33,341
53	0603728A	ENVIRONMENTAL QUALITY TECHNOLOGY DEVELOPMENT	3	0	1,327	1,616
54	0603734A	MILITARY ENGINEERING ADVANCED TECHNOLOGY	3	16,270	15,762	5,207
55	0603772A	ADV TACTICAL COMPUTER SCIENCE & SENSOR TECH	3	18,406	27,392	15,613
		Advanced Technology Development		633,601	684,393	490,905
56	0603308A	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION	4	37,929	61,528	12,573
57	0603619A	LANDMINE WARFARE AND BARRIER - ADV DEV	4	7,802	10,934	22,803
58	0603639A	ARMAMENT ENHANCEMENT INITIATIVE	4	37,302	56,286	30,139
59	0603653A	ADVANCED TANK ARMAMENT SYSTEM	4	8,464	1,922	118,139
60	0603713A	ARMY DATA DISTRIBUTION SYSTEM	4	16,084	10	17
61	0603747A	SOLDIER SUPPORT AND SURVIVABILITY	4	7,594	12,719	13,574
62	0603774A	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	4	2,240	3,164	10,968

Exhibit R-1

Department of the Army
FY 2001 RDT&E Program

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 2000

Thousands of Dollars

Line No	Program Element Number	Item	Act	FY 1999	FY 2000	FY 2001
63	0603779A	ENVIRONMENTAL QUALITY TECHNOLOGY	4	0	0	4,897
64	0603790A	NATO RESEARCH AND DEVELOPMENT (H)	4	3,843	1,858	1,920
65	0603801A	AVIATION - ADV DEV	4	10,996	8,655	5,848
66	0603802A	WEAPONS AND MUNITIONS - ADV DEV	4	0	4,681	28,679
67	0603804A	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	4	21,337	8,428	6,317
68	0603805A	CBT SERVICE SUPPORT CONTROL SYS EVAL & ANALYS	4	14,312	11,017	13,753
69	0603807A	MEDICAL SYSTEMS - ADV DEV	4	11,205	16,566	15,259
70	0603851A	TRACTOR EARL	4	915	1,079	979
71	0603854A	ARTILLERY SYSTEMS DEMONSTRATION/VALIDATION	4	300,429	266,158	355,309
72	0603856A	SCAMP BLOCK II (SPACE)	4	7,449	10,622	20,277
73	0603889A	COUNTERDRUG R&D PROJECTS	4	800	0	0
		Demonstration and Validation		488,701	475,627	661,451
74	0604201A	AIRCRAFT AVIONICS	5	15,027	6,324	42,280
75	0604220A	ARMED, DEPLOY OH-58D	5	0	0	532
76	0604223A	COMANCHE	5	352,217	463,124	614,041
77	0604270A	EW DEVELOPMENT	5	77,557	80,019	61,056
78	0604280A	JOINT TACTICAL RADIO SYSTEM	5	0	36,520	62,218
79	0604321A	ALL SOURCE ANALYSIS SYSTEM	5	35,246	53,248	44,084
80	0604328A	TRACTOR EARL	5	1,834	2,826	2,916
81	0604329A	MODERNIZED HELLFIRE	5	0	0	4,969
82	0604601A	INFANTRY SUPPORT WEAPONS	5	0	0	2
83	0604604A	MEDIUM TACTICAL VEHICLES	5	0	1,958	1,959
84	0604609A	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ED	5	659	913	3,461
85	0604611A	JAVELIN (AWWS-M)	5	3,996	489	490
86	0604619A	LANDMINE WARFARE	5	23,825	13,218	15,902
87	0604622A	FAMILY OF HEAVY TACTICAL VEHICLES	5	7,992	1,373	0
88	0604633A	AIR TRAFFIC CONTROL	5	1,550	4,911	2,026
89	0604641A	TACTICAL UNMANNED GROUND VEHICLE	5	2,528	4,905	0
90	0604642A	LIGHT TACTICLE WHEELED VEHICLE	5	0	7,441	9,893
91	0604645A	ARMORED SYSTEMS MODERNIZATION (ASM)-ENG DEV	5	4,259	2,877	2,200
92	0604649A	ENGINEER MOBILITY EQUIPMENT DEVELOPMENT	5	69,044	57,880	0
93	0604710A	NIGHT VISION SYSTEMS - ENG DEV	5	19,490	38,266	32,574
94	0604713A	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	5	62,500	60,600	86,321

Exhibit R-1

Department of the Army
FY 2001 RDT&E Program

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 2000

Line No	Program Element Number	Item	Act	FY 1999	FY 2000	FY 2001
				Thousands of Dollars		
95	0604715A	NON-SYSTEM TRAINING DEVICES - ENG DEV	5	67,515	72,529	73,295
96	0604716A	TERRAIN INFORMATION - ENG DEV	5	6,320	5,308	6,082
97	0604726A	INTEGRATED METEOROLOGICAL SUPPORT SYSTEM	5	1,901	2,301	1,771
98	0604739A	JTT/CIBS-M (TIARA)	5	4,192	4,519	6,060
99	0604741A	AIR DEFENSE C2I - ENG DEV	5	13,033	7,943	16,462
100	0604746A	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	5	9,423	16,063	12,956
101	0604760A	DISTRIBUTIVE INTERACTIVE SIMULATIONS ENG DEV	5	2,634	7,605	20,689
102	0604766A	TAC EXPLOIT NAT CAP (TENCAP)-EMD (TIARA)	5	42,025	71,879	57,419
103	0604768A	BRILLIANT ANTI-ARMOR SUBMUNITION(BAT)	5	131,940	142,753	96,102
104	0604770A	JOINT SURVEILLANCE/TARGET ATTACK RADAR SYSTEM	5	5,316	25,676	17,898
105	0604778A	POSITIONING SYS DEVEL (SPACE)	5	365	439	2,420
106	0604780A	COMBINED ARMS TACTICAL TRAINER (CATT)	5	21,644	19,775	18,498
107	0604801A	AVIATION - ENG DEV	5	11,056	13,439	7,104
108	0604802A	WEAPONS AND MUNITIONS - ENG DEV	5	39,650	68,464	22,505
109	0604804A	LOGISTICS & ENGINEER EQUIPMENT - ENG DEV	5	26,620	22,844	20,457
110	0604805A	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ED	5	19,618	23,836	49,316
111	0604807A	MEDICAL MATERIEL/MED BIO DEFENSE EQUIPMENT ED	5	5,160	9,636	6,318
112	0604808A	LANDMINE WARFARE/BARRIER - ENG DEV	5	37,467	29,893	69,584
113	0604814A	SENSE AND DESTROY ARMOR - ENG DEV	5	30,305	24,128	52,848
114	0604817A	COMBAT IDENTIFICATION	5	15,520	8,566	5,362
115	0604818A	ARMY TACTICAL COMM & CONT HARDWARE & SOFTWARE	5	33,993	38,970	33,420
116	0604819A	LINE-OF-SIGHT ANIT-TANK MISSILE (LOSAT)	5	0	0	26,800
117	0604820A	RADAR DEVELOPMENT	5	6,708	5,089	8,429
118	0604823A	FIREFINDER	5	19,601	39,860	37,363
119	0604824A	COSSI	5	16,351	0	0
120	0604854A	ARTILLERY SYSTEMS - ENGINEERING DEVELOPMENT	5	1,059	4,782	20,105
121	0605013A	ARMY INFORMATION TECHNOLOGY DEVELOPMENT	5	0	0	94,170
		Engineering and Manufacturing Development		1,247,140	1,503,189	1,770,357
122	0604256A	THREAT SIMULATOR DEVELOPMENT	6	12,354	19,683	13,901
123	0604258A	TARGET SYSTEMS DEVELOPMENT	6	12,379	13,298	13,346
124	0604759A	MAJOR TEST & EVALUATION INVESTMENT	6	35,551	39,095	44,019
125	0605103A	RAND ARROYO CENTER	6	16,812	17,523	19,872
126	0605301A	ARMY KWAJALEIN ATOLL	6	127,470	139,322	153,326

Department of the Army
FY 2001 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 2000

Line No	Program Element Number	Item	Act	FY 1999	FY 2000	FY 2001
				Thousands of Dollars		
127	0605326A	CONCEPTS EXPERIMENTATION	6	16,954	20,785	15,410
128	0605502A	SMALL BUS INV RSCH/SMALL BUS TECH PILOT PROG	6	112,204	0	0
129	0605601A	ARMY TEST RANGES AND FACILITIES	6	120,024	146,485	119,657
130	0605602A	ARMY TECHNOLOGY & SUSTAINING INSTRUMENTATION	6	41,726	31,439	33,156
131	0605604A	SURVIVABILITY/LETHALITY ANALYSIS	6	33,341	34,892	27,248
132	0605605A	DOD HIGH ENERGY LASER SYS TEST FAC (HELSTF)	6	23,131	30,803	14,521
133	0605606A	AIRCRAFT CERTIFICATION	6	2,878	3,010	3,200
134	0605702A	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	6	6,539	6,823	6,927
135	0605706A	MATERIEL SYSTEMS ANALYSIS	6	9,557	8,783	8,737
136	0605709A	EXPLOITATION OF FOREIGN ITEMS	6	3,882	4,112	3,582
137	0605712A	SUPPORT OF OPERATIONAL TESTING	6	64,312	68,659	71,079
138	0605716A	ARMY EVALUATION CENTER	6	26,248	24,163	26,337
139	0605801A	PROGRAMWIDE ACTIVITIES	6	67,210	64,014	73,811
140	0605803A	TECHNICAL INFORMATION ACTIVITIES	6	19,252	15,859	26,749
141	0605805A	MUNITIONS STANDARDZION EFFECTIVENESS & SAFETY	6	10,616	18,800	11,276
142	0605853A	ENVIRONMENTAL CONSERVATION	6	3,117	0	0
143	0605854A	POLLUTION PREVENTION	6	9,427	0	0
144	0605856A	ENVIRONMENTAL COMPLIANCE-RDT&E	6	51,522	4,000	0
145	0605857A	ACQUISITION POLLUTION PREVENTION	6	0	0	5,418
146	0605876A	MINOR CONSTUCTION (RPM) - RDTE	6	4,049	0	0
147	0605878A	MAINTENANCE AND REPAIR (RPM) - RDTE	6	90,568	0	0
148	0605879A	REAL PROPERTY SERVICES (RPS)	6	85,645	0	0
149	0605896A	BASE OPERATIONS-RDT&E	6	233,611	0	0
150	0605898A	MANAGEMENT HEADQUARTERS (RSCH & DEVELOPMENT)	6	21,983	27,746	5,371
151	0909999A	CLOSED ACCOUNT ADJUSTMENT	6	524	0	0
		RDT&E Management Support		1,262,886	739,294	696,943
152	0603778A	MLRS PRODUCT IMPROVEMENT PROGRAM	7	25,083	66,595	59,523
153	0102419A	JOINT LAND ATTACK CRUISE MISSILE DEFENSE (JLENS)	7	12,638	24,722	24,996
154	0203610A	EMERGENCY PREPAREDNESS TRAINING	7	15,000	6,000	0
155	0203726A	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	7	34,569	40,860	36,816
156	0203735A	COMBAT VEHICLE IMPROVEMENT PROGRAMS	7	89,010	83,271	99,423
157	0203740A	MANEUVER CONTROL SYSTEM	7	28,720	45,776	48,910
158	0203744A	AIRCRAFT MODIFICATIONS/PRODUCT IMPROV PROGRAM	7	23,577	80,786	95,829

Department of the Army
FY 2001 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 2000

Line No	Program Element Number	Item	Act	FY 1999	FY 2000	FY 2001
				Thousands of Dollars		
159	0203752A	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	7	6,543	3,859	2,929
160	0203758A	DIGITIZATION	7	40,056	29,941	29,671
161	0203759A	FORCE XXI BATTLE CMD, BRIGADE & BELOW	7	56,328	65,176	63,601
162	0203761A	FORCE XXI WARFIGHTING RAPID ACQUISITION PGM	7	0	36,621	6,021
163	0203801A	MISSILE/AIR DEFENSE PRODUCT IMPRV PROGRAM	7	14,452	32,211	12,365
164	0203802A	OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS	7	1,201	17,687	64,418
165	0203808A	TRACTOR CARD	7	3,780	3,869	3,837
166	0208010A	JOINT TACTICAL COMMUNICATIONS PROG (TRI-TAC)	7	34,086	18,293	38,926
167	0208053A	JOINT TACTICAL GRD STATION (TIARA)	7	11,576	27,849	6,267
168	0301359A	SPECIAL ARMY PROGRAM	7	9,479	18,796	5,215
169	0303140A	INFORMATION SYSTEMS SECURITY PROGRAM	7	14,650	15,247	8,140
170	0303141A	GLOBAL COMBAT SUPPORT SYSTEM - ARMY	7	0	0	71,955
171	0303142A	SATCOM GROUND ENVIRO (SPACE)	7	50,648	35,958	43,229
172	0303150A	ARMY GLOBAL C2 SYS	7	17,455	11,542	14,234
173	0305114A	TRAFFIC CNTL/APPROACH/LANDING SYS (JPALS)	7	0	0	783
174	0305128A	SECURITY AND INTELLIGENCE ACTIVITIES	7	899	6,866	0
175	0305204A	TACTICAL UNMANNED AERIAL VEHICLE	7	50,189	43,087	29,427
176	0305206A	AIRBORNE RECONNAISSANCE ADVANCED DEVELOPMENT	7	7,224	4,895	4,898
177	0305208A	DISTRIBUTED COMMON GROUND SYSTEMS	7	8,585	8,004	7,894
178	0708045A	MANUFACTURING TECHNOLOGY	7	50,532	99,528	57,906
179	1001018A	NATO JSTARS - TIARA	7	2,784	0	0
		Operational Systems Development		609,064	827,439	837,213
		Total Research Development Test & Eval Army		5,030,770	5,225,268	5,260,346

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10	0602303A	Missile Technology	123
11	0602307A	Advanced Weapons Technology	129
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13	0602601A	Combat Vehicle and Automotive Technology	139
14	0602618A	Ballistics Technology	157
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Sense and Destroy Armor Munition - Engineering Development	0604814A	1081
Sensors and Electronic Survivability	0602120A	95
Smoke, Obscurant and Target Defeating System - Engineering Development	0604609A	737
Soldier Support and Survivability	0603747A	553
Support of Operational Testing	0605712A	1253
Survivability/Lethality Analysis	0605604A	1223
Tactical Exploitation of National Capabilities (TENCAP) - Engineering & Manufacturing Development (TIARA)	0604766A	911
Tactical Unmanned Aerial Vehicles	0305204A	1505
Tactical Unmanned Ground Vehicle	0604641A	759
Tank and Medium Caliber Ammunition	0603639A	523
Target Systems Development	0604258A	1179
Technical Information Activities	0605803A	1269
Terrain Information - Engineering Development (TIARA)	0604716A	849
Threat Simulator Development	0604256A	1175
University and Industry Research Centers	0601104A	67
Warfighter Advanced Technology	0603001A	333
Warfighter Technology	0602786A	275
Weapons and Munitions - Advanced Development	0603802A	597
Weapons and Munitions - Engineering Development	0604802A	959
Weapons and Munitions Advanced Technology	0603004A	389
Weapons and Munitions Technology	0602624A	173

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

DATE: February 2000

BUDGET ACTIVITY: 1 - Basic Research

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

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	12139	14119	14459	14763	14997	15218	15437	Continuing	Continuing
A91A In-House Laboratory Independent Research - Army Material Command	8128	9761	10022	10261	10415	10560	10700	Continuing	Continuing
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	3352	3637	3703	3758	3831	3901	3978	Continuing	Continuing
A91D In-House Laboratory Independent Research - Corps of Engineers	659	721	734	744	751	757	759	Continuing	Continuing

A. 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. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601101A In-House Laboratory Independent Research**

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 PB)	13574	14193	14499
Appropriated Value	13678		
Adjustments to Appropriated Value			
a. Congressional General Reductions	-104		
b. SBIR / STTR	-268		
c. Omnibus or Other Above Threshold Reductions		-40	
d. Below Threshold Reprogramming	-1167		
e. Rescissions		-34	
Adjustments to Budget Years Since FY 1999 PB			-40
Current Budget Submit (FY 2001PB)	12139	14119	14459

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601101A In-House Laboratory Independent Research**
	PROJECT **A91A**

COST *(In Thousands)*	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A91A In-House Laboratory Independent Research - Army Material Command	8128	9761	10022	10261	10415	10560	10700	Continuing	Continuing

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

FY 1999 Accomplishments:

- 8128 - Missile RDEC – Conducted research on transparent metals and IR emissivity control for new and improved missile sensors, gel propellant for rocket/missile propulsion, chaos control techniques for guidance and control, and computational fluid dynamics for structural capabilities.
  - Armaments RDEC – Evaluated micro-electro mechanical systems (MEMS) technology for low-cost projectile guidance and control (G&C) and material characteristics and advanced energetic materials for improved propellants and explosives.
  - Tank-Automotive RDEC – Developed advanced propulsion simulation tools to upgrade ground vehicles quicker and cheaper; completed assessment of non-linear military vehicle dynamics to make next generation vehicles lighter and more mobile; developed advanced ground vehicle signature algorithms to significantly enhance vehicle survivability.
  - Natick RDEC – Validated models of materials/fabric/food; transferred results to the clothing program by providing scientific understanding of air-humidity interactions for improved clothing comfort and utility; transferred results to the rations program by providing tools for precise measurement of moisture distribution in rations to improve quality.
  - Edgewood RDEC – Initiated a project to examine the feasibility of developing sensors to detect viruses. Started development of new data reduction/analysis algorithms that would be required for satellite/high altitude chemical imaging sensors.
  - Aviation RDEC – Demonstrated the feasibility of an oscillatory-blowing concept to eliminate rotor airfoil stall in a 2-D model test; demonstrated the capability of Particle Image Velocimetry (PIV) to measure 2-D instantaneous velocity fields; developed mathematical model for the active-elevon concept and integrated it into a comprehensive rotorcraft analysis code; developed a more computationally efficient wake-tracing technique to capture rotor wake during blade/vortex interaction; developed family of slotted airfoils with 20% higher maximum lift/drag ratio.
  - Communications-Electronics RDEC – Investigated IR imaging technology in military medicine; reduced size of VHF and UHF microstrip antennas for conformal platform applications; developed and evaluated advanced electrolytes for lithium rechargeable batteries; modeled the electromagnetic propagation/interference of phased array antennas improves communications-on-the-move capabilities; established framework to transition research on mid-IR laser using difference frequency generation.

Total 8128

FY 2000 Planned Program:

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91A

•	9596	- 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 – Conduct research on meta stable intermolecular composites (nanoparticle explosives), advanced low cost fuzing technology (MEMs, multi-function processing), advanced barrel coating modeling, and effects of high flame temperature and high pressure on current and Future Combat Systems. Evaluate smart materials for projectile in-flight course correction. - Tank-Automotive RDEC – Improve unique advanced propulsion technology, sophisticated multibody ground vehicle dynamic systems, and advanced signature management techniques to develop future vehicles that are lighter, more mobile, and highly survivable. - Natick RDEC – Validate mathematical models to gain insights into protective properties, strength of fabrics, and aerodynamics of parachutes. Perform nanotechnology research to create new high performance polymers for fabrics and protection applications. - Edgewood RDEC – Conduct research 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 – Focus on optimization of blowing-slot location, frequency of oscillation and amplitude of blowing in the dynamic stall environment; construct full scale Particle Image Velocimeter; develop design approaches and concepts to integrate the actuation system with the blade structure to achieve a continuous elastic deformation of the airfoil contour near the trailing edge of the blade. - Communications-Electronics RDEC – Transition antenna technologies: improve power sources technology, advance sensor technology base.
•	165	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	9761	

FY 2001 Planned Program:

•	10022	- 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 – Characterize meta stable intermolecular composites. Conduct research in the area of composite material in the areas of high pressure loading (i.e. gun components). Conduct research on smart material designed to provide in flight course corrections. - Tank-Automotive RDEC – Evaluate/validate the accuracy and sensitivity of warfighting requirements simulation models for advanced propulsion, non-linear multibody dynamics, signature management and nontraditional material stress analysis. - Natick RDEC – Transition results from biotechnology efforts to improved food safety and chemical protective fabrics. - Edgewood RDEC – Conduct research for a specific virus detector based on previously validated concepts. Continue construction of data reduction/analysis algorithms needed for the development of a satellite/high altitude chemical imaging sensor. - Aviation RDEC – Validate concepts for "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 newly developed antenna technologies; improve power sources technology; advance sensor technology base.
Total	10022	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91C

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	3352	3637	3703	3758	3831	3901	3978	Continuing	Continuing

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 1999 Accomplishments:

•	2152	- Conducted research to examine transcutaneous immunization. Researchers discovered that application of cholera toxin to the skin resulted in immunization against the cholera toxin and other substances mixed with the toxin. Research in this area may eventually lead to use of a "band-aid" to administer vaccines. - Conducted research to explore the different types of brain cell death and mechanisms to stop secondary damage that frequently occurs after initial brain trauma. The development of neural brain cell therapy appears to be a promising avenue for restoring part of the brains injured tissue and functions. - Evaluated gene level expression of one species of malarial parasite derived from previous studies. Findings will facilitate development of drugs and vaccines that will interact with the gene products discovered through this process.
•	1200	- Examined feasibility of using genetically engineered plants to produce proteins associated with human diseases. The use of plants will provide a low cost source for effective multivalent vaccines against a variety of disease producing organisms. Preliminary results have demonstrated the feasibility of producing an important plague vaccine protein in plants. - Explored use of cDNA microarrays to measure thousands of gene responses to Filovirus infection of human cells in culture. Identified a pattern of gene expression related to immune system modulators that may help to develop therapeutic drugs against Filovirus infections.
Total	3352	

FY 2000 Planned Program:

•	3541	- Solicit basic research proposals and make awards that focus on militarily relevant research to identify countermeasures against infectious diseases, defenses against environmental extremes and operational hazards to health, and mechanisms of combat trauma and innovative treatment and surgical procedures. Monitor progress of research and evaluate scientific results from final reports.
•	96	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	3637	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91C

FY 2001 Planned Program:

•	3703	- Solicit basic research proposals and make awards that focus on militarily relevant research to identify countermeasures against infectious diseases, defenses against environmental extremes and operational hazards to health, and mechanisms of combat trauma and innovative treatment and surgical procedures. Monitor progress of research and evaluate scientific results from final reports.
Total	3703	

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

DATE: February 2000

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: A91D

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A91D In-House Laboratory Independent Research - Corps of Engineers	659	721	734	744	751	757	759	Continuing	Continuing

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 1999 Accomplishments:

•	659	- Integrated the convolution equation as part of an approach to reduce the effects of image data noise. - Began development of a response- and durability-based model for coal tar seal coats for asphalt pavements. - Developed a 2-D distributed watershed model incorporating radar precipitation data for stream flow forecasting. - Demonstrated feasibility of measuring snowpack water equivalence with Frequency Modulated Continuous Wave radar for flood prediction. - Investigated Microbiology influenced corrosion processes.
Total	659	

FY 2000 Planned Program:

•	718	- Reduce image noise by developing a new adaptive interation technique. - Develop a response- and durability-based model for coal tar seal coats for asphalt pavements. - Begin development of a hydrologic model combining surface water with saturated and unsaturated groundwater. - Demonstrate ultra-broad-band radar techniques to reduce false alarm rates from surface variation to improve mine detection. - Begin exploration and optimization of transport characteristics of charged particles in soil for potential electrostatic absorption.
•	3	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	721	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91D

FY 2001 Planned Program:

•	734	- Transition techniques developed for image noise reduction. - Complete development of a response- and durability-based model for coal tar seal coats for asphalt pavements. - Develop a hydrologic model combining surface water with saturated and unsaturated groundwater. - Demonstrate the potential to detect/discriminate unexploded ordnance using trace chemical detection. - Develop techniques for directed sub-surface migration/concentration of contaminants through soils using electro-osmotic pulse technology.
Total	734	

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

DATE: February 2000

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	122255	125918	132164	130876	133026	135293	137416	Continuing	Continuing
AF20 Advanced Propulsion Research	2042	2422	2509	2607	2634	2656	2674	Continuing	Continuing
AF22 Research in Vehicular Mobility	450	472	485	493	501	508	515	Continuing	Continuing
AH42 Materials and Mechanics	1628	1915	1990	2040	2068	2087	2106	Continuing	Continuing
AH43 Research in Ballistics	3135	4008	4126	4226	4286	4340	4392	Continuing	Continuing
AH44 Advanced Sensors Research	4235	4041	4144	4231	4298	4362	4423	Continuing	Continuing
AH45 Air Mobility	1836	1978	2034	2089	2127	2163	2201	Continuing	Continuing
AH47 Applied Physics Research	2611	3073	3182	3271	3309	3340	3367	Continuing	Continuing
AH48 Battlespace Information & Communications Res	5436	6730	6927	7100	7205	7299	7390	Continuing	Continuing
AH52 Equipment for the Soldier	862	944	984	1015	1026	1032	1037	Continuing	Continuing
BH57 Scientific Problems with Military Applications	51999	50382	51559	52499	53413	54318	55232	Continuing	Continuing
AH66 Advanced Structures Research	1167	1409	1463	1508	1523	1534	1543	Continuing	Continuing
BH67 Environmental Research - Army Materiel Command	3092	3507	3570	3631	3696	3762	3828	Continuing	Continuing
AH68 Processes in Pollution Abatement Technology	349	368	374	380	387	395	402	Continuing	Continuing
BS04 Military Pollutants and Health Hazards	555	621	631	640	653	665	678	Continuing	Continuing
BS13 Science Base/Medical Research Infectious Disease	8784	8954	9185	9385	9567	9742	9916	Continuing	Continuing
BS14 Science Base/Combat Casualty Care Research	3517	3949	4042	4122	4196	4269	4340	Continuing	Continuing

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)							DATE February 2000		
BUDGET ACTIVITY 1 - Basic Research			PE NUMBER AND TITLE 0601102A Defense Research Sciences						
BS15 Science Base/Army Operational Medecine Research	9026	5353	5495	5617	5725	5827	5928	Continuing	Continuing
BS17 Molecular Biology/Military HIV Research	374	431	439	445	482	642	661	Continuing	Continuing
BS19 Telemedicne Soldier Status Research	450	611	620	631	609	672	703	Continuing	Continuing
BS20 Science Base Emerging Infectious Diseases	0	0	3975	0	0	0	0	3975	3975
AT22 Soil and Rock Mechanics	1654	1856	1887	1915	1952	1989	2028	Continuing	Continuing
AT23 Basic Research/Military Construction	1436	1549	1595	1619	1650	1682	1714	Continuing	Continuing
AT24 Snow, Ice and Frozen Soil	1244	2164	1185	1203	1217	1227	1237	Continuing	Continuing
BT25 Enviornmental Research - Corps of Engineers	3908	4425	4503	4569	4656	4746	4838	Continuing	Continuing
A305 Automatc Target Recognition	992	1169	1205	1235	1253	1268	1283	Continuing	Continuing
A31B Infrared Optics Research	1985	2337	2426	2500	2531	2561	2589	Continuing	Continuing
B52C Mapping and Remote Sensing	2098	2288	2327	2362	2408	2455	2503	Continuing	Continuing
B53A Battlefield and Environment Signature	3134	3674	3812	3939	3983	4013	4039	Continuing	Continuing
B74A Human Engineering	2219	2599	2687	2761	2795	2823	2850	Continuing	Continuing
B74F Personnel Perormance and Training	2037	2689	2803	2843	2876	2916	2999	Continuing	Continuing

A. Mission Description and Justification: This program element sustains U.S. Army scientific and technological superiority in land warfighting capability, provides new concepts and technological options for the maintenance of Army land power, and provides the means to avoid scientific surprise, while exploiting scientific breakthroughs. This program responds to the scientific and technological requirements of the Department of Defense Basic Research Plan, the Army Science and Technology Master Plan, and the Army Modernization Plan, and enables the technologies that could significantly improve joint warfighting capabilities. The in-house portion of the program capitalizes on the scientific talent and specialized facilities to expeditiously transition knowledge and technology into the appropriate developmental activities. The extramural program leverages the research efforts of other government agencies, academia, and industry. This translates to a coherent,

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences

well-integrated program which is executed by the following five primary contributors: 1) the Army Research Laboratory (ARL), which includes the Army Research Office; 2) the Army Materiel Command

Research, Development and Engineering Centers (RDECs); 3) the Army Corps of Engineers laboratories; 4) the Army Medical Research and Materiel Command laboratories; and 5) the Army Research Institute. 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 establishment 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. The basic research program is coordinated with the other Services via the Joint Directors of Laboratories panels, Project Reliance, and other interservice working groups.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	125314	125613	128578
Appropriated Value	126463	126613	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-1149		
b. SBIR / STTR	-3079		
c. Omnibus or Other Above Threshold Reductions		-370	
d. Below Threshold Reprogramming	630		
e. Rescissions	-610	-325	
Adjustments to Budget Years Since (FY 2000/2001 PB)			+3586
Current Budget Submit (FY 2001PB)	122255	125918	132164

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences	PROJECT AF20

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AF20 Advanced Propulsion Research	2042	2422	2509	2607	2634	2656	2674	Continuing	Continuing

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 generation, 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 air-breathing engines and power trains that will support improvements in system mobility, reliability and survivability, and ultimately serve to reduce the logistics cost burden on future concepts, including the Future Combat Systems (FCS) program. Logistic issues are key concerns in the Army After 2010 planning.

FY 1999 Accomplishments:

- 2042 - Achieved quick execution (overnight turn around) for Version 2.0 of the National Combustor Code, providing an increased incentive for industry to use the code. Successfully completed Level 1 PCA Milestone (Program Commitment Agreement to Congress) entitled "Reduce Turnaround Time on Aerospace Application by 200-to-1 Relative to a 1992 Baseline". The National Combustor Code performed a 1.3 million node calculation of the flow from the exit of a compressor through the combustor to the entrance of the turbine of a gas turbine engine with a 10-hour turnaround time.
  - Completed 3-D gear crack propagation code to improve transmission safety.
  - Investigated improved high temperature mechanical property stability of SiC/SiC composites through microstructural control.
  - Obtained images in a centrifugal compressor diffuser of velocity transients between steady flow and surge that contain diffuser stall cell, pre-stall and post-stall structures.
  - Completed investigation of stator end wall blockage effects on performance of multistage axial compressor. These results will ultimately enable significant improvements in compressor efficiency to be realized through reductions in secondary flow losses.
  - Calibrated 3-D gear crack propagation code with data from Boeing single tooth bending fatigue test gear in order to improve transmission design safety.
  - Investigated material and lead wire attachment technique for ceramic based thin film strain gauges for use to 1200°C.
  - Attained first 4-port through-flow wave rotor map experimentally.
  - Completed aerodynamic design of an efficient wave rotor-to-high pressure turbine transition duct.

Total 2042

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AF20

FY 2000 Planned Program:

•	2410	- Investigate a surge model for centrifugal compressors. Use model to determine mass flow injection schedules for centrifugal compressor range improvement experiments. Validate model through rig tests. - Complete measurement of unsteady correlations and rotor tip clearance in a multistage axial compressor. These results will ultimately enable improvements in compressor performance to be realized by improvements in the predictive capability of 3-D viscous computational analysis tools for multistage axial compressors - Apply particle image velocimetry to centrifugal compressor research stage at peak operating point to capture detailed flow physics associated with the onset of stall/surge. This data will enable the realization of flow physics based active stabilization and hence improved component efficiency. - 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 investigation of comprehensive thermomechanical life prediction model for advanced structural ceramics enabling insertion of durable structural ceramics into manned gas turbines. - Acquire data for validation of analysis for spiral bevel gear thermal behavior, leading to reduced rotorcraft drive train weight and increased safety. - Assist industry with extension of gear tooth crack propagation code to shaft coupling tooth crack propagation (National Rotorcraft Technology Center program). - Complete mechanical design and structural analysis of a wave rotor "rotor". - Apply micro-elastohydrodynamic lubrication analysis for lubrication of superfinished gears to complete gear contact stress analysis. - Develop communication protocols and signal processing techniques for use with ultrasound wireless data transmission system.
•	12	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	2422	

FY 2001 Planned Program:

•	2509	- Incorporate environmental effects in life prediction model for advanced structural ceramics, including effects due to combustion products. - Investigate wave rotor concept for on-rotor combustion, thereby integrating high-pressure turbomachinery and combustor component functions into a single component. This cycle is projected to reduce fuel consumption by 16% and increase specific power by 18%. - Apply and assess the validity of newly developed engine weight and safety prediction algorithms. These algorithms will forecast the impact of new advanced technology on the weight and safety of new engines. - Validate gear fault detection methodology incorporating sensor fusion for improved rotorcraft transmission safety and reliability. - Integrate first version of gear crack imitation code with crack propagation code in rotorcraft drive system safety model.
Total	2509	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences		PROJECT: AF22

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AF22 Research in Vehicular Mobility	450	472	485	493	501	508	515	Continuing	Continuing

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

FY 1999 Accomplishments:

•	450	- Validated state-of-the-art vehicle dynamics phenomena. - Optimized vehicle/human control models for off-road scenarios. - Optimized fundamental power train characteristic phenomena using advanced simulation procedures.
Total	450	

FY 2000 Planned Program:

•	245	- Validate advanced power train simulation algorithms. - Derive militarily relevant system powertrain sensitivities.
•	219	- Enhance state-of-the-art, real-time vehicle dynamics understanding.
•	8	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	472	

FY 2001 Planned Program:

•	240	- Fundamentally improve unique propulsion combustion/fuel injection modeling capability.
•	245	- Use high fidelity non-linear validation techniques to examine military vehicle response.
Total	485	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT AH42

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH42 Materials and Mechanics	1628	1915	1990	2040	2068	2087	2106	Continuing	Continuing

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 ceramics, advanced polymer composites, advanced metals, and multifunctional materials. These advanced materials will enable lethality and survivability technologies for the Future Combat Systems (FCS). This research is conducted by the Army Research Laboratory, at the Aberdeen Proving Ground, MD and at the NASA Langley Research Center in Hampton, VA in support of materials technology applied research in project 0602105A/AH84.

FY 1999 Accomplishments:

- 1628 - Revised first generation low-cycled fatigue model to account for fiber architecture, fiber-matrix microstructure, and interphase relationships to more accurately predict the performance of polymer matrix composites
  - Coupled micro- and macro-models for improved prediction of micro-cracking and durability in thick section composites used for lightweight vehicles and ordnance.
  - Determined critical parameters effecting the formation of AlON ceramic microstructure and its relationship to the physical properties of transparent armor.
  - Provided first generation model to enable engineering surface sensitive properties of materials using energetic directed ion-laser beam techniques
  - Devised experimental technique to determine the dynamic behavior and defeat mechanisms of conceptual armor materials subjected to multiple external excitations.
  - Established cooperative activity with Brunel Univ. to improve adaptive integration methods for modeling elastomeric materials and highly damped structures, and transfer in-house nonlinear viscoelastic models of elastomers to Penn. State Univ. and Lord Corp., Erie, PA.
  - Completed four-point-bending static tests on thick curved composites to validate failure criteria.

Total 1628

FY 2000 Planned Program:

- 1904 - Determine the synthesis-microstructure-property relationships in polymer/clay nanocomposite materials.
  - Refine low cycle fatigue predictive models for integrally-designed armor composite materials that include effects of material flaws and damage
  - Investigate processing-microstructure effects on elastic properties of a functionally graded material.
  - Extend predictive models and experimental techniques for cluster beam and pulsed laser ablation deposition of protective coatings.

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- Investigate and devise coupled theoretical models for constitutive laws governing the high strain rate behavior of lightweight metal alloys and hybrid armor candidate materials.

FY 2000 Planned Program: (continued)

- Extend numerical and design models of elastomeric structures to include higher order plate and shell finite elements, and evaluate large strain combined loads viscous models against measured data.

•	11	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	1915	

FY 2001 Planned Program:

•	1990	- Investigate the effects of interfacial chemistry on the engineering properties and microstructural damage/failure mechanisms of organic/inorganic nanocomposites. - Explore novel technologies for damage detection and mitigation in lightweight, multifunctional armor materials. - Investigate alternative uses of cluster beam techniques to enhance surface quality and durability in vacuum processes. - Investigate shock response and micromechanical damage/failure mechanism of a functionally graded material. - Investigate failure mechanisms in metal/ceramic hybrid materials under complex stress states and conduct two-dimensional shock experiments on novel, lightweight armor materials. - Evaluate the possible extension and application of this computational, elastomeric material modeling technology area to intelligent material systems, including electro-rheological fluids.
Total	1990	

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BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT AH43

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH43 Research in Ballistics	3135	4008	4126	4226	4286	4340	4392	Continuing	Continuing

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 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 formulation of more energetic propellants, more accurate and lethal projectiles and missiles, and advanced armors for increased survivability of Army combat systems, including the Future Combat Systems (FCS). This research is conducted at the Army Research Laboratory, Aberdeen Proving Ground, MD in support of ballistic technology applied research in project 0602618A/AH80.

FY 1999 Accomplishments:

•	3135	- Devised molecular modeling capability to predict heats of formation of novel propellant formulations; furthered execution of three dimensional computational fluid dynamic model for predicting ignition of multi-phase, multi-dimensional charge configurations – applied model to Modular Artillery Charge for Crusader - Provided capability that couples computational fluid dynamics and rigid body computational techniques to compute the flight aerodynamics of complex missiles and smart munitions; aerodynamic forces for various designs of an extended range projectile were computed for multiple angles of attack at a transonic velocity. - Devised constitutive model and experimental techniques to determine the coupled effect of mechanical, electrical and magnetic fields on armor and projectile materials for ballistic applications.
Total	3135	

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FY 2000 Planned Program:

•	3952	- Investigate theoretical chemistry and physics-based models, including 3-dimensional (3-D) ballistics models of future high performance solid propellants, validated by ignition and combustion experimentation, to predict mechanical stability, impetus, energy release, flame temperature, and critical intra- and inter-molecular propellant properties. - Couple computational fluid dynamics/thermal/rigid body dynamics tools for complex aerodynamic shapes and launch dynamics of advanced munitions. - Incorporate coupled constitutive models into the magneto-solid-mechanics version of the CTH model (a computational solid mechanics model developed by Sandia National Laboratory) being developed as part of the work package on electrodynamic defeat of anti-armor threats. - Perform shock wave propagation experiments in functionally graded materials to determine the effect of directionality on its shock, release, tensile and energy dissipation properties. Determine the effect of the material property gradient on wave front curvature and amplitude for general directions of propagation.
•	56	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	4008	

FY 2001 Planned Program:

•	4126	- Refine predictive first principles of chemistry and physics-based models and 3-D interior ballistics models and apply ignition and combustion experimental data to predict ballistic properties of advanced high-performance solid propellants in propulsion systems. - Devise advanced computational models, smart munitions aerodynamic prediction capabilities, and flight vehicle control element design tools to reduce design cycle time and cost of advanced munitions. - Incorporate fundamental theory of shock propagation in Functionally Graded Materials (FGMs) into wave mechanics code and complete critical experiments to validate the model. Complete integration of FGM constitutive model to provide 3-D modeling capability for the design of FGMs that will enable future lightweight combat vehicle concepts.
Total	4126	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences		PROJECT: AH44

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH44 Advanced Sensors Research	4235	4041	4144	4231	4298	4362	4423	Continuing	Continuing

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, information capacity of electro-optical imaging systems, nonlinear optical materials and devices, remote sensing, emissive materials and intelligent system distributive interactive simulations and battlefield acoustic signal processing algorithms. Research involves fundamental science and engineering principles that support survivable sensor systems, displays, and environmental monitoring, both point and remote. Monolithic and hybrid optoelectronic structures in gallium arsenide and lithium niobate are investigated as integrated processors for novel signal and radar processing and control. Diffractive and micro-optic elements are investigated to enhance performance of imagers and optical processors. 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.

FY 1999 Accomplishments:

- 654 - Established numerical tool set for quantifying the information capacity of an electrooptic (EO) imaging system.
  - Determined feasibility of optical limiter for TARDEC application.
  - Investigated the luminescence properties of nanocrystalline phosphors and organic materials for emissive displays.
  - Characterized and Fabricated binary, subwavelength diffractive lens.
- 2117 - Determined a real-time technique for extracting depth information from an image stream, applying nonlinear optical techniques.
  - Conducted image processing using the mathematics of partial differential equations implemented as a real-time parallel analog optoelectronic processor.
  - Established a correlation between trajectory likelihood and the magnitude of its associated exponent and established a technique to evaluate closure models and their trajectories using Lyapunov exponents.
- 1378 - Used electromagnetic model results of an anti-tank mine to generate synthetic aperture radar images in three-dimensions. Used the 3D images to evaluate achievable resolution in a forward imaging configuration.
  - Calculated the cross-range superresolution with a scanning radar for targets at various ranges using multiple signal classification (MUSIC).
- 86 - Investigated several innovative acoustic signal processing techniques.

Total 4235

FY 2000 Planned Program:

- 1494 - Determine the optimal luminescence material for low power high brightness display.
  - Investigate designs for low cost, low power imaging system for Warrior Extended Battlespace Sensor System (WEBS).
  - Integrate binary, subwavelength lens with vertical cavity surface emitting laser.

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BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH44

FY 2000 Planned Program: (continued)

- Record and fix gratings in photorefractive media for 3D holograms.
- Further design and test iterative algorithms for designing subwavelength diffractive optical elements.

• 797 - Report on analysis of dielectric mine measurements for increased mobility of Future Combat Systems (FCS).
- Investigate cross-range superresolution of complex targets with scan-MUSIC (S-MUSIC) for improved automatic target recognition (ATR) thereby providing increased lethality of FCS.

• 1678 - Utilize fuzzy logic to control level of object detail and to model volumetric objects while maintaining a constant frame rate.
- Investigate and report on techniques for the real-time rectification of sensor imagery utilizing nonlinear and adaptive optics.
- Utilize Lyapunov exponents based closure model to assess the improvement of turbulence calculations as related to acoustic and optical sensors.

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

Total 4041

FY 2001 Planned Program:

• 2486 - Record and fix multiplexed gratings in a 3D hologram.
- Design low power high brightness display for Army applications.
- Design nonlinear optical materials for eye protection using current optical viewing designs.
- Complete analysis and documentation of ultra-wideband (UWB) ground penetrating radar utility analysis for mine/unexploded ordnance (UXO) detection for increased mobility of FCS.
- Extend capabilities of S-MUSIC and blind deconvolution superresolution algorithms and validate applicability using field data for improved ATR thereby providing increased lethality of FCS.

• 1658 - Establish techniques for real-time rectification of sensor imagery utilizing features with the scene.
- Investigate the effects of turbulence induced phase and intensity fluctuations on ground to ground laser systems and identify techniques to reduce the effects.

Total 4144

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

DATE: February 2000

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH45

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH45 Air Mobility	1836	1978	2034	2089	2127	2163	2201	Continuing	Continuing

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 1999 Accomplishments:

- 1836 - Identified structure/actuator concepts for application to multi-controller active, on-blade systems for low vibration rotorcraft.
  - Fabricated an isolated, instrumented baseline rotor for increased payload, reduced noise and vibration.
  - Investigated stereo particle image velocimetry for rotor wake measurements.
  - Completed research on advanced aeroacoustic prediction code using parallel computer.
  - Completed research on pressure sensitive paint technique for blade surface pressure measurement
  - Performed forward flight aeroelastic stability testing of swept tip hingeless rotor blades.
  - Investigated aeroelastic and dynamic response of on-blade elevon controls for vibration reduction.

Total 1836

FY 2000 Planned Program:

- 1931 - Complete research of stereo image velocimetry technique.
  - Complete detailed rotor wake geometry measurements during blade/vortex interaction using stereo image velocimetry technique.
  - Complete an axial-flight wind tunnel test to separate induced power from total power measurement.
  - Design and fabricate scale model rotor blades equipped with oscillating blowing to control flow separation.
  - Perform analytic validation of swept tip blade stability characteristics.
  - Conduct parametric studies of active control with on-blade elevons for low vibration rotors.
- 47 - Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1978

FY 2001 Planned Program:

- 2034 - Complete rotor aerodynamic and acoustic codes using scalable software.
  - Complete hover test using model blades equipped with oscillating blowing to control flow separation.
  - Investigate aeroelastic coupling characteristics for improved rotor stability.
  - Validate analytical methods for on-blade control vibration characteristics.

Total 2034

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH47

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH47 Applied Physics Research	2611	3073	3182	3271	3309	3340	3367	Continuing	Continuing

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. Also investigate relativistic effects on accuracy of global positioning system (GPS). The basic knowledge learned will be applied to novel optoelectronic devices. Active and passive optoelectronic components and subsystems that are of importance for Army systems will be investigated. These include applications for superlattice-based lasers and detectors, 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. Reduced size, weight and cost and higher operating temperature are especially important for future combat vehicles, including the Future Combat Systems (FCS).

FY 1999 Accomplishments:

•	2137	- Established performance of type II quantum cascade lasers from GaSb based materials operating at 3.5μm and 240°K.
		- Established fully general relativistic equations/algorithm for GPS positioning and time transfer.
		- Established strain-effect-enhanced wave-guide modulators and amplifiers.
•	474	- Synthesized new anode material for higher energy rechargeable batteries for reduced weight and cost.
		- Synthesized new electrolyte solvents for capacitors and rechargeable lithium-ion batteries.
		- Synthesized/evaluated new cathodic electrocatalysts for high performance methanol fuel cells for individual soldier applications.
Total	2611	

FY 2000 Planned Program:

•	2455	- Establish cylindrical model of Q-switch for micro-laser.
		- Advance InAs/GaSb based superlattice detector and laser structures.
		- Investigate equations for navigation in a curved space-time.
		- Explore semiconductor strain effects and wide bandgap physics for future optoelectronic components.
•	594	- Investigate/eliminate side-reactions limiting storage and low temperature performance of new, more energetic anode material for rechargeable lithium-ion batteries.
		- Synthesize new solvent for capacitor electrolyte to enable low temperature operation in burst communications applications.
		- Evaluate conductivity and chemical stability of new membrane electrolytes for high performance fuel cells.
•	24	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	3073	

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BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH47

FY 2001 Planned Program:

•	2540	- Investigate materials with low defects for electrically pumped interband quantum cascade laser with optimized operating characteristics and investigate InAs/GaSb based superlattice detector. - Establish positioning algorithm in the Fermi frame of reference of the earth. - Investigate wide bandgap active device structures.
•	642	- Formulate solid electrolyte for rechargeable lithium battery with high energy density/good low temperature performance. - Formulate new high voltage low temperature electrolyte for high performance electrochemical capacitor. - Improve Lithium/polymer battery chemistry for long storage, high energy density battery. - Improve chemistry for direct methanol fuel cell.
Total	3182	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT AH48

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH48 Battlespace Information & Communications Res	5436	6730	6927	7100	7205	7299	7390	Continuing	Continuing

Mission Description and Justification: This project addresses fundamental research in technologies that will enable 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 more robust, intelligent, interoperable, and survivable if the Army is to retain both information and maneuver dominance. This research will address the areas of information assurance and the related signal processing for wireless battlefield communications along with intelligent systems for C4I. The information assurance and signal processing research will provide 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 for C4I research will focus on providing the agent technology capabilities that will reduce the cognitive load on the commander, improve the timeliness, quality and effectiveness of actions and in the long run speed the decision-making process and reduce the size of tactical operation center (TOC) staffs.

FY 1999 Accomplishments:

- 3540 - Provided secure mobility management techniques for mobile host protocols that support mobile ad-hoc network configurations.
  - Investigated several survivable information architectures for information protection that addresses security, software reliability, data integrity, and system recoverability and produced a preliminary report.
  - Define mobile distributed multiple access Anti-Jam (AJ) communication networks for brigade and below.
  - Conducted a set of simulations of software intelligent agents that can detect information operations on combat networks.
  - Conducted research on hierarchical digital modulation algorithms for classification and identification of signals on the battlefield and published technical papers of findings.
  - Examined the use of robust spatial diversity combining algorithms for tactical communications.
  - Provided algorithms for performing channel and source coding for tactical communications, with error correcting codes, that are capable of operating in high-bit error battlefield environments.
- 1896 - Provided user alert agent technology utilizing University of Maryland's intelligent agent architecture.
  - Investigated the interaction of humans and intelligent agents with a focus on agent autonomy.
  - Defined requirements and approach for an agent that monitors event detection and synchronization over bandwidth limited channels.
  - Examined the theoretical foundation of cooperative intelligent agents that will underpin the Army Command Support System.
  - Investigated the application of soft computing techniques (fuzzy logic, neural nets, etc.) to enable agents to deal with uncertainly.

Total 5436

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH48

FY 2000 Planned Program:

•	4130	- Refine secure mobility management techniques for mobile host protocol that support mobile ad-hoc networking on the move. - Refine intelligent agents for vulnerability assessment of dynamic tactical networks. - Evaluate concept for mobile distributed multiple access Anti-Jam (AJ) communication networks for brigade and below. - Complete investigation of survivable information architectures for information protection that address security, software reliability, data integrity and system recoverability. - Evaluate and refine hierarchical digital modulation algorithms for classification and identification of signals on battlefield. - Develop spatial diversity combining algorithms for tactical communications - Evaluate and refine algorithms for performing channel and source coding for tactical communications that are capable of operating in high-bit error battlefield environments.
•	2489	- Validate intelligent agent architecture by testing architecture and alert agent technology in collaboration with the Advanced Battlefield Processing Technology Science and Technology Objective (STO). - Document the critical aspects of human-agent interaction that must be considered in the development of agent applications. - Assess the extensibility and adaptability of the intelligent agent architecture to the synchronization of physical and software agents against a user defined mission plan. - Conduct detailed research on the language that will facilitate agent-to-agent communication to expand the theoretical foundations of cooperative intelligent agents. - Evaluate the use of soft computing approaches to enhance the ability of agents to deal with uncertainty. - Assess the application of intelligent agent technology to natural language understanding and context tracking.
•	111	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	6730	

FY 2001 Planned Program:

•	4072	- Provide efficient algorithms for Internet protocols for highly mobile tactical networks for experimental applications. - Review final hierarchical digital modulation algorithms by testing, identifying and classifying complex signals. - Utilize a mobile ad-hoc network to interconnect a team of physical agents and higher echelons to show improved information flow. - Validate the performance of source and channel coding for tactical communications in high bit error battlefield environments. - Validate hierarchical digital modulation algorithms for classification and identification of signals on battlefield. - Validate performance of spatial diversity combining algorithms for tactical communications.
•	2855	- Validate intelligent agents for mission planning, rehearsal and status monitoring of a physical agent.

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	PROJECT AH48

- In collaboration with the Advanced Battlefield Processing Technology STO, display the state of physical or software agents through a 2D/3D battlespace situation display.

FY 2001 Planned Program: (continued)

- Evaluate the robustness of the theoretical foundation for cooperating agents by using its architecture and control language to integrate agents assessing the network vulnerability in conjunction with agents that monitor the execution of the mission.
- Validate the performance of natural language and context tracking agents that understand speaker's intent while visualizing graphical information.

Total 6927

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT AH52

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AH52 Equipment for the Soldier	862	944	984	1015	1026	1032	1037	Continuing	Continuing

Mission Description and Justification: Basic research focused on five core technology areas critical to the Soldier System: mathematical modeling, physical performance measurement, polymer science/textile technology, biotechnology 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, performance sustaining rations essential to the health and well-being of soldiers.

FY 1999 Accomplishments:

•	862	- Screened new materials using "electrospinlacing" technology for the production of "seamless" multifunctional protective clothing. - Validated mathematical models of textile damage effects from abrasion, strain, and ballistic impacts. - Incorporated production variables into the assessment of physical and chemical factors affecting nonlinear optical behavior of candidate laser eye protective material. - Applied sophisticated analytical methodologies to formulated meat proteins to determine the effects of microwave sterilization of military rations. - Quantified soldier physical performance emphasizing biomechanical and anthropometric parameters of the soldier's load. - Characterized the form and function of polymer/clay nanocomposites relevant to high performance, multifunctional fabrics and structures for the protection of the future soldier. - Conducted computational experiments to provide validated model algorithms that predict the performance of airdrop systems necessary for projecting the force using DoD High Performance Computing resources.
Total	862	

FY 2000 Planned Program:

•	942	- Elucidate photochemical deterioration inherent in nonlinear optical materials used in eye protection. - Provide quantification of comfort measures for combat clothing to allow rapid improvements in design without impact on function. - Investigate models for high strain rates in polymeric fabric systems to correlate with prediction of ballistic performance. - Evaluate bioceramic approach to tailor templates for the evolution of high performance nanoceramics for lightweight ballistic protection.
•	2	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	944	

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BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT AH52

FY 2001 Planned Program:

•	984	- Prepare nanoparticles of nonspherical and nonlinear geometries to begin evaluation of their potential in improving the strength of composites for use in lightweight systems. - Validate the applicability of molecular modeling codes to predict the one-dimensional strain in candidate high strength polymeric systems for use in soldier protective items. - Relate the uniform comfort measures to soldier performance using a multidomain indicator of performance.
Total	984	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT BH57

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BH57 Scientific Problems with Military Applications	51999	50382	51559	52499	53413	54318	55232	Continuing	Continuing

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 materials sciences), the engineering sciences (mechanics, aeronautics, electronics, and mathematical and computer sciences), and the environmental sciences (atmospheric and terrestrial). It covers approximately 575 research grants and contracts with leading academic researchers and approximately 1,400 graduate students yearly, and supports research at over 100 institutions in 44 states.

FY 1999 Accomplishments:

•	23292	- Improved survivability of armor by creating high performance ceramic/metal reinforced bulk metallic glass composites with a 1000% increase in compressive strain to failure and with a 50% increase in absorbed energy. - Utilized electromagnetically induced transparency in laser cooled and trapped atoms to slow the movement of light which has applications to optical computing/processing and nonlinear optical effects with extremely low intensity light. - Demonstrated that nanoparticles of metal oxides adsorb and destroy hazardous compounds. - Identified two genes that affect hibernation and may lead to the soldier's ability to resist hypothermia.
•	24007	- Produced the highest bandwidth per channel to date for an optoelectronic integrated circuit photoreceiver array, enabling potential applications in ultrafast information processing. - Developed an important new tool, the 3-D front tracking method, which may overcome the semiconductor manufacturing problem involving deposition and etching. - Incorporated an embedded network of piezoelectric ceramics into dielectric films to create efficient, low cost composite manufacturing techniques for "smart" structures such as rotor blades. - Developed a new theory of sound propagation that accounts for temperature fluctuations and isotropic turbulence for acoustic tracking of tanks and helicopters.
•	4700	- Enhanced science, mathematics and engineering education programs at Historically Black Colleges/Minority Institutions to improve their capacity to conduct science and engineering research in areas critical to the Army through the acquisition of state-of-the-art research equipment and instrumentation.
Total	51999	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BH57

FY 2000 Planned Program:

•	22282	- Develop new biomimetics synthetic processing routes to produce laminated ceramic-polymer composites for improved armor. - Synthesize reactive "smart" polymers that can react to external stimuli for thermal and visible signature reduction of soldiers and equipment. - Apply quantum effects such as entanglement and nonlocality to develop enhanced techniques for information storage, communication, and processing. - Create new photonic materials from genetically engineered bacteriorhodopsin to improve optoelectronics and greatly increase information storage density.
•	23904	- Develop algorithms for efficient multicast distribution and broadcasting, and for scalable routing in very large tactical mobile communications networks. - Model physical and operational phenomena for Army applications such as fluid dynamics for ballistics and rotorcraft, and armor penetration mechanics. - Investigate combustion thermal management in ultra-low heat rejection environments to improve propulsion in Army vehicles. - Develop revolutionary devices to solve several types of "unsolvable" problems through quantum computational analysis. - Develop simulation models of contaminant sorption and degradation processes for insertion into the DoD Groundwater Model System.
•	3000	- Vehicle Mobility Research to be executed IAW FY00 Appropriation Conference Report
•	1196	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	50382	

FY 2001 Planned Program:

•	24881	- Synthesize moldable rigid-rod optical polymers for exceptionally rugged, cheap optical components for targeting and communications systems. - Develop photocatalytic methods to decompose chemical agents. - Conduct research in self-assembly 3D photonic band gaps for potential application to single photon communications. - Conduct research in thermophilic organisms to create heat resistant enzymes for use as catalysts in industrial chemical reactions for synthesis and processing of Army materiel.
•	26678	- Design of novel access protocols needed to support multimedia traffic streams for mobile communications networks. - Conduct advanced computational research to address problems in robotics, autonomous navigation and battle management. - Explore the feasibility of smart active/passive structural damping control utilizing magnetorheological fluid based dampers for stability augmentation of bearingless helicopter rotor blades. - Develop durable ice-phobic coatings to prevent ice build up on antennas, rotor blades and power lines.
Total	51559	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT AH66

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AH66 Advanced Structures Research	1167	1409	1463	1508	1523	1534	1543	Continuing	Continuing

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 enable the evolution of design tools for improved helicopter structures and dynamic response. This structures-focused research includes reductions in vehicle vibratory loads, improved vehicle stability, advanced fatigue methodologies for metallic structures, improved composites technology throughout the vehicle, and the long-term maturation of an integrated stress-strength-inspection technology. These advancements 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 1999 Accomplishments:

- 1167 - Provided improved multiblade formulation for comprehensive analysis, validated dynamic and aeroelastic predictions for gimbaled tiltrotor; and under a CRDA with Penn State, extended aeroelastic-tailoring studies for soft-inplane tilt rotor systems.
  - Published test standards to measure delamination onset and fracture toughness of composite laminates, and conducted research on a probabilistic method for analyzing low velocity impact resistance in composite panels.
  - Conducted fatigue analysis for arbitrary flexbeam layup under combined tension/torsion loads, and investigated 3D damage primitives for matrix crack induced delamination failures.

Total 1167

FY 2000 Planned Program:

- 1402 - Generate an experimental design of the wind tunnel test of twist actuated active rotor system 'open loop' configuration.
  - Research advanced smart structure actuator with improved performance and reduced cost
  - Implement tiltrotor analytical model including power train dynamics and explore vibration reduction potential analyses.
  - Publish results of actively controlled stability augmentation on tiltrotor configuration, and correlate with predictions from several analytical methods.
  - Verify damage resistance and residual strength models for low velocity impact damage in composite panels.
  - Research 3D finite element analysis with coupled tension/torsion loading to predict strength and life of flexbeam laminates.

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- Investigate structural parameters that influence damage progression.

FY 2000 Planned Program: (continued)

- Extend Mode II & III and Mixed Mode I & II delamination fracture criteria to include fatigue durability.

•	7	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	1409	

FY 2001 Planned Program:

•	1463	- Evaluate forward flight characteristics in wind tunnel test of twist actuated active rotor system in 'open loop' configuration. - Investigate experiment design of 2nd wind tunnel tests of twist actuated active rotor system 'closed loop' configuration. - Incorporate active control and smart material analytical models into comprehensive analysis. - Investigate probabilistic method for designing low velocity impact resistant composite panels. - Conduct research in fatigue analysis for arbitrary flexbeam layup under combined tension and cyclic torsion loading. - Investigate improved damage growth predictions to better understand interactions between structural components such as skin and stringers. - Prepare draft test standards for Mode II & III and Mixed Mode I & II delamination onset criteria for fatigue durability of unidirectional composite laminates.
Total	1463	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT BH67

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BH67 Environmental Research - Army Materiel Command	3092	3507	3570	3631	3696	3762	3828	Continuing	Continuing

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 1999 Accomplishments:

- 1230 - Fabricated and examined specimens prepared with wire-wrapped, solid cylindrical, coating targets.
  - Characterized, evaluated, and validated a model of a Cylindrical Magnetron Sputtering (CMS) device. Identified required modeling and started acquiring and developing thermal, surface and plasma codes.
  - Demonstrated that the hydration step could be eliminated in the CL-20 manufacturing process.
  - Reduced the production of a carcinogenic by-product of the dinitrotoluene manufacturing process by 95%, cutting the total process waste by 25%.
  - Identified supercritical fluids that solubilize various candidate organic polymer binders used in pyrotechnic compounds and investigated parametrics for coating magnesium powders with polymer binder dissolved in supercritical fluid.
  - Demonstrated that oriented single crystal tungsten may be a potential replacement for depleted uranium in anti-armor penetrators.
  - Broke out sub-tasks to Small Business Research Firms for assistance in completing the above accomplishment.
- 649 - Structural, thermal stability, and corrosion resistance studies of Self-Assembled Monolayer (SAM) coatings were performed. SAMs can be applied in an environmentally benign process, and can be removed with minimal volatile organic chemicals and recycled.
  - Modified aqueous based coatings to optimize their functional properties to accelerate chemical/biological warfare agent degradation.
  - Discovered that hydrogen and oxygen atomic plasma may potentially be used for an environmentally benign CARC-type paint removal process.

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- Completed supercritical fluid extraction recovery studies on nitroguanidine (NQ) in an effort to develop a safe, cost-effective technique to demil triple-base propellants that allows recovery of all three ingredients (NQ, nitroglycerine (NG) and nitrocellulose).

FY 1999 Accomplishments: (continued)

- Used a nondestructive ion beam-based instrument to evaluate the erosive elemental interaction of combustion gases with gun tube alloys/coatings and correlated the results with erosion models. Supports an effort in the ARDEC Green Gun Barrel program.

•	464	- Completed environmentally benign degradation methods for Non-Stockpile Warfare Agents.
•	649	- Developed a method to synthesize spider silk in large quantities using genetic engineering processes.
		- Produced nanocomposites with improved thermal properties and no loss in mechanical or biodegradable properties.
		- Produced large ceramic crystals for aqueous solutions without use of high temperatures or pressures.
		- Completed research on improved biodegradability of oils treated with biosurfacants.
		- Completed research on bioengineering of emulsifiers.
		- Completed research on thermally labile paint primers for solventless paint removal.
	100	- Completed research for catalytic treatment of contaminated shells in the continuation of life-cycle demil technologies.
Total	3092	

FY 2000 Planned Program:

•	3432	- Optimize the environmentally benign CL-20 synthesis process for use in bench scale evaluation.
		- Develop model and test large caliber Cylindrical Magnetron Sputtering target configurations.
		- Evaluate biodegradable materials for incorporation in montmorillonite clay nanocomposites produced by melt extrusion (solvent-free) methods.
		- Complete studies of self-assembled monolayer-topcoat adhesion and the use of plasma surface treatment for improved adhesion.
		- Develop Soil Ecotoxicological Database for labile CW agent compounds and related compounds in soil, based on soil bioassay measurements.
		- Develop an economical manufacturing process for single crystal tungsten alloys and validate the performance of single crystal tungsten penetrators.
		- Develop supercritical fluid parameters for processing pyrotechnic binders.
•	75	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	3507	

FY 2001 Planned Program:

•	3570	- Produce CL-20 and military grade 2,4-dinitrotoluene at bench scale using new environmentally benign processes.
		- Apply selected coatings to medium and large caliber gun tubes that will be test fired.
		- Characterize microstructural and performance properties of ceramic materials produced by biomimetic processes.
		- Optimize soil ecotoxicological screening bioassays and predictive capabilities for labile CW agent compounds in soils.
		- Compare the chemical resistance and physical/thermal properties of monolayer topcoats to with heavy-metal based primer-topcoat systems.
Total	3570	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences		PROJECT: AH68

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AH68 Processes in Pollution Abatement Technology	349	368	374	380	387	395	402	Continuing	Continuing

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 cleanups of existing hazardous waste sites and control of future hazardous waste generation. Wastes of concern include explosives, propellants, chemical agents and smokes. This project supports applied research efforts in Program Element 0602720A, Projects AF25 and DO48.

FY 1999 Accomplishments:

•	349	- Determined factors regulating enzymatic degradation of explosives, characterized DNA for regulation and production, and developed conceptual model for regulation. (WES) - Completed minimal growth requirements for bacteria involved with destruction of energetic wastes. (CERL)
Total	349	

FY 2000 Planned Program:

•	358	- Produce enzymes responsible for degradation, develop basic processes for isolating and characterizing them, and isolate and characterize the enzymes. (WES) - Characterize the bacterial nitroreductase used for degrading nitramine and nitroaromatic explosives. (CERL)
•	10	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	368	

FY 2001 Planned Program:

•	374	- Determine physiological conditions necessary for optimum enzyme activity, establish effectiveness of cell-free enzyme systems and develop basic processes to obtain enzyme stability and effectiveness. (WES) - Determine the role of hydrogen cycling in explosive nitroreductase enzymes. (CERL)
Total	374	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences PROJECT BS04

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BS04 Military Pollutants and Health Hazards	555	621	631	640	653	665	678	Continuing	Continuing

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 U.S. Army Center for Environmental Health Research (CEHR) and U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM).

FY 1999 Accomplishments:

•	555	- Developed intra-laboratory validation of specific sentinel environmental toxicity hazard assessment methods. (CEHR) - Identified additional sentinel biomonitoring systems for toxicity hazard assessment. (CEHR) - Transferred intra-laboratory validated sentinel methods to PE 0602720A, Project A835 for interlaboratory and field validation and inclusion in an integrated toxicity hazard assessment package. (CEHR)
Total	555	

FY 2000 Planned Program:

•	605	- Identify sentinel biomonitoring systems for neurobehavioral toxicity hazard assessment. (CEHR) - Conduct intralaboratory validation of specific sentinel environmental toxicity hazard assessment methods for immunotoxicity and reproductive toxicity. (CEHR) - Transfer intra-laboratory validated sentinel methods for immunotoxicity assessment to PE 0602720A, Project A835 for further inter-laboratory and field validation and inclusion in an integrated toxicity hazard assessment package. (CEHR)
•	16	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	621	

FY 2001 Planned Program:

•	631	- Identify sentinel biomonitoring systems for neurobehavioral toxicity hazard assessment. (CEHR) - Improve and validate specific sentinel environmental toxicity hazard assessment methods for immunotoxicity and reproductive toxicity. (CEHR) - Improve and validate sentinel environmental toxicity hazard assessment methods for neurobehavioral. (CEHR) - Transfer intra-laboratory validated sentinel methods for reproductive toxicity assessment to PE 0602720A, Project A835 for further inter-laboratory and field validation and inclusion in an integrated toxicity hazard assessment package. (CEHR)
Total	631	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT BS13

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BS13 Science Base/Medical Research Infectious Disease	8784	8954	9185	9385	9567	9742	9916	Continuing	Continuing

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. Establishment of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations.

FY 1999 Accomplishments:

- 4020 - Characterized the immune responses to leading candidate malaria vaccines to determine how to improve these candidates.
  - Almost completed sequencing of *Plasmodium falciparum* Chromosome 14. Began to develop strategy for bioinformatics system to identify gene targets from the sequence data for use in malaria vaccine development and targeted drug development programs.
  - Identified five different target proteins for structure-based drug design of novel antimalarial drugs.
  - Exploited emerging advanced technologies to discover methods to improve detection of drug-resistant malaria and to design new drugs.
- 1091 - Determined the best approach for development of a vaccine against *Shigella dysenteriae*, one of the three major *Shigella* bacterias that cause diarrhea.
  - Identified components for a rapid test to identify *Shigella* in personnel with diarrhea.
  - Explored new vaccine delivery systems, vaccine strains, and animal models to test vaccines to prevent enterotoxigenic *Escherichia coli* (ETEC) diarrhea. Explored methods to reduce the virulence of live *Campylobacter* strains for use as vaccines.
- 1493 - Identified and characterized potential components for candidate dengue virus vaccines and diagnostic tests.
  - Constructed dengue nucleic acid candidate vaccines.
  - Identified and characterized potential components of future tests for hantavirus.
  - Assessed immune responses to candidate hantavirus vaccines in mice.
  - Conducted surveillance for hantaviruses in South America and South East Asia.
- 2180 - Characterized isolates of hepatitis E virus obtained worldwide to establish requirements for candidate vaccines to protect soldiers in diverse regions.
  - Confirmed the occurrence of natural drug resistance in *Orientia tsutsugamushi*, the cause of scrub typhus.
  - Conducted molecular studies of candidate vaccines made from Group B *Neisseria meningitidis* designed to protect recruits against bacterial meningitis.
  - Explored new procedures and reagents for improvement of far-forward diagnosis of infectious diseases.
  - Synthesized modified versions of a new candidate insect repellent.
  - Devised rapid assays for the detection of insects that carry *Leishmania* and mosquitoes that carry dengue virus.

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BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences	PROJECT BS13

Total 8784

FY 2000 Planned Program:

- 3985 - Further identify and characterize the mechanisms of protective immunity and targets of protective immune responses against malaria.
  - Discover additional malaria proteins that could be useful vaccine components.
  - Devise tests that can predict if a person who received a vaccine would be protected against malaria.
  - Devise strategies for rapidly exploiting the malaria genetic sequence for vaccine and drug development.
  - Prepare *Plasmodium vivax* malaria DNA for sequencing.
  - Identify candidate antimalarial drugs that have been prepared by chemical synthesis or isolated from plants.
  - Identify techniques for growing *P. vivax* malaria in the laboratory and testing drugs against these organisms to determine if the drugs are effective.
  - Employ computer modeling techniques to design antimalarial drugs.
  - Identify malaria proteins that could be targets of drugs and use this information to design new drugs.
  - Create a deployable field test to detect if malaria parasites are resistant to currently used drugs and use it to conduct surveillance for drug-sensitivity patterns of malaria in diverse geographic regions.
- 1308 - Identify and characterize how enteric bacteria cause diarrheal disease and how the disease process could be interrupted; use this information to help design vaccines.
  - Construct *Campylobacter* vaccine candidates.
  - Analyze available DNA sequence data of diarrheal-causing bacteria (*Campylobacter*, *Shigella*, and ETEC) to look for similarities among these different species to find potential broadly protective vaccine components.
  - Construct combined *Campylobacter*, *Shigella*, and ETEC vaccines.
- 1938 - Identify factors that predict safety and a long-lasting immune response to enable selection of the best dengue vaccine candidate for further development.
  - Assess the mechanisms of disease development in viral hemorrhagic fever to provide insights for discovery and design of vaccines or other countermeasures.
  - Construct antibodies in monkeys to evaluate the ability to protect animals from viral hemorrhagic fevers (VHF).
  - Improve the capability to rapidly identify VHF agents in the field and to provide definitive confirmation in reference labs.
  - Investigate VHF outbreaks to validate assays and obtain fresh field samples for viral isolation and analysis of immune response.
  - Determine the level of antibody necessary to prevent HEV disease. Complete characterization of human immune responses to HEV infection, disease, and vaccine.
  - Conduct epidemiological studies of HEV and analysis of virus types in Asia and Africa.
  - Sustain or refute the presence of hepatitis E disease among humans in Latin America using virus detection as basis for diagnosis.
  - Characterize animal carriers of HEV and the HEV viruses they carry.
  - Characterize human and viral factors leading to severe hepatitis E.

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- Establish the range of differences in immune stimulation among the different strains of the organism that causes scrub typhus.
- Define a group of *Orientia tsutsugamushi* isolates (the cause of scrub typhus) that combined in a vaccine would provide a broad range of protection.

FY 2000 Planned Program: (continued)

- Prepare strain-specific antigens from multiple isolates of *Orientia* for use in the development of a scrub typhus vaccine protective against many strains.
- Prepare at least one vaccine candidate (e.g., recombinant DNA) and evaluate its ability to protect mice against infection with the same strain of *Orientia*.
- Assess the immune responses to candidate hantavirus vaccines in mice.
- Characterize and evaluate factors related to immunity in monkey and human infection with hantavirus.

• 1574 - Conduct surveillance for hantaviruses in South America and Southeast Asia.
- Analyze human immune response to specific components of candidate vaccines for Group B meningococcus.
- Identify three additional vaccine strain candidates with different protein and carbohydrate components and genetically modify them to make them nontoxic for use as vaccines.
- Conduct risk assessment and identification of natural reservoirs/carriers (vectors) of diseases other than dengue.
- Study insect vectors and their role in spreading infectious diseases of military significance.
- Conduct preliminary development of a field device for detecting malaria parasites in insect vectors.
- Devise methods to process clinical samples that allow the purification of DNA molecules in less than 30 minutes.
- Construct test components to detect DNA or RNA for use in diagnosing relevant diseases such as malaria, dengue, diarrhea, and hemorrhagic fevers.

• 149 Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 8954

FY 2001 Planned Program:

• 3166 - Begin systematic screening of the DNA sequences of the malaria parasite to identify additional *P. falciparum* candidate vaccine antigens.
- Complete the DNA sequence of *P. falciparum*, the cause of serious malaria in military personnel.
- Begin sequencing the DNA of *P. vivax*, the other major causes of malaria in military personnel.
- Determine unique *P. falciparum* gene targets that could be incorporated into a diagnostic test to detect drug-resistant malaria.
- Identify potential populations for field testing a drug for treatment of multidrug-resistant malaria.
- Discover new antimalarial drug candidates. Continue efforts to define mechanism(s) of antimalarial drug resistance.

• 1545 - Identify potential components of a combined *Shigella* vaccine effective against multiple strains of *Shigella*. Identify the best ETEC candidate components for inclusion in a combined vaccine to prevent diarrhea caused by multiple bacterial species including ETEC, *Shigella*, and *Campylobacter*.
- Identify components of candidate *Campylobacter* vaccines and vaccine approaches that would be compatible with the *Shigella* and ETEC components of a combined diarrhea vaccine.
- Identify DNA reagents for *Shigella*, *Campylobacter*, and ETEC that will be compatible with the common diagnostic platform for diagnosing diarrhea in forward areas.

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FY 2001 Accomplishments: (continued)

•	4474	- Identify immune responses to dengue infection to help evaluate efficacy of candidate dengue vaccines. - Complete a risk assessment of chigger and tickborne diseases to military personnel. - Conduct research to select the best vaccine candidate for prevention of TBE in military service members. - Define the best strategy for acquisition of a vaccine to prevent tickborne encephalitis (TBE). - Assess and define the operational impact of disease caused by hemorrhagic fever viruses and other highly lethal viruses such as Lassa. - Define the range of immunological differences among *Orientia* isolates. - Prepare strain-specific antigens from multiple isolates of *Orientia* for use in the development of a scrub typhus vaccine. - Prepare at least one vaccine candidate (e.g., recombinant DNA) and evaluate its ability to protect mice against an infection challenge from the strain of *Orientia* used to prepare the vaccine. - Prepare proteins and/or carbohydrates that are common to all strains of Group B meningococus that can potentially be used to protect against all strains. - Complete establishment of a system for worldwide surveillance of insecticide resistance.
Total	9185	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences		PROJECT: BS14

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BS14 Science Base/Combat Casualty Care Research	3517	3949	4042	4122	4196	4269	4340	Continuing	Continuing

Mission Description and Justification: This project conducts research to understand the basic mechanisms of combat-related trauma. This research identifies trauma-related topic areas for exploratory techniques and the experimental models necessary to support in-depth trauma research studies. This research is the basis for the advancement of trauma treatment and surgical procedures to extend the time of death due to bleeding 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 1999 Accomplishments:

- 1930 - Conducted research on formulations to extend the liquid storage time span of red blood cells to 10 weeks to enhance far-forward blood supplies.
  - Began studies to characterize temperature and physical properties of plasma storage bags to decrease product losses during shipping.
  - Investigated the efficacy of dressings designed to staunch massive bleeding in combat casualties.
  - Established a clinically relevant model of combined head injury and hemorrhage as a model to assess optimal resuscitation methods.
  - Performed research into fundamental aspects of severe hemorrhage to determine requirements for aggressive resuscitation.
  - Investigated biologics/pharmaceuticals to prevent injury in the brain, spinal cord, and other organs after resuscitation. The biologics/pharmaceuticals studied include nerve cell sodium channels and the proteasome system and drugs including dihydrolipoic acid, ANH 649, glutamate, nicotinamide adenine dinucleotide, and a thyroid-releasing, hormone-releasing analog.
- 443 - Identified potential antimicrobial peptide compounds and tested their efficiency in cell cultures as a step in developing an antiplaque and anticaries dental protective formulations.
- 419 - Established cell culture system to test a molecular biology based biologic, antisense DNA, that is directed against bronchial epithelial mucus genes to block the excessive secretion of mucus that occurs after smoke inhalation.
  - Investigated methods for the diagnosis and repair of armored leg injuries including bone, blood vessels, and skin.
  - Demonstrated that neurotoxins from marine snails are effective neuroprotective agents when used in low doses.
- 725 - Developed gene analysis methods to assess cytokine contribution to secondary tissue damage that occurs after trauma.
  - Verified the sensitivity of noninvasive sensors designed to monitor physiological parameters for the diagnosis and treatment of casualties.
  - Investigated optimal sensor configuration for monitoring trauma casualties.

Total 3517

FY 2000 Planned Program:

- 506 - Develop a stable antiplaque and anticaries peptide for incorporation into the U.S. military field ration.
  - Evaluate the feasibility of developing an anticaries vaccine to reduce dental casualties far forward.

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BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS14

FY 2000 Planned Program: (continued)

•	246	- Investigate the degree of fluid resuscitation that is optimal after severe hemorrhage.
•	1783	- Examine concentrated fluid therapy as a treatment for combined brain trauma and hemorrhage. - Assess the effects of oxygen inhalation on heart and blood vessels after hemorrhage. - Compare heart and blood vessel and metabolic responses in controlled and uncontrolled hemorrhage to develop trauma-specific resuscitation protocols. - Test a resuscitation protocol using the biologic compound polynitroxyl hetastarch for resuscitation after combined brain trauma and hemorrhage. - Test complement activation inhibitors as therapeutics to prevent organ injury after resuscitation. - Investigate the function of cellular signaling as a method to reduce cellular inflammation after resuscitation. - Assess monitoring of heartbeat variability as a method to estimate hemorrhagic status. - Determine inflammation potential of supernatants from liquid red blood cell storage systems. - Compare efficacy of competing methods that are used to prepare plasma products with enhanced shelf lives. - Test testosterone as a therapy to enhance survival after severe trauma and infection.
•	411	- Investigate structural properties of Haversian bone to develop methods to enhance fracture healing. - Evaluate efficacy of hydroxyapatite- and chlorhexidine-coated stainless steel fixator pins in preventing infection in bones. - Investigate total intravenous anesthetic as a method to improve battlefield anesthesia.
•	925	- Evaluate the use of cultivated skin cells to replace skin grafts for burns. - Test the combination of anti-rejection drugs synthetic MHC peptide, CTLA4-IG, and anti-CD154 as a treatment to prevent skin graft rejection after burns. - Evaluate an experimental imaging system used to assess depth of skin injury after burns or trauma.
•	78	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	3949	

FY 2001 Planned Program:

•	399	- Screen antiplaque and anticaries peptides in appropriate test models.
•	1268	- Conduct research into optimal resuscitation protocols to treat casualties after severe hemorrhage. - Conduct research into the diagnosis and treatment of blast, behind armor, and other blunt trauma.
•	504	- Compare computerized programs that integrate sensor inputs to allow far-forward detection of lung injury. - Investigate nerve cell receptor-specific analgesia and pain relief to increase return-to-duty capabilities far forward. - Test a molecular biology-based biologic termed antisense DNA that is directed against mucus genes for its ability to inhibit excess mucus secretion in preclinical smoke inhalation models.
•	1871	- Evaluate pharmaceutical treatments to counter central nervous system injury that occurs after an initial trauma.

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- Evaluate animal models to assess efficacy of pharmacologic therapies directed against injury that occurs after resuscitation from severe hemorrhage.

FY 2001 Planned Program: (continued)

- Formulate second generation plasma products that incorporate improvements in stability and weight.

Total 4042

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BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT BS15

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BS15 Science Base/Army Operational Medecine Research	9026	5353	5495	5617	5725	5827	5928	Continuing	Continuing

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. A portion of this research supports the Science Research Objective (SRO) on "Enhancing Soldier Performance."

FY 1999 Accomplishments:

- 4645 - Demonstrated that carbohydrate supplements enhance physical and mental performance during simulated operational Special Forces unit combat operations; demonstrated that creatine supplements increase muscle endurance and recovery during knee extension exercise.
  - Explored differences in immune function in animals during exposure to stress; conducted animal studies of sleep deprivation to identify strategies that could influence learning during periods of severe stress.
  - Examined energy expenditure in a variety of military training exercises/operations, documenting high levels of energy use among warfighters, including U.S. Marines and Army Personnel.
- 991 - Validated a rat model of human hypothermia.
  - Demonstrated a quantitative index of the inflammatory response induced by endotoxin, which is increased by a variety of stressors including rewarming after cold injury.
  - Discovered that hyperthermia-induced leakage of fluids from the circulatory system was reduced by the administration of a calcium-blocking drug, suggesting that this may have beneficial effects on heat injury at the cellular level.
- 1941 - Explored the feasibility of prognostic indicators of impending bone injury in a study of Marines at Parris Island.
  - Convened an international symposium to review vertebrate chemoreceptor oxygen sensing mechanisms, adaptation to altitude, and potential for novel bioengineered oxygen sensing applications.
  - Identified the presence of a pro-inflammatory transcription factor in a nonmammalian model, as an in vivo model to assess militarily relevant immunotoxicity.
  - Discovered alterations in stress hormones for military personnel engaged in survival, evasion, resistance, and escape training, suggesting potential indicators of psychological stress levels.

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BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS15

FY 1999 Accomplishments: (continued)

- Identified the effects of single versus multiple subthreshold blast overpressure exposures to lung, heart, brain, kidney, liver, and the gastrointestinal tract.

•	1449	- Developed a nonhuman primate model of nerve fiber degeneration important for preventing vision loss after retinal laser injury. - Identified changes in the choroidal vasculature after q-switched neodymium laser exposure using noninvasive imaging techniques. - Evaluate the ability of the optical switch to protect against laser-induced retinal injury from micro- and nanosecond pulsed lasers. - Demonstrated decreased activity in the brain area responsible for complex task performance during sleep deprivation. - Assessed newly developed tests of visual performance (digital imaging, small letter contrast test, and color acuity test) to determine if they are useful in evaluating macular disease, glaucoma, and diabetic retinopathy.
Total	9026	

FY 2000 Planned Program:

•	1407	- Explore effects of an amino acid dietary supplement on muscle metabolism and strength following a protracted resistance exercise training program in women (an Army Strategic Research Objective, SRO). - Determine the ability of vitamin/antioxidant supplements to prevent or improve recovery from over-use muscle injury or preserve lean body mass during sustained operations (SRO).
•	1227	- Identify biochemical mechanisms and functional consequences of overtraining in soldiers with prolonged physical exertion and other operational stress (SRO). - Complete studies on oxidative stress and the immune response. - Investigate methods for measuring changes in gene expression in animals following exposure to militarily relevant chemicals.
•	995	- Investigate mechanisms of heat acclimation strategies to optimize thermoregulation and tissue protection. - Investigate the mechanisms of various interventions (hypertonic saline/dextran and flunarizine) to reduce hypothermia and rewarming injury in a rat model of human hypothermia (SRO).
•	1637	- Determine noninvasive neuroendocrine markers of mental performance (marksmanship, sensory processing, attention, and vigilance) in an operationally stressful environment. - Identify predictors of operational task performance with sleep deficit based on the relative contribution of a learning component using data from human sleep dose study (SRO). - Explore adaptive strategies of humans to laser exposure for inclusion in laser battlefield models and a virtual reality training system for soldiers. - Characterize laser-induced ocular trauma and treatment efficacy by advanced ocular imaging (optical coherence tomography, enhanced resolution scanning laser ophthalmoscopy) with simultaneous functional assessments.
•	87	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	5353	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS15

FY 2001 Planned Program:

•	1606	- Explore approaches to reduce metabolic water requirements through thermoregulatory and osmoregulatory mediators (SRO). - Investigate the effects of caffeine and/or ephedrine on metabolic rate and performance in cold environments (SRO). - Explore feasibility of modifying chemoreceptor oxygen sensing to simulate altitude to accelerate acclimation in hypoxia (SRO). - Evaluate and quantify the efficacy of cytokine antagonists as prophylaxes/therapies to heat injury/illness.
•	1723	- Discover mechanisms of stress fracture and the relationship to bone mineral density to determine if stress fracture incidence can be reduced through interventions to enhance bone mineral build-up (SRO). - Model biophysical properties of human tissues for use in predictive injury models. - Evaluate methods for measuring gene expression in animals following exposure to militarily relevant chemicals and relate findings to toxicological outcomes.
•	2166	- Identify and quantify cytokines and other cellular mediators in sleep deprivation and extreme fatigue generated in adverse environments. - Use positron emission tomography imaging to evaluate brain activity while performing cognitive tasks under sleep deprivation (SRO). - Assess potential therapeutics against blast-induced neuronal damage in animal models. - Investigate pharmacological intervention strategies to enhance performance in a stressful environment.
•		- Explore the timing of pharmacological interventions for treatment of laser-induced retinal injury.
Total	5495	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences		PROJECT: BS17

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BS17 Molecular Biology/Military HIV Research	374	431	439	445	482	642	661	Continuing	Continuing

Mission Description and Justification: This project provides for basic research for early diagnosis and identification of technologies to design prevention and treatment of human immunodeficiency virus (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 1999 Accomplishments:

•	374	- Identified complex protein candidates for HIV vaccines. - Characterized the immune response against complex protein vaccine candidates. - Explored DNA vaccine candidates.
Total	374	

FY 2000 Planned Program:

•	419	- Evaluate the importance of different HIV strains to determine which strains should be included in an HIV vaccine. - Define ways to measure if an individual develops protective immune response to HIV vaccines, necessary for vaccine design. - Analyze drug resistance among HIV-1 isolated from patients to establish drug treatment strategies for military dependents.
•	12	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	431	

FY 2001 Planned Program:

•	439	- Evaluate new methodologies for exploration of HIV drug resistance mechanisms.
Total	439	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT BS19

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BS19 Telemedicne Soldier Status Research	450	611	620	631	609	672	703	Continuing	Continuing

Mission Description and 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 advancing the means to determine soldier physiological status and aiding medical diagnosis and treatment. A significant thrust area will work to ascertain the sensors most relevant to determine change in soldier physiological status.

FY 1999 Accomplishments:

- 142 - Began work to determine design improvements, with a view to delivering a slave telepresence microsurgery system to the Uniformed Services University of Health Sciences in FY 2000 for telepresence microsurgery system.
- 41 - Established human use protocols to test telesurgical mentoring systems in clinical trials for virtual reality assisted telesurgery system; established telecommunications links between Fort Detrick and Johns Hopkins University.
- 175 - Awarded contract, both to conduct market survey of ophthalmic fundus imaging equipment and to develop "benchmark" patient screening protocol for teleopthalmology for diabetic retinopathy screening.
  - Committed funding for basic technology development of a flexible ureteroscopic simulator for endoscopic simulator development, minimally invasive surgical research.
- 92 Conducted research in Web-based consultation for medical specialties.

Total 450

FY 2000 Planned Program:

- 474 - Investigate training devices incorporating patient simulation, virtual reality, and computer-aided instruction to train care providers at all levels.
- 121 - Conduct research on predictive diagnostics for computer-assisted critical care and medical decision support to increase the capabilities of caregivers at far-forward localities.
- 16 - Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.

Total 611

FY 2001 Planned Program:

- 507 - Conduct research on training devices to train care providers at all levels.
- 113 - Conduct research on predictive diagnostics for computer-assisted critical care and medical decision support to enhance far-forward casualty care capabilities.

Total 620

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT BS20

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BS20 Science Base Emerging Infectious Diseases	0	0	3975	0	0	0	0	3975	3975

Mission Description and Justification: This one year congressional project's scientific and technical objectives focus on speeding development of infectious disease threat countermeasures necessary to support operations in non-industrialized countries and those in which infrastructure has been damaged or destroyed. It will also fund the necessary research to counter the military operational impact of emerging infectious diseases.

FY 1999 Accomplishments: Project not funded in FY 1999

FY 2000 Planned Program: Project not funded in FY 2000

FY 2001 Planned Program:

•	3975	- Perform and complete basic research to identify potential measures to counter the threat of emerging infectious diseases.
Total	3975	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences		PROJECT: AT22

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT22 Soil and Rock Mechanics	1654	1856	1887	1915	1952	1989	2028	Continuing	Continuing

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: 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; development of adaptive or responsive construction materials suitable for camouflage, concealment, and deception measures for fixed or semi-fixed assets; and determining and quantifying the non-linear, hysteretic response of deformable soils to transient loadings resulting from high-speed curvilinear vehicle maneuver. 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 1999 Accomplishments:

•	1654	- Completed first-principle code calculations simulating oblique-impact long-rod penetration tests against concrete targets. - Incorporated selected responsive/passive materials into/onto substrate host. - Completed analytical models for predicting traffic distribution, cohesive soil moisture response, and compaction behavior. - Developed analytic model describing influence of partial soil saturation on surface shear strength.
Total	1654	

FY 2000 Planned Program:

•	1807	- Incorporate projectile erosion algorithms into penetration prediction codes. - Determine appropriate combinations of responsive/passive composite materials for camouflage, cover, and deception as a function of environment and facility. - Develop theoretical formulation for penetration of wheels into partially saturated soils during cross-country movement. - Verify constitutive models for asphalt pavement materials and implement constitutive models for granular materials into an advanced pavement system model.
•	49	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	1856	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences	PROJECT: AT22

FY 2001 Planned Program:

•	1887	- Develop finite element interface algorithms for response of target joints and fractures to projectile penetration.
		- Develop experimental quantity of responsive/passive camouflage, cover, and deception material.
		- Model soil response to transient loading patterns of wheeled and tracked vehicles.
		- Evaluate pavement interface, load, dynamic response, and traffic distribution models.
•		- Determine physics of fiber-soil interaction that facilitates increased soil stability.
Total	1887	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT AT23

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT23 Basic Research/Military Construction	1436	1549	1595	1619	1650	1682	1714	Continuing	Continuing

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 has significant dual-use application potential.

FY 1999 Accomplishments:

•	1436	- Developed collaborative engineering methodologies to enable asynchronous design and engineering of facilities. - Characterized Electrical Time-Domain Reflectometry (ETDR) for evaluation of structural health of large concrete structures. - Conducted 3D response analysis of steel buildings for seismic safety. - Develop concepts for magnetostrictive patch structural health monitoring systems.
Total	1436	

FY 2000 Planned Program:

•	1508	- Fundamental understanding of the behavior of structural connections under high cyclic loads (like earthquakes). - Characterization of post-elastic responses of frame and shear walls to tri-directional earthquake loading. - Models for determining structural health using ETDR techniques.
•	41	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..
Total	1549	

FY 2001 Planned Program:

•	1595	- Develop theory for collaborative axiomatic designs. - Develop and test models for force development in shape memory alloy (SMA) pre-/post-tensioned systems. - Evaluate principles for infrastructure applications of functionally gradient materials systems that are multiple function layer-wise systems that can perform multiple sensor/actuator functions over a finite distance.
Total	1595	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT AT24

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT24 Snow, Ice and Frozen Soil	1244	2164	1185	1203	1217	1227	1237	Continuing	Continuing

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 Navy and Air Force science and technology efforts, and form the basis for 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. This work is managed by the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

FY 1999 Accomplishments:

•	1244	- Developed vectorized seismic wave propagation code for viscoelastic/porous media. - Developed computer model to analyze ice properties derived from satellite microwave footprints. - Developed procedures for mapping regional atmospheric icing.
Total	1244	

FY 2000 Planned Program:

•	1146	- Investigate small-scale heterogeneity for state-of-the-snow/ground modeling. - Analyze spatial variability of icing processes relevant to communications and air operations. - Determine efficiency of snow as a filter for chemical particulates.
•	983	- Identify cold unique phenomena for Homeland Defense issues such as bio-terrorism and chemical agent releases.
•	35	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..
Total	2164	

FY 2001 Planned Program:

•	1185	- Develop model for parameterizing turbulent energy exchange over snow. - Develop statistical characterization of ice thickness relevant to winter operations. - Broaden understanding of snow friction processes relevant to military operations.
Total	1185	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BT25

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
BT25 Enviornmental Research - Corps of Engineers	3908	4425	4503	4569	4656	4746	4838	Continuing	Continuing

Mission Description and Justification: This project provides the basic research needed to develop the technologies to address Army issues in the restoration, compliance, conservation, and non-industrial pollution prevention areas. The focus in restoration 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. This project will also examine the underlying requirements for comprehensive environmental modeling and simulation products to address environmental issues. The project supports applied research under PE 0602720A, Projects AF25, D048, and A896. Funds in this project are used to support extramural research via university contracts supporting in-house laboratory efforts.

FY 1999 Accomplishments:

- 1958 - Explored fundamentals of physical/chemical response of unexploded ordnance on candidate detection sensors. (WES)
  - Completed examination of the effects of genetic variety in cryptogamic crusts as a factor in propagation of soil inoculants. (CERL)
  - Completed investigation of non-linear hill slope and water channel modeling dynamics for geoarcheology. (CERL)
  - Improved theory, scaling, and computational tools for simulating fate and transport of contaminants in groundwater. (WES)
  - Explored fundamentals of organic compound fate in freeze-thaw environments and combined biological/geochemical/geophysical measurement and detection. (CRREL)
  - Developed kinetic and mechanistic understanding of sonochemical destruction of nitro containing compounds. (CERL)
  - Determined plant varieties with improved resilience to military traffic and suitable for revegetation of training lands. (CRREL)
- 1950 - Completed description of major biological degradation pathways of major explosives types; e.g., contaminants and media. (WES)
  - Combined low-temperature, bio-geochemical fate of mixed organics and metals with discontinuous permafrost models. (CRREL)
  - Established cause/effect relationship of military stressors and ecosystem responses. (WES)

Total 3908

FY 2000 Planned Program:

- 4309 - Conduct investigation of photocatalytic destruction mechanisms for nitroaromatic compounds. (CERL)
  - Investigate interrelationship between changes in soil microbial composition and plant succession dynamics. (CERL)
  - Examine chemical and biological indicators to measure the succession productivity of biological crusts. (CERL)
  - Investigate the use of bacterial enzymes for biodegradation of nitroaromatics. (CERL)
  - Develop non-linear theories for acoustic behavior for weapons noise mitigation. (CERL)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BT25

FY 2000 Planned Program: (continued)

- Complete investigation of the fundamentals of magnetic and electromagnetic induction spectroscopy (WES) and pan-spectral electromagnetic sensing (CRREL) to support enhanced discrimination and identification of buried unexploded ordnance.
- Complete determination of fundamental mechanisms of soil erodibility and runoff erosivity due to soil freeze/thaw conditions. (CRREL)
- Complete determination of genetic characteristics of native plants in cold regions (CRREL)
- Complete description of major biological degradation pathways of major explosives types using cold-adapted organisms. (CRREL)
- Complete the determination of the phenomenology for predicting the interfacial properties and multiphase soil hydraulic properties of nonaqueous phase liquids (NAPLs) using computational molecular thermodynamics. (CRREL)
- Determine the mechanisms of adsorption and transformation mechanisms in low carbon aquifer soils. (WES)
- Describe the fundamental mechanisms of biostabilization of polycyclic aromatic hydrocarbons under denitrification conditions in sediment and "reduce-and-bind" phenomena of explosives. (WES)
- Investigate ecosystem characterization/monitoring concepts through a basic understanding of microbial respiratory guilds. (WES)
- Explore the basic principles of the concentrations (CERL) and immobilization (WES) of explosives contaminants.
- Investigate experimental/numerical approaches to describe toxicological interactions of contaminant mixtures (WES).
- Investigate dielectric and conductive properties of contaminated fine-grained sediments (CRREL).

• 116 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..

Total 4425

FY 2001 Planned Program:

• 3432
- Determine effects of soil microbial composition on decomposition, mineralization, nutrient availability, and ultimately succession dynamics. (CERL)
- Establish methods to quantify biogeochemical indicators of the health of biological crusts. (CERL)
- Complete investigation of bacterial enzymes for biodegradation of nitroaromatics. (CERL)
- Validate theoretical noise attenuation rates over sound absorbing surfaces. (CERL)

•
- Complete description of the fundamental mechanisms of biostabilization of polycyclic aromatic hydrocarbons (PAHs) under denitrification conditions in sediment and of "reduce and bind" phenomena of explosives. (WES)
- Determine further mechanisms of adsorption and transformation mechanisms of polycyclic aromatic hydrocarbons in low carbon aquifer soils. (WES)
- Investigate other concepts of ecosystem characterization/ monitoring concepts through a basic understanding of microbial respiratory guilds. (WES)
- Explore additional basic principles of the concentrations (CERL) and immobilization (WES) of explosives contaminants.
- Investigate additional experimental/numerical approaches to describe toxicological interactions of contaminant mixtures (WES).
- Determine the dielectric and conductive properties of contaminated fine-grained sediments (CRREL).
- Explore the fundamental microbial dynamics in zero-valent iron systems (WES)

• 1071 - Develop basic understanding of physical, chemical, and biological phenomena specific to contaminant toxicity assessment and mineralization and to ecosystem maintenance, mitigation, and rehabilitation (CERL, CRREL, WES).

Total 4503

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT A305

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A305 Automatc Target Recognition	992	1169	1205	1235	1253	1268	1283	Continuing	Continuing

Mission Description and Justification: This project focuses on the fundamental underpinnings of aided and automatic target recognition capabilities for land warfare scenarios (primarily characterized by low depression angle, relatively short range and highly intense competing clutter backgrounds). Electro-optic/infrared (EO/IR) imaging systems utilizing advanced algorithms for interpreting and recognizing targets over extended battlefield operating conditions are essential for the warfighter. This project will provide fundamental capability to predict, explain and characterize target and background content. These efforts are aimed at evaluating the complexity and variability of target and clutter signatures and, ultimately, utilize that knowledge to conceptualize and design advanced Automatic Target Recognition (ATR) paradigms to enhance robustness and effectiveness. These ATR strategies include utilization of emerging sensor modalities such as spectral imaging and multi-sensor approaches. These research findings support several technology efforts including multi-domain smart sensors, third generation forward looking infrared (FLIR), advanced multi-function LADAR, and advanced technology demonstrations (ATD) such as Multi-Function Staring Sensor Suite, Target Acquisition, and Joint Combat Identification. Research will also be conducted in the area of acoustic sensors, which can provide very low cost target detection capabilities.

FY 1999 Accomplishments:

•	992	- Performed thermal measurements in laboratory conditions on canonical shapes and compared results with model predictions. - Generated multiple instances of targets using existing capability and compared with measured signatures. - Evaluated the phenomenology differences of co-registered 3-5 micron thermal images with 8-12 micron counterparts. - Extended 8-12 micron IR automated detection and clutter rejection algorithms to the 3-5 micron regime. - Completed initial development of innovative new approaches to acoustic beam-forming and target identification.
Total	992	

FY 2000 Planned Program:

•	1151	- Assess quality of thermal prediction for various scenarios (e.g., ground vehicles, etc.) - Isolate high and low false alarm rate images from infrared (IR) data base and compute metrics of image complexity. - Conduct phenomenological studies of multi-spectral data to determine preferred operating bands for land warfare scenarios. - Create a matching pursuits detection paradigm to accumulate evidence of primitive sub-elements of target emissions. - Survey hyperspectral data (both infrared and visible) and its applicability to land warfare missions.
•	18	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..
Total	1169	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences	PROJECT A305

FY 2001 Planned Program:

•	1205	- Assess fidelity of thermal predictions for background data; improve model as indicated. - Correlate performance of one or more modern IR ATR algorithms with image complexity measures. - Recommend preferred operating wavelengths for broadband mid and long wave thermal imagers, based on measured phenomenon. - Conduct phenomenological studies of hyperspectral data to assess minimum number of bands to achieve high discrimination performance at an affordable price for land warfare scenarios.
Total	1205	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT A31B

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A31B Infrared Optics Research	1985	2337	2426	2500	2531	2561	2589	Continuing	Continuing

Mission Description and Justification: This project sustains the Army's theoretical and experimental research in materials for 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 (FPAs) with significantly improved performance for major platforms, especially future combat vehicles, laser radar (LADAR) techniques that can utilize those FPAs, and low cost night vision aids that allow for wide distribution will be required. Therefore, research is focused on materials, devices and techniques required for high performance smart dual color staring infrared focal plane arrays (IRFPAs), innovative LADAR architectures, 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. LADAR research is focused on frequency modulation/continuous wave (FM/cw) techniques that permit high-resolution but low frequency range readout. Research for uncooled IRFPAs is based on thin film ferroelectric materials and novel detector architectures with improved thermal isolation structures.

FY 1999 Accomplishments:

•	450	- Designed 0.8 μm quantum well modulator for LADAR.
•	1535	- Characterized normal incidence absorption properties for a variety of quantum dot material systems.
		- Investigated quantum dot structures for reduced dark current in IR detectors.
Total	1985	

FY 2000 Planned Program:

•	2324	- Investigate high power 1.5 *u*m diode laser and quantum well modulator/mixer for LADAR with 600 MHz bandwidth.
		- Investigate improved thin films and detector structures for low cost uncooled IR detector array.
		- Investigate use of vertical cavity surface emitting lasers (VCSELs) for optical readouts of IR FPAs.
		- Investigate growth of 8-12μm HgCdTe on silicon.
•	13	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..
Total	2337	

FY 2001 Planned Program:

•	2426	- Investigate material growth and device design for long wave infrared (LWIR) FPA operating above 100°K.
		- Investigate design for IRFPA to be utilized for active and passive imaging.
		- Design optical mixer array for LADAR.
Total	2426	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences		PROJECT: B52C

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
B52C Mapping and Remote Sensing	2098	2288	2327	2362	2408	2455	2503	Continuing	Continuing

Mission Description and Justification: This project supports research in fundamental topographic sciences to improve the tactical commander's knowledge of the battlefield; to extract and attribute natural and man-made features from reconnaissance imagery in near-real time; to exploit terrain analysis and reasoning techniques, and to explore the potential of space technology to provide real-time terrain intelligence, command and control, and targeting support. The research provides the theoretical underpinnings for Program Element 0602784A, Project A855.

FY 1999 Accomplishments:

•	2098	- Evaluated optimal combination of sensor information for generation of topographic data. - Evaluated geostatistical wavelet technique for performing image compression. - Upgraded climate atmosphere model parameters to enhance tactical decision aids. - Investigated methods for automated data capture, characterizing and quantifying models and the dependent relationships across terrain, threat, and military activities.
Total	2098	

FY 2000 Planned Program:

•	2228	- Investigate multivariate statistical analysis, multivariate interpolation, and enhancements for image analysis. - Investigate generating topographic data using a combination of sensor information. - Evaluate initial geostatistical models of climatic atmospheric parameters integrated with line-of-sight models for denied areas where limited or no data is available. - Evaluate models and their performance to characterize expected battlefield state against actual data sets from operational databases.
•	60	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..
Total	2288	

FY 2001 Planned Program:

•	2327	- Investigate enhancement of neural net and subpixel methods of feature extraction. - Investigate hyperspectral imagery analysis/segmentation. - Devise model to predict precipitation frequency data in the absence of weather data in denied areas.
•		- Investigate the potential to integrate empirical and inductive analysis systems.
Total	2327	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences		PROJECT: B53A

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
B53A Battlefield and Environment Signature	3134	3674	3812	3939	3983	4013	4039	Continuing	Continuing

Mission Description and Justification: This project provides an in-depth understanding of the complex atmospheric boundary layer associated with high-resolution meteorology, the transport, dispersion, optical characteristics and detection of chemical and biological aerosols, and the propagation of full-spectrum electro-magnetic and acoustic energy. It impacts Army chemical and biological defense operations, electro-optic and acoustic sensors, smoke/obscurant deployments and target acquisition. This project supports Army Strategic Objectives, provides technology for the Integrated Meteorological System (IMETS) and supports Project Reliance under the Defense Technology Area by providing Tri-Service transport and dispersion research. This project is the leader in boundary layer meteorology research over land and urban terrain.

FY 1999 Accomplishments:

- 3134 - Analyzed atmospheric effects on acoustic imaging and coherence using a three-axis orthogonal microphone array for enhanced signal processing.
  - Determined the effects of turbulent intermittency and partial saturation on acoustic target detection and bearing estimation for enhanced signal processing.
  - Produced methods for approximate representation and decomposition of turbulence structure using wavelet and other analyses, and applied to acoustical scattering calculations for improved acoustic target acquisition.
  - Completed a set of experiments and theory on the impact of polarization on image propagation in the real and battlefield atmosphere for enhanced electrooptical target acquisition.
  - Analyzed a coupled high-resolution meteorological transport and dispersion model for an improved hazard avoidance tactical decision aid.
  - Analyzed a coupled 3-D surface/boundary layer meteorological model that improved the high-resolution meteorological transport and dispersion model by incorporating target area meteorological parameters.
  - Improved techniques for reducing false alarm rates in real-time detection of biological warfare agents using fluorescence spectra.
  - Evaluated converting the Battlescale Forecast Model (BFM) to a non-hydrostatic model for improvement of severe weather predictions.
  - Generated an intermediate scale hydrostatic forecast model to provide BFM with an upgraded capability to depict and forecast mesoscale phenomena not seen in global scale model data.

Total 3134

FY 2000 Planned Program:

- 3659 - Model and perform experiments on low-frequency acoustic propagation in forest canopies and littoral regions to assess impact on acoustic sensors.
  - Complete theory and software linking 3-D atmospheric propagation and radiative transfer models to standard interfaces, such as the Total Atmospheric and Oceans server (TAOS), for DoD simulations to improve virtual testing, analysis, and simulation capabilities.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: B53A

FY 2000 Planned Program: (continued)

- Compare coupled 3-D surface layer/boundary layer meteorological model with experimental data for verification and validation of a hazard avoidance tactical decision aid.
- Investigate methods for discriminating, in real-time, between naturally occurring and man-made aerosols, using both fluorescence and elastic scattering for real-time detection of biological warfare agents.
- Couple canopy and urban flow technologies into transport and dispersion models for more realistic depiction of smoke, clouds, dust aerosols and toxins on the battlefield.
- Incorporate detailed Surface Energy Balance in Surface Layer Model for improved thermal dynamics.
- Participate in a joint interagency stable boundary layer meteorological field experiment, Cooperative Atmospheric Surface Exchange Study (CASES 99) to achieve a better understanding of stable boundary layer processes for environmental model performance improvements.
- Determine new algorithms for depicting physical processes for better analysis and prediction of icing, low level clouds, and precipitation at time and spatial scales required for accurate quantitative depiction of target area atmospheric conditions.
- Extend capabilities of acoustic target recognition into more complex environments through research on theory and numerical models of propagation of sound through inhomogeneous anisotropic turbulence including refraction and ground reflections.

• 15 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..

Total 3674

FY 2001 Planned Program:

• 3812
- Investigate and correct problems with transient turbulence model which will decrease computational requirements.
- Improve boundary layer model capabilities by incorporating stable atmospheric algorithms.
- Model and perform experiments on high-frequency acoustic propagation in forest canopies and littoral regions.
- Establish experimental capability for hyperspectral or sensor fusion research with applications for atmospheric propagation to enhance electro-optical target acquisition.
- Investigate the use of multiple excitation wavelengths to excite fluorescence for characterizing aerosol particles, especially biological warfare agents, and elastic scattering for characterization of inhomogeneous aerosols.
- Evaluate new algorithms for depicting physical processes to better analyze and predict turbulence, wind shear, and visibility at time and spatial scales required for accurate, quantitative depiction of target area atmospheric conditions.
- Provide numerical models for acoustic propagation over complex (hilly and mountainous) 3-D terrain to enable acoustic signal analysis.

Total 3812

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT B74A

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
B74A Human Engineering	2219	2599	2687	2761	2795	2823	2850	Continuing	Continuing

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), and the Army Strategic Research Objectives (SROs).

FY 1999 Accomplishments:

•	2219	- Completed data collection efforts on human auditory processes in detecting sound in various environments and estimating the distance from the sound source. - Implemented draft set of operational metrics for measuring depth perception and visual attention. - Generated a model that evaluates changes in soldier performance and workload as a function of changes in display design. - Devised random incidence corrector and calibration procedures for a "general damage" auditory model. Submitted impulse noise standards for Committee on Hearing and Bioacoustics (CHABA) review. - Refined previously completed psychological stress measures and investigated the effects of cognitive skill performance. - Implemented a methodology for studying the role of visual attention in target acquisition.
Total	2219	

FY 2000 Planned Program:

•	2574	- Complete analysis and documentation of previous studies on human auditory perception. - Conduct an experiment to examine target and obstacle detection, depth and distance estimation, and size and depth perception using color night vision devices. - Generate advanced windows based version of auditory hazard model with active middle ear muscles and azimuthal correction capabilities. - Conduct a field experiment to measure the effects of information availability (timing and frequency) and information accessibility on situational awareness and decision making ability using helmet mounted displays (HMDs). - Investigate the effects of specific battlefield stressors on situational awareness and decision making under conditions of uncertainty. Provide a draft set of operational stress measures. - Provide an analysis of the effects of selective visual attention on target acquisition in static, optically imaged scenes, to AMSAA's soldier-in-the-loop target acquisition modeling effort.
•	25	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..
Total	2599	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT B74A

FY 2001 Planned Program:

•	2687	- Investigate the effect of acoustic source motion on human auditory perception. - Conduct experiments to examine the effects of chromatic and luminance differences between imagery and overlaid graphics and symbology on night vision performance. - Generate hearing protection algorithms and incorporate into auditory hazard model. - Measure and compare the individual and combined effects of both audio cues and visual presentation of information on task performance using HMDs. - Refine and validate previously established operational stress measures. - Expand studies of selective visual attention on target acquisition to electrooptically (IR and I2) imaged scenes and provide results to AMSAA's soldier-in-the-loop target acquisition modeling effort.
Total	2687	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences		PROJECT B74F

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
B74F Personnel Perormance and Training	2037	2689	2803	2843	2876	2916	2999	Continuing	Continuing

Mission Description and Budget Item Justification: This project conducts behavioral science research in areas with high payoff opportunities for improved training, leadership, and personnel performance, including: methods for faster learning and improved skill retention; leader effectiveness for improved team and unit 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 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 1999 Accomplishments:

•	2037	- Determined the role of transformational leadership behavior on platoon performance.
		- Generated a model to maximize training effectiveness and efficiency for selected Army tasks, such as topographic map reading.
		- Conducted research on a technique to better understand the attitudes of inner-city youth toward Army service.
		- Completed research on the importance of propensity to enlist and actual enlistment behavior for different groups of officers and enlisted personnel.
		- Completed research on individual differences in spatial ability and how those differences affect an individual's ability to navigate complex routes.
Total	2037	

FY 2000 Planned Program:

•	2623	- Establish preliminary models for effective leadership of small, next-century units to maximize leader and unit resiliency to adversity.
		- Complete research on analyzing tacit knowledge and how it contributes to effective leadership.
		- Model the results of a long-term analysis on the durability of tank gunnery skills in the absence of practice.
		- Complete research to determine the effects of training on the ability of commanders to handle large amounts of information.
		- Complete analysis of how European Armies have adjusted to rapid changes in their societies.
•	66	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs..
Total	2689	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences	PROJECT B74F

FY 2001 Planned Program:

•	2803	- Complete a model on the effects of electronic communication on the development of trust between leaders and subordinates. - Evaluate the use of latent semantic analysis to assess an individual's knowledge structure and to aid in automatic analysis of free-range text. - Determine the effects of different types of missions and gender issues on cohesion, morale, and performance effectiveness. - Determine and understand the unique characteristics of digital skills in terms of their effects on learning, durability, and transferability of trained skills.
Total	2803	

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

DATE: February 2000

BUDGET ACTIVITY: 1 - Basic Research

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

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	42343	64370	54365	49026	49804	50603	51462	Continuing	Continuing
BH50 Telecommunications Research	8634	9595	9760	9908	10099	10293	10493	Continuing	Continuing
BH53 Advanced Distributed Interactive Simulation Research	1864	1177	1195	1214	1236	1260	1284	Continuing	Continuing
BH54 Advanced Sensors Research	8809	9791	9960	10111	10305	10503	10707	Continuing	Continuing
BH56 Advanced Displays Research	4204	6833	5955	6045	6160	6279	6400	Continuing	Continuing
BH59 University Centers of Excellence	3716	6214	1988	1986	1985	1983	1982	Continuing	Continuing
BH62 Electromechanics and Hypervelocity Physics	8206	8815	7951	7944	7937	7931	7965	Continuing	Continuing
BH64 Materials Center of Excellence	2112	2416	2457	2494	2540	2590	2640	Continuing	Continuing
BH65 Microelectronics Center of Excellence	2204	1958	1992	2023	2062	2101	2142	Continuing	Continuing
BH73 National Automotive Center of Excellence	2594	5800	4908	2956	3012	3070	3128	Continuing	Continuing
J07 Counter Terrorism Program	0	11771	0	0	0	0	0	11771	11771
J08 Institute for Creative Tchnologies	0	0	8199	4345	4468	4593	4721	Continuing	Continuing

A. Mission Description and Budget Item Justification: This program element leverages research in the private sector through Federated Laboratories, Centers of Excellence, and the University Affiliated Research Center. Federated laboratories are an innovative and forward thinking approach focusing the talents of industry and academia on critical technology needs of the Army. Federated laboratories are partnerships between the Army Research Laboratory (ARL) and 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 associations 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 that 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

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601104A University and Industry Research Centers**

consortia researchers through long term rotational assignments. The federated laboratory approach for ARL is in accordance 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. The Army's Institute of Creative Technologies (ICT) is also included in this program element. The ICT is a partnership with academia and the entertainment industry to leverage innovative research and concepts for training and design. Examples of specific research of mutual interest to the entertainment industry and the Army are technologies for immersion, networked simulation, standards for interoperability, and tools for creating simulated environments. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and DoD Project Reliance

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	44839	47066	48024
Appropriated Value	45138	65066	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-299		
b. SBIR / STTR	-1185		
c. Omnibus or Other Above Threshold Reductions		-265	
d. Below Threshold Reprogramming	-1131		
e. Rescissions	-180	-431	
Adjustments to Budget Years Since (FY 2000/2001 PB)			+6341
Current Budget Submit (FY 2001 PB)	42343	64370	54365

Change Summary Explanation: Funding – FY 2001: Project J08 increased (+4000) to support research on more effective immersive environments; Project BH73 increased (+2000) to support research on 21st Century Truck.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH50

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH50 Telecommunications Research	8634	9595	9760	9908	10099	10293	10493	Continuing	Continuing

Mission Description and Justification: This project provides long term collaboration between the Army Research Laboratory and competitively selected industry/university consortium 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; multi-media concepts.

FY 1999 Accomplishments:

•	8634	- Determined signaling protocols for call hand-off, origination, delivery, and internet protocol mobility in a highly mobile battlefield environment. - Established network management techniques based on a next-generation, software-based, fault-tolerant distributed object computing platform and a multi-tier network architecture to manage tactical communication networks - Completed 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 and demonstrated at the Federated Laboratory Symposium. - Generated packetization and error recovery methods for multimedia communications over wireless battlefield channels. - Researched and provided inter-media and inter-participant multimedia synchronization using sub-millisecond time synchronization to provide multimedia applications to the tactical network.
Total	8634	

FY 2000 Planned Program:

•	9336	- Establish data distribution schemes based on adaptive triggers and intelligent agents to support a fault tolerant architecture. - Provide 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 communication networks. -Establish compression techniques for multimedia delivery to tactical networks. - Simulate large-scale highly mobile untethered battlefield networks. - Investigate laser communications using adaptive optics technology.
•	259	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	9595	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH50

FY 2001 Planned Program:

•	9760	- Determine information hiding techniques to enhance information assurance over wireless battlefield channels. - Describe simulation of large-scale highly mobile untethered battlefield networks. - Show the feasibility of 3D-network management system integrated into advanced visualization techniques for tactical command and control. - Improve communications using a laser system with adaptive optics. - Investigate mobile wireless communications at frequencies above 5 gigabytes. - Investigate global information distribution over satellites or surrogate satellites with intelligent, adaptive multicast techniques.
Total	9760	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601104A University and Industry Research Centers** PROJECT **BH53**

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH53 Advanced Distributed Interactive Simulation Research	1864	1177	1195	1214	1236	1260	1284	Continuing	Continuing

Mission Description and Justification: This project establishes long term collaboration between the Army Research Laboratory and a competitively selected Army Center of Excellence in Information Sciences (ACEIS). The Clark Atlanta University, a HBCU, will perform research in information science. The research focuses on the mid- to far-term needs of Army Command and Control Systems. It performs research in information science with emphasis in the following areas: interactive and intelligent systems; database and information systems; and distributed and parallel processing systems. This project also supports research critical to the Army at the Army High Performance Computer Research Center beginning in FY99. The research includes characterizing the effect of trailing vortices on paratrooper deployment, structural response of armored vehicles to perforating and nonperforating impact, developing more efficient gun and missile propulsion systems, and developing materials suitable for armor/anti-armor applications.

FY 1999 Accomplishments:

- 583 - Identified the visual clues that detect a "Sense of Presence" on a virtual battlefield that include the detection, identification, and location of visual stimuli, conveyed to the human via parallel paths.
  - Investigated techniques to optimize each stimulus in order to develop effective visualization applications.
  - Explored how battle command knowledge and experience can be utilized to provide visual problem solving for a knowledge base using the internet.
  - Established an experimental environment to formulate advanced concepts for information transfer systems.
  - Provided a capability to identify signatures of anomalous activities in large data systems.
  - Identified issues associated with transfer of learning in virtual environments.
- 1281 - Extended techniques for simulation of parachute inflation fluid-structure interactions and applied them to parachute fluid structure interactions for full 3D parachute models.
  - Described methods to model the effect of the vortex-wake system behind a large transport aircraft on paratrooper separation from aircraft.
  - Described methods to model aircraft wake vortices and vortice shedding as it relates noise generation and suppression from helicopter blades.
  - Described adaptive girding, mesh moving, and multi-body modeling techniques and apply these techniques to modeling paratrooper exit from large transport aircraft.
  - Established 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.
  - Provided, as required for new research applications, fast and efficient parallel mesh generation/regeneration algorithms for use in fluid-object (mesh moving) applications or solution adaptive computations.
  - Advanced highly parallel solvers for sparse linear systems for applications to solve problems in fluid flow, structural mechanics, electromagnetics and heat transfer.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH53

FY 1999 Accomplishments: (continued)

- Extended virtual environment using neural nets and fuzzy logic. Incorporated advanced data mining techniques into intelligent data base capabilities.
- Investigated technologies for information distribution in a wireless mobile environment.

Total 1864

FY 2000 Planned Program:

- 557 - Describe different scenarios for "Sense of Presence" and performance in battlefield virtual environments.
  - Explore knowledge acquisition, knowledge dissemination, concept analysis, and decision tools to enable users to engage in visual problem solving technologies when working with large knowledge bases.
  - Capture signatures of anomalous activities in large data systems using cluster analysis, Fourier Transforms, and Neural Networks.
  - Study the transferability of soldiers' knowledge and experience gained during training in a virtual environment to the real world..
- 588 - Extend techniques for simulation of parachute inflation fluid-structure interactions and apply them to parachute fluid structure interactions for full 3D parachute models. In conjunction with Natick, verify model against empirical data.
  - Establish methods to model the effect of the vortex-wake systems behind multiple large transport aircraft flying in formation on paratrooper deployment (i.e., extend model to multiple aircraft and multiple paratroopers).
  - Investigate highly parallel algorithms for repartitioning of dynamic and adaptive meshes.
  - Validate computational algorithms for transient/dynamic analysis and scientific computations.
- 32 - Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1177

FY 2001 Planned Program:

- 585 - Evaluate prototype "Sense of Presence" in a battlefield virtual environment.
  - Explore techniques identifying signatures to handle data analysis in real time on an active system.
- 610 - Deliver production quality software which can be used by Army personnel at the Natick RDEC for simulation of parachute inflation fluid-structure interactions and apply parachute fluid structure interactions for full 3D parachute models.
  - Verify computational models for simulating the vortex-wake systems behind multiple large transport aircraft flying in formation on paratrooper deployment .
  - Analyze lightweight, battlefield survivable structures for agile combat platforms.
  - Establish simulation based design of composite materials for application to Future Combat Vehicle and Rotorcraft.
  - Model ballistic impact on composite materials in application to combat systems.

Total 1195

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH54

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH54 Advanced Sensors Research	8809	9791	9960	10111	10305	10503	10707	Continuing	Continuing

Mission Description and Justification: This project provides long term collaboration between the Army Research Laboratory and a competitively selected industry/university consortium 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, microsensors which integrate microelectromechanical systems (MEMS), acoustic, seismic, and RF technologies. These technologies are fundamental elements required to realize vision of a medium weight force to detect, target, and engage the enemy.

FY 1999 Accomplishments

- 1842 - Established a comprehensive millimeter wave (MMW) radar backscatter database for low grazing angle backscatter and a scattering model for improved target tracking and detection algorithms.
- 1389 - Established the application of low-power signal processing techniques to a medical monitoring problem.
  - Evaluated a network situation of distributed signal processing.
  - Designed reconfigurable processor performing fusion of 2 color infrared (IR) imagery.
- 2308 - Imaged utilizing dual color 256x256 quantum well infrared photodetector (QWIP) and 240x320 HgCdTe (MCT) IR Focal Plane Arrays (IRFPAs); improved quantum efficiency by 50% for QWIP detector array and 60% for MCT.
- 1390 - Evaluated distributed microsensor testbed at Spesutie Island, Aberdeen Proving Ground, MD.
- 1880 - Improved automatic target recognition (ATR) performance for forward looking infrared (FLIR) by rapid updating from reconnaissance imagery, improved detection of camouflaged targets using hyperspectral sensing and established coregistered multisensor dataset for detection of mines and buried unexploded ordnance.

Total 8809

FY 2000 Planned Program:

- 1932 - Design a 94 GHz radar with a 64-element electronically scanned antenna at an Aberdeen test site. The antenna will be capable of receiving a transmitting in two orthogonal polarizations and will employ high level of integration necessary for low cost production
- 2341 - Investigate multi-domain smart sensor (MDSS) with dual color IRFPAs and eye safe LADAR; design spatial noise mitigation and low power optical IRFPA read-out techniques.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH54

FY 2000 Planned Program: (continued)

•	2033	- Evaluate computing architectures for the application of adaptive computing techniques to low-power signal processing for networks of distributed microsensors.
•	1117	- Evaluate combination of fixed and mobile unattended ground sensors.
•	2104	- Develop multi-fusion algorithms in support of third generation imaging sensors.
•	264	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	9791	

FY 2001 Planned Program:

•	9960	- Investigate innovative adaptive signal processing techniques to enable fusion of self-organizing multidomain networks. - Investigate adaptive multisensor fusion algorithm that requires minimal training for detection and recognition of battlefield targets. - Explore innovative hardware/software architecture for on-sensor processing of advanced multi and hyperspectral sensors, and multimode radio frequency (RF) sensors.
Total	9960	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH56

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH56 Advanced Displays Research	4204	6833	5955	6045	6160	6279	6400	Continuing	Continuing

Mission Description and Justification: This project supports a competitively selected university/industry consortium that was formed to provide solutions for the many requirements for information assimilation on the battlefield. The focus of the consortium is to develop more powerful and more user friendly computer displays and information control constructs to provide access to all information of practical use and provide data visualization in an efficient manner without overwhelming the user. 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 1999 Accomplishments

- 4204 - Studied scaling problems with spatial reasoning in a large, multi-dimensional battlefield databases.
  - Integrated FOX Course of Action (COA) tool to Decision-Analytic Wargaming tool, OWL, and analyzed the efficacy of COAs, and demonstrated at the Annual Federated Laboratory Symposium.
  - Integrated and tested speech and gaze inputs into battlefield visualization and simulation environments.
  - Investigated application software and displayed simulated information from widely distributed Microsensor network on commander's workstation.
  - Established cross-consortium (Displays, Sensors and Telecommunications) research products using the architecture developed in the Integration Support Laboratory (ISL).
  - Established audio icons for joint modality displays.
  - Completed integration of FOX & OWL with CADET and transitioned to CECOM.
  - Conducted experiments on Cognitive Engineering Applications in the collaborative planning and maneuvering area.

Total 4204

FY 2000 Planned Program:

- 5659 - Transition refined integrated course of action development and analysis tools for use in collaborative technology STO and ATDs.
  - Publish guidelines, methods and procedures for development of more effective visual-auditory displays and guidance on use of eye-tracking in interacting with displays.
  - Provide Beta algorithms for vision-based gesture analysis, for speech/gesture integration, and for bimodal speech recognition as well as selected foreign language translation (DRAGON).
  - Transition Automation Speech Recognition (ASR) server to collaborative technologies STO and ATDs.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH56

FY 2000 Planned Program: (continued)

		- Provide cognitive Engineering Applications model(s) to collaborative technology STO, CECOM and Battle Labs (support output of Cognitive Engineering STO).
•	991	- Implement and assess registration system and technique for overlaying 3D information onto video or see-through helmet mounted display. - Develop single and dual access electronic stabilization algorithms for mobile displays.
•	183	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	6833	

FY 2001 Planned Program:

•	5955	- Finalize and finish refinement of ISL architecture and transition package to CECOM and Battle Labs. - Provide algorithms using wavelets and fractals for embedded coding of image/video. - Incorporate talking and gesturing avatars into collaborative planning and execution scenarios. - Extend the FOX-RAVEN-CADET paradigm to include collaborative planning within the intelligence arena. - Using Army Soar-MODSAF architecture: provide a commander/staff model capable of conducting cognitive engineering of Army command and control interfaces; create model–opposing force commanders to direct other Soar-controlled unit entities. - Investigate technologies to enable commanders to tailor C2 systems to support their individual cognitive processes. - Research intelligent systems that provide an enabled understanding of information needs for situation and tasks.
Total	5955	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH59

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH59 University Centers of Excellence	3716	6214	1988	1986	1985	1983	1982	Continuing	Continuing

Mission Description and Justification Army Centers of Excellence are active in the fields of rotary wing technology, fuel cell technology, the foundations of image science, and science, mathematics, and engineering (SME) training. The Army's Centers have significant collaborative participation by Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) and all future Army Centers will be formed in partnerships 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 1999 Accomplishments:

- 1885 - Completed model for noise/vibrations reduction; tested magneto-rheological (MR) dampers to alleviate rotor aeromechanical instabilities; reformulated motion equation for reconfigurable flight control systems; developed intelligent algorithms for transmission fault detection/classification; implemented joint probabilistic decision making process for multi-attribute, multi-objective, multi-constraint design problems; implemented adaptive neural net controller, with fuzzy logic controls, on the R-50 helicopter test bed.
- 1831 - Concluded research at the Illinois Institute of Technology center on advanced fuel cell and advanced battery research and transferred the results to advanced research and advanced technology development.
  - Advanced target imaging research by fusing data from laser radar systems and forward-looking infrared sensors using pose estimation of ground-based targets rather than algorithms to determine the position and orientation of targets at the Johns Hopkins University Center on image analysis.
  - Supported science, mathematics and engineering (SME) education at Contra Costa College to strengthen academic programs in SME and encouraged underrepresented minority students to pursue advanced degrees and careers in science and engineering.

Total 3716

FY 2000 Planned Program:

- 1929 - Investigate and validate a first principle-based approach to model the sound wave propagation through a non-uniform, unsteady flow field.
  - Investigate wake instability, turbulence modeling, and vortex core axial velocity, using an advanced Mie-scattering technique.
  - Complete advanced design concept development, such as multi-element airfoils, to reduce dynamic stall effects on maneuvering flight.
  - Develop and validate analytical models for predicting response of damaged asymmetric composites under influence of hygrothermal stresses.
  - Conduct piloted simulation of transient response limit avoidance system.
  - Develop an accurate elastomeric material model, including effects on rotorcraft loads, response and stability.
- 2173 - Generate computer models of targets and synthetic image generation to guide theoretical work and verify existing image recognition theories at the Johns Hopkins University center.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH59

FY 2000 Planned Program: (continued)

- Support science, mathematics and engineering (SME) education at Contra Costa College to strengthen academic programs in SME and attract underrepresented minority students to careers in these fields.
- Conclude multidisciplinary research program in landmine detection and identification and transfer the results to advanced research and advanced technology development.

•	1945	- Link entertainment industry and defense through the development of a center, the Institute for Creative Technologies, to research networked, realistic simulation tools focused on incorporating entertainment industry methods and data into combat training devices (moved to Project J08 in FY01). - Explore emerging entertainment technologies that may be applicable to meet future Army training needs (moved to Project J08 in FY01). - Research applicability of entertainment database tools and methods for use in Army modeling and simulation (moved to Project J08 in FY01).
•	167	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	6214	

FY 2001 Planned Program:

•	1988	- Conduct interdisciplinary investigations at Penn State University, the University of Maryland and Georgia Institute of Technology on topics of specific relevance to rotorcraft science and technology base in conjunction with the National Rotorcraft Technology Center.
Total	1988	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH62

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH62 Electromechanics and Hypervelocity Physics	8206	8815	7951	7944	7937	7931	7965	Continuing	Continuing

Mission Description and Justification: This project funds electromechanics and hypervelocity physics Army basic research relating to electromechanical components (electromagnetic launchers and power supplies) for applications to electromagnetic (EM) 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 EM Armaments Program strategy, highest emphasis has been placed on advancing the state-of-the-art in pulsed power, materials to achieve extended rail life, 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 development with applications for anti-armor, artillery, air defense, and the Future Combat Systems (FCS).

FY 1999 Accomplishments

•	8206	- Showed efficient hypervelocity gun launch of lethal launch packages (40-mm, 2.5km/s, 50% mass in the projectile) with sufficient gun rail life and projectile accuracy to compete with conventional gun technology. - Proved defeat of advanced armors with novel penetrators at both ordnance velocity and hypervelocity. - Established the system utility of the EM gun concept. - Supported compulsator exploitation efforts and explored disk topology technology.
Total	8206	

FY 2000 Planned Program:

•	8578	- Investigate pulsed power technology; with emphasis on the disk topology approach. - Investigate alternative EM pulsed power applications. - Conduct research on high current, fast transient switching for EM pulsed power. - Examine launcher and launch package technologies for future field applications. - Prove the robust defeat capabilities of EM gun penetrators. - Examine electric power generation, storage and distribution for mobility.
•	237	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	8815	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH62

FY 2001 Planned Program:

•	7951	- Evolve thermal management technology for EM pulsed power, switching, and railgun needs. - Design and fabricate laboratory launcher for technology evaluation. - Evaluate alternate EM pulsed power options. - Evaluate material and structural components of launchers and launch packages for future field applications - Exploit robust EM gun penetrators. - Conduct research on advanced switch technology for mobility.
Total	7951	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH64

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH64 Materials Center of Excellence	2112	2416	2457	2494	2540	2590	2640	Continuing	Continuing

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 breakthroughs in materials science relevant to Army needs. Basic research in materials science and engineering is focused on armor, armaments, personnel protection, ground vehicles, tactical missiles, chemical/biological materials defense, and related Defense Science Research Areas, with application to the Future Combat Systems (FCS). The project emphasizes advanced materials characterization; integrated, multifunctional composites; dendritic/hyperbranched polymers and nanostructured materials research. Current collaborative research agreements are with U. Delaware, Johns Hopkins U., and Michigan Molecular Institute. U. Michigan, U. Minnesota, U. California-San Diego, U. Maryland-College Park, U. Pennsylvania, Cornell U., Princeton U., Howard U. and Boston College are also integrated into the Program. This work is closely coordinated with the ARL in-house materials research project funded through PE 0601102A, Project AH42.

FY 1999 Accomplishments

•	2112	- Characterized Silicon Carbide (SiC) surfaces and thermal cycling effects on electrical, structural and metallurgical properties of SiC contacts and interfaces. - Devised new model and improved Ion Beam Assisted Deposition processing technology that involves photon stimulated dissociation of absorbed hydrogen to explain and control the formation of diamond-like coatings on surfaces of advanced materials. - Established micromechanical models that incorporate polymer-fiber interphase phenomena to predict processing and moisture effects on residual stress and other critical composite material properties.. - Completed a design and optimization procedure for vacuum assisted resin transfer molding using analytical model and simulation genetic algorithm. - Provided basic research on novel dendritic and hyperbranched polymer-fiber surface treatments that enhance the environmental durability and shear/impact resistance of composite materials. - Designed and tested dendritic polymer substrate and bioconjugate materials for use in biotoxin detection and immobilization.
Total	2112	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH64

FY 2000 Planned Program:

•	2351	- Establish in-situ ultrasonic velocity technique for characterization and process monitoring of lithium aluminosilicate glass for transparent armor. - Determine trapping rates and energies for hydrogen traps present in high strength steels. - Improve fracture toughness and poor interfacial adhesion of E-beam curable resins. - Devise novel experimental technique to investigate high-strain rate behavior in sub-micron region next to fiber surfaces in composite materials. - Design and synthesize dendritic/hyperbranched polymer nanoreactors for chemical decontamination application. - Prove that antibody-dendritic polymer-metal conjugates are able to improve biosenor signal amplification by at least an order of magnitude.
•	65	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	2416	

FY 2001 Planned Program:

•	2457	- Extend basic theory, processing technology, and testing methodology for tailoring and characterizing fiber surfaces, fiber-matrix interphase, matrix composition, and 3-D architecture of fiber-reinforced composite materials. - Establish guiding principles for data documentation, testing and design of multi-functional, integrated composite materials. - Devise transport models and extend basic knowledge to describe and understand penetrant-penetrant and penetrant-polymer interactions in multiphase polymer systems and for selective/controlled transport of penetrants in tailored "smart" polymer membranes and coatings. - Establish underpinning theory and processing technology for rapid repair and joining of dissimilar metals/ceramics by self-propagating reactions in multi-layer foils.
Total	2457	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH65

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH65 Microelectronics Center of Excellence	2204	1958	1992	2023	2062	2101	2142	Continuing	Continuing

Mission Description and Justification: The Microelectronic Research Agreement (MICRA) supports a long-term collaboration between Army Research Laboratory scientists and the universities. This program allows the Army to leverage extensive scientific manpower and know how of the universities to work in a collaborative manner with Army scientists to address critical Army microelectronics issues related to night vision, RF and optical sensors, bio sensors, batteries/fuel cells and high temperature power electronics for future electric vehicles. The goals of this effort are to conduct innovative research and exploit new concepts in solid state physics, electrical engineering, photonics, microelectromechanics (MEMS) and chemical/electrochemical engineering to support specific Army needs. The program provides for a mutual exchange of personnel and for a sharing of research capabilities.

FY 1999 Accomplishments

•	2204	- Designed a silicon carbide (SiC) switch for high temperature and high current electronic applications such as all-electric vehicle. - Expanded understanding of physics of millimeter wave (MMW) devices for applications such as passive MMW imaging and high resolution radar. - Investigated electroless plating oxidized vertical cavity surface emitting lasers (VCSELS) and specialized complementary metal oxide semiconductor (CMOS) circuits for sensor processing. - Improved catalysts for methanol-air fuel cell for man- and vehicle-portable power supplies. - Designed high brightness light emitting diodes (LEDs) for fiber gyro rotational rate sensor for missile navigation applications and transitioned to MRDEC.
Total	2204	

FY 2000 Planned Program:

•	1905	- Use newly created aluminum nitride (AlN) insulating films to fabricate high power switches that can operate at high temperatures in future electric combat vehicles. - Investigate new catalysts to improve methanol fuel cell efficiency. - Integrate vertical cavity surface emitting lasers (VCSELS) with silicon driver chips for very high speed optical data processing. - Optimize the fabrication process for microelectromechanical RF filters.
•	53	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	1958	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH65

FY 2001 Planned Program:

•	1992	- Apply low resistivity high temperature metallization to the fabrication of SiC high power switches. - Fabricate cavityless vertical amplifiers and incorporate into smart pixel based optical signal processors. - Validate performance of low loss perovskite films in RF phase shifters for electronically scanned antennas. - Integrate ferroelectric thin films with optimized phyroelectric response with silicon to fabricate uncooled IR sensor elements.
Total	1992	

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

DATE: February 2000

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH73

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
BH73 National Automotive Center of Excellence	2594	5800	4908	2956	3012	3070	3128	Continuing	Continuing

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, University of Alaska, University of Tennessee, and Clemson University, while key industry partners include the major U.S. automotive manufacturers and suppliers.

FY 1999 Accomplishments:

•	2594	- Completed optimization of overall simulation network by linking optimal subsystem simulations into a seamless distributed design network for military vehicle, powertrain and structural design. - Completed experimental validation of fully functional system model using advanced hardware prototypes. - Finalized mechanism for fostering effective government, industry and academic partnering which facilitates cooperative dual-use technology development, reduces research costs and duplication of efforts.
Total	2594	

FY 2000 Planned Program:

•	5647	- Research derivation of next generation, high fidelity, military vehicle simulation models. - Develop and implement target cascading methodology for integrated optimization. - Assess accuracy of new simulation capability using enhanced, unique experimental procedures.
•	153	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	5800	

FY 2001 Planned Program:

•	4908	- Incorporate new generation building blocks for enhanced military vehicle simulation models. - Assess new simulation model accuracy over a wide range of military vehicles and conditions.
Total	4908	

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

DATE: February 2000

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: J07

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
J07 Counter Terrorism Program	0	11771	0	0	0	0	0	11771	11771

Mission Description and Justification: This project establishes a one year Congressionally-directed program to be conducted by the Army Engineer Research and Development Center and a competitively selected industry/university consortium for the purpose of leveraging world class research relevant to mitigating the efforts of terrorist acts. This basic research program will explore technologies that deter, resolve, and mitigate terrorist acts, including physical structure and effects research. The research will investigate revolutionary approaches in science and technologies that will provide next generation solutions for force protection and terrorist threats. These technologies include new and/or improved structural strengthening methods and materials to building collapse, improved window, roof, wall systems to reduce injuries from flying glass and debris, new blast shielding systems, and vulnerability assessment modeling. The work is managed by the Structures Laboratory, U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 11454 - Design, fabricate and complete a laboratory high-pressure simulator to investigate debris hazard mitigation technology.
  - Investigate high-performance materials for structural strengthening.
  - Examine debris hazard modeling techniques.
  - Investigate next-generation window systems.
- 317 - Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.

Total 11771

FY 2001 Planned Program: Not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT J08

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
J08 Institute for Creative Tchnologies	0	0	8199	4345	4468	4593	4721	Continuing	Continuing

Mission Description and Justification: This project supports simulation and training technology research at the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. ICT was designated in August 1999 by DDR&E as a University Affiliated Research Center (UARC) to support Army training and readiness through research into simulation and training technology such as mission rehearsal, leadership development, and distance learning. ICT will actively engage industry (multimedia, location-based simulation, interactive gaming) to exploit dual-use technology. ICT will serve as a means for the military to learn about, and benefit from entertainment technologies, and enable their transfer into military systems. ICT will also work with creative talent from industry in order to adapt their concepts of story and character to increasing the degree of immersion experienced by participants in synthetic experiences, and to improving the utility of the outcomes of these experiences. In return, industry will leverage the DoD sponsored research being done by the Modeling and Simulation UARC. Creating a true synthesis of creativity and technology and of the capabilities of industry and the R&D community will revolutionize military training and mission rehearsal by making it more effective in terms of cost, time, the types of experiences that can be trained or rehearsed, and the quality of the result. It will also allow the United States to maintain dominance in simulation and training technologies.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program: FY 2000 project work is supported by Project BH59.

FY 2001 Planned Program:

•	8199	- Support research center on networked, realistic simulation tools focused on incorporating entertainment industry methods and data into combat training devices. - Conduct research to understand the levels of reality/fidelity required to suspend disbelief and generate verisimilitude in virtual environments in support of the new Army Vision/Transformation. - Investigate the use of avatars to depict locals, friendly and hostile forces and mission team members for mission rehearsal environments. - Create advanced immersive environment utilizing sound, visual cues, motion and other sensory elements.
Total	8199	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602105A Materials Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	12867	16266	11557	14385	14865	14791	15357	Continuing	Continuing
AHM1 Hardened Materials	2890	0	0	0	0	0	0	0	5791
AH84 Materials	9977	16266	11557	14385	14865	14791	15357	Continuing	Continuing

A. Mission Description and 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. It provides the technology base required for solving materials-related problems in individual soldier support equipment, armor, armaments, aircraft, ground and combat vehicles and combat support. Technology for advanced materials will enable the Future Combat Systems' (FCS) survivability and lethality. Project HM1 focuses on developing the materials technology needed so that future strategic missile interceptors can meet stringent performance demands. 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. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Force XXI.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	13012	13849	13825
Appropriated Value	13137	16349	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-125		
b. SBIR / STTR	-93		
c. Omnibus or Other Above Threshold Reductions		-29	
d. Below Threshold Reprogramming			
e. Rescissions	-52	-54	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-968
New Army Transformation Adjustment		TBD	-1300
Current Budget Submit (FY 2001 PB)	12867	16266	11557

Change Summary Explanation: Funding – FY 01: Project AH84 was adjusted to reflect the new Army Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602105A Materials Technology		PROJECT AHM1

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AHM1 Hardened Materials	2890	0	0	0	0	0	0	0	5791

Mission Description and Justification: This was a one-year Congressionally Funded program. This project focused on providing the materials technology for critical components meeting the stringent requirements of strategic interceptors. Materials optimizing for the advanced composite shroud (ACS) enables 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 was managed by the Army Research Laboratory, Aberdeen Proving Ground, MD, with contractual efforts at Fiber Materials, Incorporated, of Biddeford, ME (prime), and included as subcontractors Crystal Systems, Inc., of Salem, MD, and Lockheed/Martin Corp., of Sunnyvale, CA.

FY 1999 Accomplishments:

•	2890	- Completed a successful flight test of the advanced composite shroud and transitioned to the Ballistic Missile Defense Office (BMDO). - Completed the documentation of failure modes for single crystal sapphire systems. - Completed the characterization of candidate resin systems for use in single matrix system for shroud/heat shield.
Total	2890	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602105A Materials Technology		PROJECT AH84

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH84 Materials	9977	16266	11557	14385	14865	14791	15357	Continuing	Continuing

Mission Description and Justification: This project supports the Army Vision by providing the technical foundation for materials technology in metals, ceramics, polymers, and composites that are essential for lethal and survivable future Army systems that are lighter, more deployable, and more sustainable, including the Future Combat Systems (FCS). 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 1999 Accomplishments:

- 6536 - Determined dynamic properties of armor grade ceramics (Al_2O_3, SiC, B_4C) and advanced composite materials (KM2, Spectra Shield, GRP); demonstrated personnel armor system with 40% weight savings over Ranger Body Armor; transitioned to Natick Soldier Center (SBCCOM).
  - Provided advanced polymeric/barrier materials that offer improved performance and durability in Army chemical defense applications.
  - Characterized processing/microstructure/property relationships of nanostructured polymers and nano-reinforced ceramic materials for improved survivability in Army systems.
  - Devised computer models that determine the structural as well as ballistic performance of complex composite material systems for application to the family of future lightweight combat vehicles.
  - Optimized process for fabricating ballistically resistant hybrid laminate.
  - Provided rapid prototyping of ballistically tolerant novel components via laser processing.
  - Quantified ballistic enhancement in integral ceramic/composite armor; demonstrated armor configuration with improved ballistic performance.
  - Characterized and elucidated processing and microstructural relationships to produce novel metallics, ceramics and intermetallic microstructures for engineering lightweight structural armor materials.
- 2802 - Characterized, in simulated gun firings, the enhanced erosion resistance of advanced coating systems designed to significantly increase gun barrel lifetime.
  - Exhibited improved ferroelectric ceramic processing using double doping to reduce losses and increase tunability for significantly reducing the cost and weight of future antenna systems.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602105A Materials Technology	PROJECT AH84

- Fabricated prototype refractory metal shaped charged liners and verified their processibility.

FY 1999 Accomplishments: (continued)

- Devised processing techniques for fabrication of nano-materials to replace depleted uranium in penetrators.

•	639	- Investigated fatigue, flaw detection, and material characterization of thick composite structures; and completed correlation of analytical model of smart material 'Thunder' with dynamic test results. - Applied microwave non-destructive evaluation (NDE) and laser ultrasound system to detect and calibrate damage in ceramic and polymer composite structural panels, incorporated dynamic data into smart materials model; completed tests of active suspension system control for ground vehicles.
Total	9977	

FY 2000 Planned Program:

•	8489	- Devise life prediction models for Army materiel based on accelerated weathering, cyclic corrosion testing, and real-world exposure studies that will significantly reduce logistical costs for Army systems. - Quantify and optimize sensor arrays to assess ballistic damage, environmental degradation and potential chemical/biological agent threats. - Fabricate and evaluate new mass-efficient means to improve the ballistic resistance of ceramics by integrating them with organic-matrix composites to enable improved lightweight combat vehicles. - Determine the microstructural influences of metallic-intermetallic-ceramic components on the performance of current composite armor designs - Determine high strain-rate behavior and failure criteria of layered and functionally graded ceramics, metals and anisotropic composites to develop constitutive models to abet the rational design of materials for high-performance, integrated, multifunctional armors
•	3200	- Devise atomic scale, physical-based models of propellant gas interactions with the gun bore surface to predict the durability of the bore surface for a variety of coatings systems and propellants. - Show that dielectric materials for miniature smart munition antenna sections will enable extended range and improved accuracy for both direct and indirect fire weaponry. - Fabricate refractory metal explosively formed projectile liners and determine their processibility.
•	703	- Conduct microwave NDE measurement and analyses for large composite structures; develop more portable and field usable laser ultrasonic inspection technique; and evaluate an advanced off-road, high-speed wheeled testbed, for structural dynamics research; Conduct tests of TACOM selected tire for characterization in vehicle modeling.
•	1185	- Determine critical materials technologies essential for the successful testing of pulsed power machines for Army After 2010.
•	2500	- Investigate contour weaving and braiding techniques for lightweight, affordable, reduced signature, composite structures for air and ground vehicles. - Characterize high strength and high stiffness moldable resins according to mechanical, thermal, electrical and/or optical properties.
•	189	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	16266	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602105A Materials Technology / PROJECT: AH84

FY 2001 Planned Program:

•	8632	- Provide reduced-cost, appropriate-quality processing technology for lightweight combat vehicles that feature the integrated armor structure technologies available. - Devise procedures for producing bulk materials with nano-scaled microstructures for protection from extreme environments. - Model and engineer candidate multi-phase functionally graded microstructure for penetration resistance and minimal collateral damage in future lightweight combat vehicles. - Integrate multifunctional sensor arrays to assess ballistic damage, environmental degradation and potential chemical/biological agent threats. - Validate penetration and structural simulations to enable material design for future multifunctional, high-performance armor/structure solutions to counter medium-caliber and residual (post APS) large-caliber threats to future combat vehicles.
•	2184	- Produce a full scale section of a large caliber gun tube coated with an enhanced erosion resistant refractory metal coating applied by high velocity spray techniques. - Evaluate thin film phase shifter materials with properties comparable to bulk materials to significantly reduce the cost and weight of future antenna systems.
•	741	- Provide structural dynamic response improvements with active control technology on an advanced off-road, high-speed wheeled testbed; Evaluate prototype microwave NDE hardware using TACOM-provided composite test components; demonstrate laser ultrasonic inspection technology development and checkout.
Total	11557	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	16334	24850	20722	21994	23040	23432	24495	Continuing	Continuing
AH15 Ground Combat Identification Technology	3378	3330	3474	3555	3645	3883	4069	Continuing	Continuing
AH16 S3I Technology	10197	16553	14536	15155	16016	16038	16740	Continuing	Continuing
A140 High Power Microwave (HPM) Technology	2759	3005	2712	3284	3379	3511	3686	Continuing	Continuing
A142 Passive Millimeter Wave (MMW) Camera	0	1962	0	0	0	0	0	0	2000

A. Mission Description and Justification: The objectives of this program are: (1) to provide sensor, signal and information processing technology for advanced reconnaissance, surveillance, and target acquisition (RSTA), ground to ground and air to ground combat identification (ID), and fire control systems as well as the fuzing and guidance integrated fuzing functions in future munitions; and (2) to significantly improve the survivability, lethality and mobility/range of Future Combat Systems (FCS) through the development of high-power electronic components and technologies for compact, light-weight power and energy storage, conversion and conditioning, and RF/microwave directed energy (RF-DE) weapons. Three critical technologies are addressed to increase the combat effectiveness of tactical Army forces: (1) high power, solid-state/vacuum power/RF 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) and the Army Force Modernization Plan.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	16614	22978	23723
Appropriated Value	16895	24978	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-281		
b. SBIR / STTR	-125		
c. Omnibus or Other Above Threshold Reductions		-57	
d. Below Threshold Reprogramming	-89		
e. Rescissions	-66	-71	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-2001
New Army Vision/Transformation Adjustment		TBD	-1000
Current Budget Submit (FY 2001 PB)	16334	24850	20722

Change Summary Explanation: Funding – FY 01: Decrease due to reprogramming to higher priority activities and to reflect new Army Vision/Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602120A Sensors and Electronic Survivability		PROJECT AH15

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH15 Ground Combat Identification Technology	3378	3330	3474	3555	3645	3883	4069	Continuing	Continuing

Mission Description and Justification: This program provides the enabling technology necessary for advanced Combat Identification (CI) concepts and systems for mission areas not considered to date. The hardware and software improvements and modeling and simulation advances provided by this project are essential to expand and build upon the midterm CI architecture. The operational impacts to be realized are 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 addressing the fusion of situational awareness (SA) and point-of-engagement target identification (TI).

FY 1999 Accomplishments:

- 3378 - Successfully demonstrated technical and operational feasibility of Combat ID for Dismounted Soldier (CIDDS) with the Force XXI Land Warrior ensemble.
  - Assessed the technical risks for a ground vehicle-to-dismounted soldier ID system based on CIDDS.
  - Completed Phase 1 algorithm design and development phase of the Ground Integrated Target ID System (GITIS) Objective Ground to Ground target ID system. Performed operational analysis of concept with emphasis on Man-Machine Interface (MMI) concepts.
  - Developed Phase II high-fidelity ground simulator of GITIS (sensor fusion SA + TI).
  - Developed an ID concept based on SINCGARS SIP+ that allows the Fire Support Team (FIST) to ID vehicles before calling for indirect fire.
  - Completed Phase I Simulation Study of Combat Identification for Helicopters.

Total 3378

FY 2000 Planned Program:

- 3245 - Conduct high-fidelity technical and operational evaluations of GITIS algorithms and simulators.
  - Perform technical field trials and operational trials of the SINCGARS SIP+ FIST with user participation.
  - Select CI solution for Helicopters and design hardware.
  - Develop Architecture Study to investigate emerging technologies.
  - Prepare SINCGARS SIP+ study to migrate to Advanced System Improvement Program (ASIP) radio.
- 85 Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)

Total 3330

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability / PROJECT: AH15

FY 2001 Planned Program:

•	3474	- Characterize GITIS technical and operational performance. - Characterize SINCGARS SIP + FIST technical and operational performance - Characterize technical performance of CI for Apache-Longbow. - Complete Architecture Study to determine and define emerging technologies. - Analyze results of SINCGARS SIP + /ASIP study.
Total	3474	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602120A Sensors and Electronic Survivability		PROJECT AH16

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH16 S3I Technology	10197	16553	14536	15155	16016	16038	16740	Continuing	Continuing

Mission Description and Justification: This project provides for the synergistic applied research for sensors; signal processors; sensor and information processing; and automatic target recognition (ATR) technology for reconnaissance, intelligence, surveillance, and target acquisition (RISTA), fire control, smart munitions and fuzing systems. In the RISTA and fire control area, the project will investigate: (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 communications systems; (6) advanced battlefield sensor and information processing to conduct a dynamic and real time situation assessment to present a common picture of the battlespace to commanders; and (7) advanced information processing methods to provide automatic information technologies to enable commanders to utilize widely dispersed sensor and legacy information sources. Project goals in the smart munitions and fuzing area include advanced microwave, MMW, acoustic, electrostatic, and LADAR technologies to reliably sense low cross section targets in high countermeasures and clutter environments. These technologies support the FCS; Army Vision; and Advanced Technology Demonstrations/ Advanced Concept Technology Demonstrations (ATD/ACTD), DoD initiatives, and systems such as: Target Acquisition; Multi Function Staring Sensor Suite (MFS^3); Warrior Extended Battlespace sensors (WEBS); Smart Sensor Webs; Raptor; Anti-personnel Landmine Alternative (APLA); Battlespace Command and Control; Joint Combat Identification; Rapid Battlefield Visualization; 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 1999 Accomplishments:

- 1157 -Collected X-band radar signatures of kinetic energy (KE) rounds during live-fire tests for full spectrum active protection system (APS).
  -Completed fully polarimetric monopulse Ka-band instrumentation radar for high resolution inverse synthetic aperture radar (ISAR) measurements to support smart munitions sensor development.
- 2129 -Integrated second-generation algorithms into ultra-wideband radar to detect land mines.
  -Established improved stationary target classification for real-beam radars.
- 2811 -Designed optoelectronic processor interconnect circuit involving advanced CMOS drive circuits capable of some processing functions and VCSEL array interconnects.
  -Designed and fabricated infrared (IR) imaging acousto-optic tunable filter (AOTF) in support of hyperspectral imaging STO.
  -Characterized optical limiters for TARDEC applications.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602120A Sensors and Electronic Survivability
	PROJECT AH16

FY 1999 Accomplishments: (continued)

-Improved ability to fabricate miniature lenses using subwavelength diffractive optical elements for high speed image processors.
-Explored optimum conditions for invariant focusing via optical processing for Future Combat System (FCS) optical systems.

- 4100 -Determined an acoustic detection algorithm for multiple target identification. Developed body-worn sensor for soldier performance monitoring; developed capability for medic to interrogate soldiers remotely; evaluated mortar munition test firings to demonstrate capability to glide extended ranges in excess of 12km with a 120mm mortar munition; evaluated potential impact of magnetic sensors for unattended ground sensors.
-Investigated concepts and tools for sensor fusion on unattended ground sensors.
-Trained an ATR algorithm originally developed using 8-12 micron thermal emission phenomenology with 3-5 micron data and assessed performance.

Total 10197

FY 2000 Planned Program:

- 4056 -Evaluate field techniques for calibration of coherent fully polarimetric active and passive MMW target acquisition systems to provide increased situation awareness for the future network centric forces.
-Evaluate performance of second-generation mine detection algorithms and performance of forward-looking vehicle mounted sensors for increased mobility and survivability of FCS.
-Investigate impact of near and far field signatures on MMW target acquisition emulations and algorithm development for increased lethality of FCS.
- 2100 - Investigate visible imaging microsensor and IR imaging microsensor designs for WEBS.
-Evaluate magnetic sensor capabilities for unattended ground sensors.
- 4281 - Investigate advanced acoustic target identification algorithms.
- Investigate multi-target acoustic tracking for WEBS and MFS^3.
- Investigate a fused 3-5 micron and 8-12 micron ATR algorithm exploiting unique characterics of each and assess performance.
- 3137 - Design high data rate, highly parallel opto-electronic interconnects.
- Evaluate extended depth-of-field optical systems.
- Investigate algorithm and processing architecture for hyperspectral imaging.
- Investigate breadboard optical limiters for TARDEC applications.
- 2085 - Investigate techniques for the auto-rectification of submeter resolution sensor data for viewing in an integrated 2D / 3D environment.
- Integrate (from AH48) intelligent system technology that compares, in the background, sensor information against user specified priority information requests and focuses user attention to the sensed information.
- Integrate robust speech, natural language, and untethered gesture recognition research into multimodal computer interface modules.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability / PROJECT: AH16

•	700	- Next- Generation Autonomous Vehicle Navigation Control System (AUTOVAV) (Partner: Germany): Continue design of an advanced autonomous vehicle navigation control system. Complete sub-system tests of obstacle detection, classification, and avoidance technologies.
•	194	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	16553	

FY 2001 Planned Program:

•	3546	-Validate second generation mine detection algorithms with plastic mines in new environments for increased mobility of FCS. -Extend functionality of MMW radar emulation to smart weapons like MMW Longbow Hellfire and Tank Extended Range Munitions (TERM) for increased lethality of FCS. -Apply calibration and image formation techniques to field tests to support Ka-Band vehicle mounted multifunction radio frequency sensor for increased survivability and lethality of FCS.
•	2308	- Model and optimize hybrid diffractive optical elements (DOEs) on vertical cavity surface emitting lasers (VCSELs) and detectors for OE processing architectures. - Determine limitations of image formation and performance of various optical designs and processors.
•	1300	-Design integrated acoustic/seismic/imaging microsensor network for WEBS. - Investigate sensor fusion concepts for acoustic/seismic/magnetic sensor. - Evaluate magnetic sensor capabilities in WEBS testbed.
•	4856	- Determine advanced acoustic target identification algorithms with real targets. -Design first iteration of a multi-band spectral imager-based ATR algorithm compatible with land warfare scenarios.
•	1996	- Validate performance of algorithms that will focus a commander's attention to critical sensor inputs and assist in synchronizing operations. - Validate performance of an integrated multimodal computer interface on-the-move control of ground station and Tactical Operations Center (TOC) displays. - Investigate if the use of submeter terrain will significantly enhance the operational utility of analytical tools that have been developed to assist a commander.
•	530	- Next- Generation Autonomous Vehicle Navigation Control System (AUTOVAV) (Partner: Germany): Continue design of an advanced autonomous vehicle navigation control system. Complete sub-system tests of obstacle detection, classification, and avoidance technologies.
Total	14536	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602120A Sensors and Electronic Survivability		PROJECT A140

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A140 High Power Microwave (HPM) Technology	2759	3005	2712	3284	3379	3511	3686	Continuing	Continuing

Mission Description and Justification: The objective of this project is to significantly improve the survivability, lethality and mobility/range of Future Combat Systems (FCS) through the development of high-power electronic components and technologies for compact, light-weight power and energy storage, conversion and conditioning, and RF/microwave directed energy (RF-DE) weapons. This program is coordinated and, when appropriate, leveraged with RF-DE and power programs in the Air Force, Navy, Defense Special Weapons Agency, National Labs, University Consortia and relevant industry and foreign partners.

FY 1999 Accomplishments:

- 2759 -Determined system design requirements for enhanced counter-air capability (ECAC) and conducted an electromagnetic compatibility (EMC) analysis of a counter-air weapon system in support of US Army Air Defense Artillery School (USADASC).
  -Conducted RF effects investigations & experiments on a fuze, forward looking infrared (FLIR) and a Global Positioning System (GPS) for TRADOC, CECOM RDEC, and Joint Live Fire Test & Evaluation (JLFT&E) office.
  -Completed the design of electromagnetic (EM) shielding components for the High Mobility Multipurpose Wheeled Vehicle (HMMWV) shelter for NRDEC.
  -Conducted research into new weapon systems with tunable capabilities for lethal, non-lethal, anti-personnel, and anti-materiel applications in support of ARDEC for the Army After 2010 and beyond.
  - Provided expertise to Army RDECs, PMs, DoD IG, TRADOC, and intelligence community regarding directed energy (DE) threat environments, effects, and hardening technology insertion.
  -Completed design of beam stick and output cavities for high average power broadband klystron amplifier and report on possibilities for size and weight reduction.
  -Conducted theoretical study of electron beam dynamics in linear beam tubes such as Reltron and klystron.
  -Completed full complement of linear beam design and simulation codes for high power vacuum electronics.
  -Designed a slotted waveguide array for use on Army platforms and field tests.
  -Conducted theoretical study of broadband klystron amplifiers for Army applications.
  -Validated benign and threat effects on Abrams and Longbow Apache information flow models, and transferred to CECOM's suite of System Performance Models.
  -Determined new test and simulation methods to study the effects and mitigation of RF-directed energy weapons (DEW) on military and commercial systems.

Total 2759

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability — PROJECT: A140

FY 2000 Planned Program:

•	2965	- Conduct RF effects investigation and experiments of selected target(s) of interest to TRADOC, CECOM RDEC, and JLFT&E. - Conduct research into new RF-DEW components and systems with tunable capabilities for lethal, non-lethal, anti-personnel, and anti-materiel applications in support of ARDEC for the FCS. - Provide expertise to Army RDECs, PMs and TRADOC regarding DE threat environments, effects, and hardening technology insertion. - Investigate designs for size/weight reduction of high power linear beam tubes (e.g. Reltrons) for FCS platforms. - Complete designs for series of experimental Reltron linear beam tubes for improved lethality against electronic targets. - Investigate advanced designs for principal broadband amplifier components including diode, cavities, and beam stick. - Investigate advanced antennas and techniques for more compact, light-weight FCS applications. - Support RDEC demos and application studies. - Design and test high power solid-state power conversion/conditioning devices/technologies for hybrid/all electric drives and RF-DE, laser and EM/ETC gun loads for FCS.
•	40	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	3005	

FY 2001 Planned Program:

•	2712	- Conduct research into new DEW components and systems with tunable capabilities for lethal, non-lethal, anti-personnel, and anti-materiel applications in support of ARDEC for the FCS. - Provide expertise to Army RDECs, PMs and TRADOC regarding DE threat environments, effects, and hardening technology insertion. - Complete first stage designs for size/weight reduction of linear high power beam tubes. - Construct experimental designs for series of broadband klystron amplifier experiments. - Design a high gain, broadband antenna or antenna system for high power FCS applications. - Support RDEC demos and application studies. - Design and test high power solid-state power conversion/conditioning devices/technologies for hybrid/all electric drives and RF-DE, laser and electric gun loads for FCS.
Total	2712	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602120A Sensors and Electronic Survivability / PROJECT: A142

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A142 Passive Millimeter Wave (MMW) Camera	0	1962	0	0	0	0	0	0	2000

Mission Description and Justification: This is a Congressionally funded program; not part of the Army's core mission. This is a development technology program for a passive/active MMW imaging system to demonstrate its performance capabilities as a covert all-weather surveillance and target acquisition system. Funding is provided to perform research on enabling MMW technologies in support of passive/active MMW imaging. These funds have been provided to the Army Research Lab as a result of Congressional interest for the development of a Passive MMW Camera (PMC).

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	1909	- Establish a better thermal resolution and wider field of view version of the PMC that will be lightweight, low-cost and flightworthy for performing radio-silent navigation and landing, reconnaissance, and search and rescue under conditions of clouds and fog.
•	53	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	1962	

FY 2001 Planned Program: Project not funded in FY 2001.

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	23854	30048	31080	31475	31536	32962	32793	Continuing	Continuing
A47A Aeronautical and Aircraft Weapons Technology	20793	26790	27502	27795	27721	28993	28725	Continuing	Continuing
A47B Vehicle Propulsion and Structures Technology	3061	3258	3578	3680	3815	3969	4068	Continuing	Continuing

A. Mission Description and 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 2010. RWVs offer a practical solution to many of the DoD / Army's operational needs because of their ability to take off and land vertically, and to operate efficiently and effectively at or below tree top level for nap-of-the-earth (NOE) missions. Accordingly, RWVs present unique design challenges and require significantly different analysis compared with traditional fixed wing vehicles, which do not have rotors and do not hover or fly in NOE. 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, avionics 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 coordinated government / industry / academia 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 at least matched by industry. Army, NASA, Navy, and Federal Aviation Administration (FAA) provide staffing and support for the NRTC operations. Technology developed in this PE will support the future DoD Joint Transport Rotorcraft (JTR) identified to potentially replace the aging Army CH-47D Chinook and Navy CH-53 Super Stallion helicopters. Upgrade activities [as applicable] of Army systems such as the AH-64 Apache, RAH-66 Comanche, UH-60 Blackhawk, Navy SH-60 Seahawk and USMC AH-1 Cobra are supported as well.

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; Allied Signal Engines, Phoenix, AZ; Sikorsky Aircraft, Stratford, CT; Rolls Royce, Indianapolis, IN; Kaman Aerospace Corp., Bloomfield, CT; Pratt & Whitney, Hartford, CT; Raytheon STX, Washington, D.C.; 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; Naval Postgraduate School, Monterey, CA; California Polytechnic University, San Luis Obispo, CA; 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,

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology

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; University of Alabama, Huntsville.

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 Directorate (VTD) /Army Research Laboratory (ARL), NASA Langley Research Center, Hampton, VA; and Vehicle Technology Directorate / ARL, NASA Glenn Research Center, Cleveland, OH.

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 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 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 (AH-64D Longbow Apache), 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 Agreements with the Netherlands, Israel, Japan, Germany, France and the United Kingdom (UK).

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	24943	30165	31184
Appropriated Value	25160	30165	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-217		
b. SBIR / STTR	-333		
c. Omnibus or Other Above Threshold Reductions		-64	
d. Below Threshold Reprogramming	-656		
e. Rescissions	-100	-53	
Adjustments to Budget Years Since FY 2000/2001 PB			-104
Current Budget Submit (FY 2001PB)	23854	30048	31080

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology		PROJECT A47A

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A47A Aeronautical and Aircraft Weapons Technology	20793	26790	27502	27795	27721	28993	28725	Continuing	Continuing

Mission Description and Justification: The objective of this project is to conduct research and mature advanced RWV technologies for DoD / Army rotorcraft that significantly increases 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. Areas of research focused on fluid mechanics, dynamics, weight reduction, advanced materials applications, infrared (IR) / visual electro-optical (EO) signatures, internal / external cargo handling, combat damage repair, vulnerability reduction, ballistic tolerance and crashworthiness will provide higher performance, improved survivability and sustainability, and reduced cost for propulsion and air vehicle subsystems. The propulsion technology in this project supports the goals of the DoD IHPTET / Joint Turbine Advanced Gas Generator (JTAGG) program. Advanced active controls, aerodynamics, handling qualities, acoustic signatures and smart materials technologies will provide rotors and flight controls with increased payload / range, maneuverability / agility and survivability. Flight simulation, avionics, weapons integration, aircrew / machine integration and pilot-vehicle interface technologies are focused on development of advanced crew stations and mission equipment packages that will provide improved workload distribution, reduced design / development time, and increased lethality and mission operational effectiveness. This project also supports work done under the auspices of the 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. Technologies developed by this project will transition to advanced development technology demonstration programs with application to current as well as future DoD / Army rotorcraft systems.

FY 1999 Accomplishments:

- 6850 - Conducted extensive sling-load flight-test and simulation studies, and documented in a US national conference paper the accurate prediction of sling load envelope prediction and critical handling-qualities metrics.
  - Validated and optimized Rotorcraft Aircrew Systems Concepts Airborne Laboratory (RASCAL) control laws using the Control Designer's Unified Interface Tool (CONDUIT) tool and successfully ported the optimized RASCAL control laws into the Rapid Prototyping Simulation Environment (RIPTIDE).
  - Successfully validated in an extensive motion-based piloted simulation the capability to achieve improved handling qualities for UH-60 partial authority control systems.
  - Used hybrid computational methods to develop approaches for reducing rotorcraft adverse aerodynamic forces and increasing range and speed.
  - Completed first version and training of Man-machine Integrated Design Analysis System (MIDAS) cockpit design tool with new human operator cognitive models and performed part-task simulation studies to verify predictions of crew station awareness measures.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602211A Aviation Technology
PROJECT: A47A	

- Performed simulation evaluation of situation awareness measures to minimize spatial disorientation and improve symbology designs; transitioned results to RAH-66 Comanche.

FY 1999 Accomplishments: (continued)

- Integrated SBIR Phase II, Pilot-Rotorcraft Intelligent Symbology Management Simulator (PRISMS) into a laboratory virtual prototyping environment for developing helmet mounted display symbology.

- 500 - Conducted preliminary design studies for advanced rotor core concepts, including on-blade control, high-lift devices, active twist, and variable diameter rotor to guide critical component fabrication and evaluation.

- 2174 - Performed preliminary design efforts for advanced precision kill weapon system aircraft integration concepts.
  - Completed airborne unmanned-to-manned systems functional definition and transitioned results to Airborne Manned Unmanned System Technology (AMUST) demonstration program.
  - Analyzed pertinent OSD open systems directives, emerging electronics industry standards and specifications, and Joint Technical Architecture (JTA) and DoD avionics requirements to define a low cost, common mission processing system for current and developmental rotorcraft. Identified technical issues and preliminary design information for implementation of plug-and-play modules, reusable software, and COTS electronics.
  - Conducted analysis to update cargo lift study data in support of JTR Integrated Concept Team mission needs assessment and JTR Technical and Operational Concept Development.

- 1882 - Conducted testing on composite fuselage joints to validate structural integrity; develop methods to co-cure complex composite rotorcraft assemblies to reduce cost; conducted structural validation testing of dynamic models of airframe fittings for improved structural integrity and structural weight; developed landing gear concepts capable of heavy gross weight performance; conduct preliminary studies of smart materials for vibration/stress reduction in airframes.

- 1355 - Completed fabrication of monolithic ceramic low pressure (LP) turbine airfoil and attachment configuration consistent with IHPTET / JTAGG Phase III providing higher temperature capability and increased horsepower to weight ratio; fabricated advanced high pressure (HP), reduced stage count compressor for IHPTET / JTAGG Phase III providing higher pressure ratio, lower weight, reduced specific fuel consumption and reduced operation and support costs; completed design of inter-metallic composite (IMC) spar / shell HP turbine blade providing higher temperature capability and increased horsepower-to-weight ratio; conducted detailed design of advanced ceramic matrix composite (CMC) JTAGG III combustor providing higher temperature capability and increased horsepower to weight ratio; completed preliminary design of high strength, lightweight shaft providing a reduction in the number of bearings required resulting in reduced JTAGG III engine weight.

- 2165 - Completed evaluation of ceramic and polymer based leading edge materials for low dielectric, long life rotor blade protection in sand and rain environments.
  - Bench tested preliminary high-efficiency engine IR suppressor that reduces engine performance penalty to signature reduction ratio by 50%.

•	4934	- Completed component development / demonstration / test / validation and transition of NRTC technology to government / industry partners in the areas of: corrosion sensors evaluation; integrated helicopter design interface tools; composite swashplate fabrication; validated interior noise reduction methodology; tail rotor buffet alleviation; fasteners and installation for composites; composite life prediction methodology. - Continued NRTC advanced technology development efforts in water and soil crash dynamics; crashworthy fuel tank design concepts / criteria; active side stick controllers; smart and multifunction rotorcraft antennas; flight management computer technology; and rotorcraft collision avoidance technology.

FY 1999 Accomplishments: (continued)

•	933	- Provided payment for DFAS services.
Total	20793	

FY 2000 Planned Program:

•	6473	- Conduct comprehensive flight test demonstration / validation of ADS-33 requirements applied to the UH-60 with and without a sling load. - Begin piloted evaluation of RASCAL flight control laws in hardware in-loop RASCAL development facility. - Conduct detailed analytical study of control law concept for advanced rotor control based on 2/rev inputs to active pitch links. - Create and analyze conceptual designs of advanced rotorcraft in response to evolving Army After 2010 operational concepts. Provide characteristics of these designs for input to war game simulations. - Continue verification, validation and accreditation for MIDAS human operator models. Transition tool to industry through cooperative R&D agreements. - Perform in-flight validation of performance, workload, and situation-awareness improvements with panoramic (100 degree Field of View (FoV)) night vision goggles (NVG) vs. standard 40 degree for FoV NVG's. - Develop and / or tailor government / industry low cost, common, open system architecture design standards and specifications for DoD rotorcraft platform avionics. - Conduct preliminary evaluation of the MIDAS human operator models on a major Army project. - Perform PRISMS simulation evaluation of situation awareness measures to minimize spatial disorientation and improve symbology designs; transition results to RAH-66 Comanche and future rotorcraft systems.
•	7595	- Evaluate Variable Geometry Advanced Rotor Technology (VGART) core concepts applicability based on initial small- scale demo testing; conduct parametric analysis to determine core concept technology mix potential for transition to 6.3 Variable Geometry Advanced Rotor Demonstration (VGARD) program. - Fabricate large-scale critical components and begin bench tests for VGART core concept candidates. - Evaluate core concept initial wind tunnel data to guide variable geometry rotor candidate selection and prioritization for VGARD.
•	2019	- Fabricate complex rotor components in single co-cure to demonstrate lower production cost; conduct durability tests of drive shafts to demonstrate high temperature capability; select smart rotor control concept for improved blade performance; design primary structural concepts for ballistic protection.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology
	PROJECT A47A

•	1330	- Complete rig testing of ceramic LP turbine; complete combined rig testing of advanced HP compressor for IHPTET / JTAGG Phase III demonstrating improved engine performance capability and reduced weight; complete fabrication and rig testing of advanced CMC JTAGG III combustor ; complete detailed design of high strength, lightweight shaft providing a reduction in the number of bearings required resulting in reduced JTAGG III engine weight; complete detailed design of advanced fuel control providing improved engine/airframe performance and affordability to future turbine engines.
•	2769	- Complete preliminary concept screening, design and fabricate light weight, high-efficiency engine IR suppressor components that reduce suppressor weight by 20%

FY 2000 Planned Program: (continued)

- Conduct detailed comparisons of predictive vs. test structural behavior based on results full-scale Advanced Composite Airframe Program (ACAP) crash tests and execute code modifications if necessary; perform component test and evaluation to support load adaptive crashworthy landing gear strut for 40% increased gear energy absorption; perform analysis of crashworthy fuel system components and alternative materials to support 30% system weight reduction; re-design rotorcraft assemblies for cocured composite manufacture to reduce cost.

•	6200	- Complete component development / test / validation and transition of NRTC technology to government / industry partners in the areas of: helicopter maneuver loads, active/passive noise control technology for helicopter interiors, vacuum-based resin transfer molded tailrotor blade, planetary ring gear design technology, high speed blade core carving process, simulator evaluation of synthetic vision and decision aiding tools, crashworthy fuel tank methodology, and vibration/stress reduction in airframes. - Conduct NRTC advanced technology development efforts in the areas of low cost and efficient composite structures, fan-in-fin unsteady aerodynamics, reduced manufacturing and operating costs, rapid prototyping tool fabrication technology, health and usage monitoring (HUM) technology, variable speed vapor cycle system and advanced applications of a 3-axis sidestick controller.
•	404	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	26790	

FY 2001 Planned Program:

•	7214	- Conduct analytical / simulation demonstration of active / passive external cargo load stabilization allowing higher operational speeds. - Conduct flight test evaluation of CONDUIT / RIPTIDE optimized control laws to achieve a high bandwidth in-flight simulation capability. - Demonstrate real-time rotor state measurement / estimation capability on RASCAL. - Complete analytical / simulation study of benefits of on-blade control using CONDUIT / RIPTIDE tools. - Develop hardware and perform flight test evaluation of envelop limiting / cueing concepts. - Validate partial authority flight control concepts, providing attitude command/attitude hold capability with existing partial authority actuators in a joint flight test experiment in National Research Council (NRC) in-flight simulator (Ottawa, Canada). - Provide expert analysis and critique of advanced platform designs from the rotorcraft community and assess their applicability to DoD needs. - Incorporate human modeling modifications into MIDAS identified by prior year evaluation testing. - Demonstrate reductions in crewstation design cycle and crewmember error potential resulting from full-scale application of MIDAS tool. - Complete development and tailoring of government / industry low cost, common, open system architecture design standards and specifications based on COTS plug and play common modules and reusable software for rotorcraft platform avionics

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology	PROJECT A47A

- Continue evaluation of MIDAS human operator models. Transition tool to industry through cooperative R&D agreements and/or commercialization.
- Develop virtual reality interface for MIDAS.

• 7023 - Complete bench and wind tunnel testing of critical components for variable geometry rotor core concept technologies.
- Formulate, select, and recommend rotor system technology configuration for the 6.3 Variable Geometry Advanced Rotor Demonstration (VGARD) program.
- Complete core concept applicability based on small scale demo testing.

FY 2001 Planned Program: (continued)

- Conduct active on-blade control loads modeling tools upgrade for transition to 6.3 VGARD concept mix and pre-design requirements.

• 2530 - Conduct full-scale validation testing of complex, smart rotor components to demonstrate structural integrity and cost reduction; fabricate sub-scale structural armor specimens for ballistic testing.

• 1480 - Complete fabrication of high strength, lightweight shaft providing a reduction in the number of bearings required resulting in reduced JTAGG III engine weight; complete fabrication of advanced fuel control providing improved engine/airframe performance and affordability to future turbine engines.

• 2838 - Demonstrate full-scale, light weight, high-efficiency engine IR suppressor; perform low-energy dynamic impact testing of load adaptive crashworthy landing gear strut; perform coupon impact testing of alternative crashworthy fuel system components / designs for system weight reduction; perform conceptual analyses of advanced ballistic protection techniques for Army rotorcraft to achieve 15% net reduction in installed armor weight; demonstrate 50% assembly labor reduction for complex composite rotorcraft assemblies; apply smart materials to adaptive airframe structures to reduce vibration; develop more accurate structural load predictions to reduce airframe weight and development time; evaluate durable composite rotorcraft structural concepts to reduce weight and operational costs.
- Screen low glint canopy coating material specifications.

• 6417 - Complete component development / test / validation and transition of NRTC technology to government/industry partners in the areas of: lightning protection for rotorcraft with composite airframes, and flotation stability of rotorcraft active/passive rotorcraft interior noise reduction, crash safety, rotorcraft exterior noise methodology, behavior of fastened airframe joints, high temperature composite applications, composite nondestructive testing, resin properties affecting marcel generation, low cost composite structures, high speed machining of titanium composites, and high speed blade core carving.
- Continue NRTC advanced technology development efforts in advanced rotor ice protection system, low noise and improved bearing contact bevel cages, rotorcraft antenna technologies, variable speed vapor cycle cooling system, helicopter decision aiding system, helicopter operations and approaches.

Total 27502

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A Aviation Technology		PROJECT A47B

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A47B Vehicle Propulsion and Structures Technology	3061	3258	3578	3680	3815	3969	4068	Continuing	Continuing

Mission Description and Justification: The objective of this project is to conduct research and mature advanced RWV engine, drivetrain and airframe technologies for DoD / Army rotorcraft that significantly increase strategic and tactical mobility / deployability, increase reliability, reduce maintenance costs and increase combat sustainability. Propulsion research focuses on fluid mechanics and high temperature materials for significantly improved small airflow turbine engines and components. This propulsion research supports the goals of the DoD IHPTET / JTAGG program. Research areas focused on aerodynamic loads, aeroelastic interactions, integrated composites, structural integrity, low cost manufacturing and crashworthiness will provide improved rotor and airframe structures subsystems. Gears, bearings, and shaft component research develops advanced drivetrains at significantly reduced weight and cost. Research support the Rotorcraft Drivesystems for the 21st Century technology demonstration.

FY 1999 Accomplishments:

- 1763 - Completed speed and durability testing of oil-free bearing and seal technologies for revolutionary oil-free auxiliary power units and aeropropulsion engines.
  - Completed design and fabrication of hardware for centrifugal compressor surge control experiments.
  - Analyzed 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.
  - Completed analysis and performance testing of an advanced compressor stage for IHPTET / JTAGG Phase III.
  - Conducted validation tests on thermal behavior of high speed gearing in support of advanced lightweight gearing systems.
  - Completed high temperature rig testing of magnetic bearings system.
- 1298 - Analyzed soft inplane tiltrotor rotor/hub/wing model system in hover tests at Langley Transonic Dynamics Tunnel to compare stability characteristics with stiff inplane tiltrotor model system.
  - Tested active twist concept in hover at the Langley Transonic Dynamics Tunnel; fabricated active twist rotor model components for tests in FY00.
  - Incorporated Regenerative Electronics technology power and control for Aeroeleastic Rotor Experimental System (ARES) active blade control system evaluation.
  - Acquired modal data for a baseline fuselage aluminum testbed cylinder (ATC) for correlation with finite element model (FEM).
  - Investigated full scale crashworthy fuselage with chosen energy absorbing subfloor.
  - Fabricated and tested low-cost structurally efficient concepts for helicopter fuselages.
  - Evaluated methodology for prototype instrument for bond strength measurements.

Total 3061

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602211A Aviation Technology
PROJECT: A47B	

FY 2000 Planned Program:

•	1829	- Validate centrifugal compressor flow range improvement through controlled mass flow injection at the impeller leading edge and in the diffuser vaneless space on both hub and shroud surfaces. - Analyze advanced concept configuration for close coupled, compact compressor system; complete multi-stage CFD analysis of configuration. - Complete design and fabrication of cooled ceramic matrix composite turbine nozzle airfoils for application to IHPTET/JTAGG phase III. - Complete rotordynamic feasibility and conceptual design analysis of bearing system for oil-free small turbine engine core. - Complete installation and baseline testing of unique, high temperature gas path seal rig. - Characterize performance of cost effective, low noise spiral bevel gear. - Complete testing of silicon carbide (SiC) compressor pressure sensor and lateral resonators up to 400°C and 1000°C, respectively.
•	1417	- Investigate active control technology for stability augmentation of soft inplane tiltrotor in hover, and conduct first Transonic Dynamics Tunnel tests of 'active twist' rotor model for vibration control. - Test and evaluate 'Regenerative Electronics' power and control system on the ARES for application to future on-blade active rotor concepts. - Complete tension-torsion fatigue testing of Bell ducted tail rotor flexbeam to correlate with finite element analysis (FEA) predictions. - Complete FEM and tension-bending tests of hybrid composite flexbeam laminates to validate failure criteria. - Evaluate barely visible impact damage test and analysis methods for thin-skin composite sandwich structures. - Complete development of a local 2D - global 3D analysis for delamination from matrix cracks in stringer pull-off specimens. - Complete FEA and fabrication of combined load test specimens and conduct testing of tailored composite panels. - Validate microwave non-destructive evaluation (NDE) for moisture detection in adhesively bonded composite panels to determine relationship between moisture content and bond quality.
•	12	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	3258	

FY 2001 Planned Program:

•	1986	- Conduct performance and particle image velocimetry (PIV) experiments on close coupled compact compression system to validate fluid dynamic concepts. - Analytically predict performance of selected configuration for close coupled compact compression system; verify performance via rig test. - Complete thermomechanical fatigue structural durability testing of cooled ceramic matrix composite turbine nozzle airfoil to support IHPTET readiness requirements. - Complete performance testing and validate optimum configuration for thermal management of advanced helical gear drive system. - Formulate surface fatigue database for spur gears with advanced surface coatings. - Conduct Weibull statistical analysis of fracture strength in SiC membranes using experiments and finite-element analysis.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602211A Aviation Technology / PROJECT: A47B

- Conduct a 3 hour turnaround time full combustor simulation using National Combustor Code, representing a 1000:1 reduction in turnaround time relative to 1992 baseline.
- Conduct a 3 hour turnaround time full compressor simulation using APNASA, representing a 2400:1 reduction relative to 1992 baseline.

FY 2001 Planned Program: (Continued)

•	1592	- Collaborate with industry in aeroelastic stability evaluation of Variable Diameter Tiltrotor concept in Langley Transonic Dynamics Tunnel. - Complete tests of 'active twist' rotor blade control for vibration in the Langley tunnel using closed loop control algorithms. - Conduct experiments on finite element model of composite helicopter and correlate with modal test data. - Explore delamination failure prediction methodology for hybrid composite flexbeam laminates under combined tension and bending loads. - Establish experimental and analytical methodology for composite stringer pull-off prediction. - Complete thin-skin sandwich residual tension/compression biaxial tests to predict compression after impact strength. - Validate strength and stiffness predictions of tailored composite panels and crew bulkhead combined load test specimens. - Investigate prototype microwave NDE instrument for measuring bondline strength and quality based on adhesive electrical parameter changes and/or moisture contamination.
Total	3578	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A Electronic Warfare (EW) Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	15569	17402	17310	18378	18629	20241	21259	Continuing	Continuing
A442 Tactical Electronic Warfare Technology	9047	9547	9904	10095	10278	11315	11846	Continuing	Continuing
A906 Tactical Electronic Warfare Techniques	6522	7855	7406	8283	8351	8926	9413	Continuing	Continuing

A. Mission Description and Justification: This program investigates electronic warfare (EW) technologies that deny the enemy use of our Command, Control, Communications, Computer, and Intelligence (C4I) radio spectrum. This work covers the radio frequency (RF), infrared (IR), electro-optics (EO), and ultra-violet (UV) spectrum. Developments in electronic countermeasures (ECM) and self protection will protect Army forces from a broad range of RF surveillance/tracking systems, imaging radars, advanced RF/ EO/ IR missiles, and smart munitions. Automated intelligence fusion and automated battlefield assessment management tools are also being researched. These efforts will provide a decisive advantage to our operational forces against the full range of traditional and non-traditional threat forces. This will lead to winning the battlefield information war by controlling the electromagnetic spectrum and conducting successful electronic disruptive/destructive measures to threat mission planning. This program is primarily managed by Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Monmouth, NJ. 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 intelligence and electronic warfare. 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 Advanced Technology), PE 0604270A (Electronic Warfare Development), and PE 0603745A (Tactical Electronic Support Systems - Advanced Development).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A Electronic Warfare (EW) Technology

B. Program Change Summary:	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	16116	17487	18082
Appropriated Value	16249	17487	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-133		
b. SBIR / STTR	-267		
c. Omnibus or Other Above Threshold Reductions		-46	
d. Below Threshold Reprogramming	-216		
e. Rescissions	-64	-39	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-18
New Army Vision/Transformation Adjustment		TBD	-754
Current Budget Submit (FY 2001 PB)	15569	17402	17310

Change Summary Explanations: Funding – FY 2001: Projects were adjusted to reflect the new Army Vision/Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A Electronic Warfare (EW) Technology		PROJECT A442

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A442 Tactical Electronic Warfare Technology	9047	9547	9904	10095	10278	11315	11846	Continuing	Continuing

Mission Description and Justification: This project addresses the RF, IR, and EO technologies needed for self or stand-off protection of air and ground platforms and other high value assets. The following areas are investigated:

- RF technologies that provide the capability to detect, identify, locate, prioritize, and countermeasure radar directed target acquisition, target-tracking sensors, surface-to-air, air-to-air, top attack and fused munitions.
- IR technologies that provide the capability to detect, identify, locate, prioritize, and countermeasure heat seeking surface-to-air, air-to-air, and anti-tank guided munitions (ATGMs).
- EO technologies that provide the capability to detect, identify, locate, prioritize, and countermeasure laser-aided and electro-optically directed gun or missile systems.
- Electronic support (ES) technologies that provide the capability to intercept, direction find, and locate non-communications signals for targeting and tactical situational awareness.

FY 1999 Accomplishments:

- 3160 – Completed assessment of techniques for precision direction finding of ultra-high frequency (UHF) radars.
  – Investigated the use of ultra-wideband digital RF memory for a potential use in RF countermeasures
  – Completed the design of IR and UV missile warning models for use in modeling and simulation of advanced electronic warfare suites.
- 2665 – Investigated short pulse laser effects against fielded advanced IR missiles for a potential improved IR countermeasure system.
  – Conducted field measurements of IR and UV signatures of surface-to-air missiles (SAMs) and ATGMs, background and man made point false alarm sources.
- 960 – Completed testing of UV missile warning algorithms against air-to-air and ATGMs for aircraft protection.
  – Investigated two color, mid IR missile warning algorithms for potential use in ground vehicle self protection
  – Investigated low observable, multi-octave antenna technology to provide warning receivers with precision angle of arrival capability to control and direct countermeasures, and to enhance situational awareness, target hand-off capabilities.
- 2262 – Evolved and applied electronic intelligence (ELINT) cueing techniques to enable rapid detection and imaging of high priority targets, battle damage assessment, and threat avoidance over a wide area.
  – Completed adaptive matched filter receiver to improve the capability of Common Modular ELINT System (CMES) to detect/characterize modern signals in the presence of a heavy conventional signal environment.
  – Performed laboratory demonstration of electronic support measures (ESM) capability against impulse radars using high impulse detector during international testing.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A Electronic Warfare (EW) Technology
	PROJECT A442

FY 1999 Accomplishments: (continued)

- Designed modular, full spectrum capable electronic counter measure and electronic counter-counter measure (ECM/ECCM) unmanned aerial vehicle (UAV) payload to react quickly to rapidly changing emitter Low probability of Intercept and Low Probability of Detection threats.

Total 9047

FY 2000 Planned Program:

- 1308 – Investigate the use of evolving digital software radio receiver technology, to augment legacy radios in conjunction with DARPA, Air Force (AF), and Navy laboratories, that will provide the capability to receive, classify and support time difference of arrival (TDOA) emitter location of radar, communications signals, and measurement & signature intelligence (MASINT) sources for use in RF alerting and collection for tactical maneuver vehicle commanders.
  – Evolve Battle Lab scenario simulations to demonstrate warfighter benefit and develop operational concept for alerting and collection for tactical maneuver vehicle commanders.
- 976 – Evolve ultra-wide bandwidth digital RF memory module, utilizing DARPA high-speed analog-to-digital converter technology, to generate signals to deceive and jam imaging radars, with low probability of intercept, and frequency hopping air defense and surveillance radars.
  – Coordinate development of software with Naval and Air Force Research Lab (NRL and AFRL) for digital RF memory.
- 1880 – Enhance development of conformal and low observable, multi-octave antenna technology for upgrades to RF and missile warning systems.
  – Investigate low cost threat missile warning sensor technologies and algorithms for use in ground vehicle protection
  – Conduct survivability integration lab and field tests to refine next generation warning and countermeasures technologies and techniques.
  – Conduct field measurements of IR and UV signatures of surface-to-air missiles, ATGMs, background and man made point false alarm sources.
- 2867 – Investigate multi-band UV and IR countermeasure techniques to defeat emerging multispectral surface-to-air and air-to-air missiles.
  – Evolve IR countermeasures techniques to advanced anti-tank guided missile.
- 2343 – Address packaging, antenna, and signal processing technologies for the development of small, lightweight, remotely reconfigurable ES capability which employs sensor cross-cueing for precision geolocation of high value targets.
  – Evolve passive millimeter wave visualization technology to improve detection of target emitters in a dense signal environment.
  – Investigate the application of low probability of intercept (LPI) algorithms to detect and geolocate spread spectrum emitters.
  – Perform waveform analysis for threat emitters and jamming techniques .
- 173 – Small Business Innovation Research / Small Business Technology Transfer Programs

Total 9547

FY 2001 Planned Program:

- 3507 – Enhance high-speed digital receiver that will provide the capability to receive, classify using specific emitter identification (SEI) and support TDOA emitter location of both radar and communications signals.
  – Continue development of ultra wide bandwidth digital RF memory module required to generate signals to deceive and jam advanced radars.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A Electronic Warfare (EW) Technology
	PROJECT A442

FY 2001 Planned Program: (continued)

- Investigate wide bandwidth deception and countermeasure algorithms, waveforms, and modulation techniques to provide tactical countermeasure systems with the capability to degrade or delay the enemy's ability to locate dismounted, mounted, aviation, and forward support units with imaging radars.
- Conduct field measurements of RF surface-to-air, air-to-air, and anti-aircraft artillery missiles systems and fuses for investigation into RF countermeasures techniques.

•	1964	- Complete investigation of low observable, multi-octave antenna technology, test and characterize sensitivity and observability parameters via hardware-in-the-loop simulation. - Continue design and development of low cost threat missile warning sensor technologies and algorithms for use in ground vehicle protection. - Conduct field measurements of IR and UV signatures of surface-to-air missiles, ATGM's, background and man made point false alarm sources.
•	2969	- Evolve and evaluate multi-band UV and IR countermeasure techniques to defeat emerging multispectral surface-to-air and air-to-air missiles. - Transition cooperative jamming and decoy/flare techniques to integrated countermeasures technology demonstration.
•	1464	- Evolve electrically reconfigurable antennas RF collectors for airborne and ground tactical maneuver vehicles. - Integrate spread spectrum receiver technology for eventual transition to countermeasure systems. - Perform research and development to provide ES technology to intercept, geolocate, and counter emerging hostile non-communications emitters on the battlefield. - Evolve algorithms for use on software radio programs, to demonstrate with Battle Labs for operational concept. - Evolve advanced antennas, micro electromechanical systems (MEMS) low voltage switch technology for collection and mapping
Total	9904	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602270A Electronic Warfare (EW) Technology / PROJECT: A906

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A906 Tactical Electronic Warfare Techniques	6522	7855	7406	8283	8351	8926	9413	Continuing	Continuing

Mission Description and Justification: The project researches key EW technologies to gain information dominance, shape the battlefield, and protect the force, in accordance with concepts outlined for Force XXI intelligence operations. Specifically, this program will research new ways to intercept, direction find, and locate current and emerging threat communications emitters. The results will be used for targeting, tactical situation awareness, and disruption/destruction of C4I systems. Specifically, this project develops integrated RF emitter collection and mapping technologies into multifunction devices, coupled with sensor feeds, to offer real time emitter detection, location, and identification. It also 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 C4I systems. In addition, this project will provide remote capability to intelligence and electronic warfare sensor systems with EA algorithms that enable the disruption, denial or destruction of threat communication signals. Other research areas include fusion (automated assimilation and synthesis) of battlefield intelligence data and brigade level joint intelligence, surveillance, and reconnaissance capability to address operational shortfalls. These last efforts provide critical technology underpinnings for friendly force ownership of the electromagnetic spectrum. Fusion and dissemination efforts will be used to integrate data from traditional intelligence sensors and from non-traditional sources such as target acquisition systems to provide early-entry ground force commanders unprecedented battlefield awareness. User friendly intelligence and information warfare tools will provide quality data in a timely manner and enable friendly commanders to operate inside of the enemy decision cycle.

FY 1999 Accomplishments

- 2773 – Implemented attack algorithms against modern commercial communication and information systems, in a laboratory environment.
  – Completed ES/EA tactics techniques and procedures in controlled RF environment against a core signal set.
  – Adapted countermeasure analysis tools to focus on network protection.
- 3749 – Evolved techniques to incorporate data from airborne survivability equipment and integrate into multi-sensor tasking and reporting tools.
  – Utilized commercial/government off the shelf (COTS/GOTS) software to enhance database storage and retrieval techniques.
  – Enhanced Signal Intelligence (SIGINT) correlation, templating and associated terrain reasoning for visualization tools to enhance Common Ground Station (CGS) and All Source Analysis System (ASAS).
  – Evolved tools to correlate intelligence data from tactical, other services and national assets to provide early entry ground force commander with multi-service data to increase survivability and lethality through enhanced battlefield awareness.

Total 6522

FY 2000 Planned Program:

- 1959 – Modify existing testbed to emulate adversary digital communication networks, computer based networks and tactical information systems. Identify and assess the vulnerabilities and susceptibilities of RF and wired networked components.
  – Perform exploitation and attack strategies against the RF and wired network components in the enhanced testbed.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602270A Electronic Warfare (EW) Technology / PROJECT: A906

FY 2000 Planned Program: (continued)

•	3810	– Evolve enhanced intelligence collection, asset management tools and terrain reasoning tools to provide effective, user-friendly intelligence data dissemination techniques and battle damage assessment tools to enhance and protect the commander's decision and execution cycle. – Enhance technologies to integrate, disseminate and display intelligence data from tactical and national assets necessary to provide/enhance situational awareness of red forces at the brigade level. – Investigate neural network tools to optimize sensor arrays for sensor cross-cueing to provide the capability to intercept emitters 90% of time, given the emitter is within sensitivity range of two distributed sensors.
•	1959	– Survey sources of data to be displayed and determine connectivity to national assets – Adapt developed Electronic Mapping object models to display information. – Evolve target set to identify priorities of targets. – Evolve SEI process. – Model concurrent collection/communication function with tactical internet.
•	127	– Small Business Innovation Research / Small Business Technology Transfer Programs
Total	7855	

FY 2001 Planned Program:

•	1800	– Generate exploitation and attack capability against identified vulnerabilities and susceptibilities of adversaries' emerging communications networks and tactical information systems and computer based networks. – Generate methods, tactics, techniques and procedures to exploit emerging communication networks and tactical information systems and computer based networks with varying degrees of detectability to meet operational requirements.
•	1800	– Evolve software products to integrate existing joint and national intelligence sensors, provide a common format for integration of sensor information, and provide a common situational awareness of red forces for the brigade commander. – Evolve neural network tools to optimize sensor cross-cueing to provide the capability to intercept emitters 90% of time, given the emitter is within sensitivity range of two distributed sensors UAV linkage. – Identify technologies and techniques to provide next generation tools for intelligence preparation of the battlefield, asset management, and situational awareness of red and blue forces.
•	3806	– Integrate Electronic Mapping SIGINT Object Models into workstations. – Generate advanced algorithms using digital signal processing (DSP)-based optimization techniques and Artificial Intelligence (AI) sensor-cueing algorithms. – Generate advanced wavelet based algorithms for SEI. – Evolve signal, collection, mapping, analysis and visualization tools for auto-detection and templating, Battle Lab prototyping.
Total	7406	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602303A Missile Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	29234	47939	47183	30029	21846	27085	28262	0	231578
A214 Missile Technology	29234	35187	47183	30029	21846	27085	28262	0	218826
A223 Aero-Propulsion Technology	0	12752	0	0	0	0	0	0	12752

A. Mission Description and Justification: This applied research program element investigates new missile, rocket, and unmanned vehicle technologies for future, robust Army systems with special focus on the Future Combat System (FCS). The overall objective is to increase the survivability of launch systems, provide greater lethality and effectiveness under adverse battlefield conditions, increase kill probabilities against diverse targets, and provide powerful new simulation and virtual prototyping analysis tools. The missile research is conducted using system simulation, virtual prototyping, concept synthesis, hardware development, and focused technology demonstrations. 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 technology areas mature, work is transitioned to PE 0603313A (Missile and Rocket Advanced Technology) to support demonstrations of capabilities for Future Missile Technology Integration (FMTI), Low Cost Precision Kill (LCPK) for 2.75 inch rockets, and Compact Kinetic Missile (CKEM), an advanced light weight hypervelocity missile. 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). The program element contains no duplication with any effort within the Military Departments. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	30130	32892	31469
Appropriated Value	30380	48392	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-250		
b. SBIR / STTR	-469		
c. Omnibus or Other Above Threshold Reductions		-148	
d. Below Threshold Reprogramming	-305		
e. Rescissions	-122	-305	
Adjustments to Budget Years Since FY 2000/2001 PB			+5839
New Army Vision/Transformation Adjustment		TBD	+9875
Current Budget Submit (FY 2001 PB)	29234	47939	47183

Change Summary Explanation: Funding - FY 2001: Project A214 CKEM was adjusted to reflect the new Army Vision/Transformation. Project A214 Micro-Electromechanical Systems Inertial Measurement Unit (MEMS IMU) was adjusted to add research to address high-g and affordability issues.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology		PROJECT A214

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A214 Missile Technology	29234	35187	47183	30029	21846	27085	28262	0	218826

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 future systems such as FCS. 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. A major effort in this project CKEM that is a candidate to provide overwhelming lethality for the FCS Direct Fire System. As efforts in this project mature, work is transitioned to PE 0603313A (Missile and Rocket Advanced Technology) to support demonstrations of capabilities for FMTI, LCPK for 2.75 inch rockets, and demonstration of the CKEM missile. Recapitalization opportunities are identified and pursed, when appropriate.

FY 1999 Accomplishments:

- 13000 - Missile guidance systems - Completed signature tests for difficult targets and masked helicopters; assessed automatic and non-cooperative target recognition and tracker performance on wide spectrum realistic data sets and targets; initiated research into technologies for mini-unmanned aerial vehicles (UAVs) for missile targeting; began component development on next generation electronically scanned air defense fire control/guidance radar.
  - High fidelity system level simulations – developed and technically transferred to industry gray level co-occurrence matrix (GLCM) methods for infrared (IR) signature validation techniques; completed and demonstrated the programmable sensor emulator ("model board") for two missile seeker projects.
  - Missile aerodynamics and structure – Investigated turbulent exhaust plume chemistry and solid carbon oxidation; completed Preliminary Design Review (PDR) and completed design, fabrication, and optical bench testing of risk reduction conformal dome and corrector for air and missile defense and tactical missiles.
- 10950 - Smart, stealthy, smokeless missile propulsion – Demonstrated lead-free, minimum signature solid propulsion; completed actuator and control integration and completed axial pintle component design; developed gel flightweight components for long range, survivable, multi-mission capabilities.
  - Focused technology integration – Validated flightweight compact hypervelocity missile technology propulsion concepts for CKEM which will provide an overmatch capability against all tanks and armored targets; completed wind tunnel test and transitioned LCPK to PE 0603313A, which will provide reduced cost per kill, minimized collateral damage and greatly increased number of stowed kills over the present fielded system stable airframe.
- 1440 - Evaluated applicability of acoustic methods to enhanced mixing concepts for propulsion for Army missile systems.
- 1920 - Evaluated Scramjet hardware and developed a combustor concept for M > 10 operation, per congressional plus-up.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology	PROJECT A214

FY 1999 Accomplishments: (continued)

•	1924	- Upgraded active protection system (APS) radar test bed for counter-active protection system (CAPS) testing to represent new threat capabilities. Upgraded design of 2nd Generation countermeasure device to counter new threat capabilities and completed fabrication of 2nd Generation flight prototypes.
Total	29234	

FY 2000 Planned Program:

•	2442	-Global Positioning System (GPS)/MEMS IMU – Design and develop a small, inexpensive GPS/MEMS IMU combined unit using state-of-the-art technology applicable for multiple weapon applications including projectiles, missiles, vehicles, and aircraft.
•	14545	- Missile guidance systems – Integrate and test High Quantities Anti-material Submunition (HI-QUAMS) small ladar seeker brassboard which will allow more submissiles on Army Tactical Missile System (ATACMS); develop global positioning system (GPS) jamming/spoofing models of inexpensive, small hardware for Army tactical missile application; complete baseline design for a high mobility wheeled vehicle (HMMWV)-based short range air defense (SHORAD) sensor system for air defense fire control/missile guidance radar; develop enhanced guidance link technology for loitering missiles and mini-UAVs; devise counter-countermeasures for infrared imaging seeker countermeasures. - High fidelity system level simulations - Extend the field programmable gate array digital quadrature modulator for increased processor throughput and higher clock rates; investigate Doppler phase shift effects on radio frequency (RF) signatures during signal integration times and develop phase coherent signal processing techniques for frequency modulated and frequency stepped RF guidance signals; extend the Ka-band RF front-end processor design of the RF target verification monitor to handle extremely short RF pulses; implement parallel processing programmable "model board" software for real-time, dynamic representation of missile seeker input optics and target image sensed scene irregularities. - Missile aerodynamics and structure - Develop "Virtual Prototype" of the Container Launched Attack Weapon System (CLAWS) missile and launch orientation module hardware and software that will provide an order of magnitude increase in firepower for selected situations; fabricate final design of conformal optical dome and corrector elements, integrate with imaging IR seeker and perform imaging and tracking demonstration of conformal optical seeker that will provide the technology to significantly extend the range of Stinger Block II.
•	17580	- Smart, stealthy, smokeless missile propulsion – Complete development of improved fuel gel for long range, survivable, multi-mission capabilities which reduce assets required; develop hydrogen chloride (HCl)-free propellants, and a small scale motor testing of ADN propellants for minimum signature propulsion. - Focused technology integration/demonstrations – Implement Industry/Government cooperative programs for CKEM for component development in the areas of high-g guidance components and advanced propulsion, demonstrate 25% increase in missile lethality with novel penetrators and quantifying damage mechanisms other than perforation; transition current Remote Readiness Asset Prognostics/Diagnostics System (RRAPDS) technology to PATRIOT Project Office, finalize functional requirements and design specifications for RRAPDS objective system which provides near real-time logistics situational awareness thereby significantly reducing operating and support costs.
•	620	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	35187	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology	PROJECT A214

FY 2001 Planned Program:

•	7000	- MEMS IMU technology – Perform research to develop sensor and electronic design, foundry processes, and testing at competing contractor facilities for advancement of affordable, high-g MEMS IMUs.
•	10740	- Missile guidance systems – Package the HI-QUAMS seeker that will lead to a 5-10x improvement in stowed kills for MLRS/ATACMS submissiles; fabricate and test in a laboratory brassboard MEMS based Inertial Measurement Unit (IMU) which will lead to an low cost IMU with common features for use in multiple weapon systems; fabricate and test next generation SHORAD antennas; test infrared imaging counter-countermeasures. - High fidelity system level simulations – Investigate IR target signature modeling approaches applicable to active IR target acquisition and track sensors; develop methods and software for representing 3-dimensional target geometry models applicable to active IR sensors where signal polarization may be a processing discriminant; investigate methods of projecting HWIL in-band IR target images and scenes with adequate scene detail and dynamic range to include the effects of active and passive IR countermeasures; complete and demonstrate the target verification monitor with application to all types of Ka-band pulse and CW radiation in a HWIL simulation facility.
•	10343	- Smart, stealthy, smokeless missile propulsion – Complete component development of flight type hardware and integrate into a brassboard and test a flexible sustainer for long range, survivable, multi-mission capabilities which reduce assets required; complete vacuum aging study for service life prediction for cost avoidance of replacing pr opulsion systems and increased system safety and performance reliability; develop methodology for aging assessment of gel propulsion systems. - Focused technology integration/demonstrations – Revise sensor suite preliminary design, and build, test, and evaluate sensor suite breadboard hardware of RRAPDS which provides near real-time logistics situational awareness thereby significantly reducing operating and support costs; complete design of a miniature (45-60 centimeter wingspan) aerial vehicle to provide real-time targeting for short/medium range indirect fire munitions.
•	9225	- CKEM – Mature multiple industry system design concepts and validate component technology for CKEM through joint industry/government cooperative program in the areas of advanced propulsion, enhanced lethality, and miniaturized high-g guidance and control
•	9875	- Funds will be used in support of the New Army Vision/Transformation.
Total	47183	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology		PROJECT A223

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A223 Aero-Propulsion Technology	0	12752	0	0	0	0	0	0	12752

Mission Description and Justification: This Congressionally directed project focuses on missile and rocket aero-propulsion technologies. It develops aerodynamics and related propulsion technologies and demonstrates enhanced range, maneuverability, and the survivability for missiles and UAVs. It explores unique aerodynamic characteristics and propulsion concepts to enhance missile flight performance at subsonic, supersonic, and hypersonic velocities. Current efforts include: scramjet, aero-optic evaluation facility, and computational fluid dynamics.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 1909 - Scramjet - test a Scramjet propulsion concept for a missile in a ground test facility operating at full scale and at duplicated flight conditions.
  - Provide Scramjet hardware for testing, analytical performance predictions, and data reduction and analysis.
- 2864 - Aero-Optic Evaluation Facility – Test hypersonic missiles in a ground test facility operating at full scale and at duplicated flight conditions
- 7636 - Computational Fluid Dynamics (CFD) - develop a specialized computer system for designing and developing missiles and missile components using CFD.
- 343 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program

Total 12752

FY 2001 Planned Program: Project not funded in FY 2001.

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602307A Advanced Weapons Technology

PROJECT: A042

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A042 High Energy Laser Tech	0	0	993	993	992	992	991	Continuing	Continuing

A. Mission Description and Justification: Recent advances in High Energy Laser Weapon Technologies for Ballistic Missile Defense may lead the way to development of Tactical Laser Weapon Systems for Army use. Potential mission areas include counter air munitions defense and airborne electro-optical sensor countermeasures. Technical issues such as lethality, laser fluence degradation due to thermal blooming and atmospheric obscurants, precision optical pointing and tracking, and low-cost laser countermeasures must be resolved before a determination for weapon system development can be made. This U.S. Army Space and Missile Defense Command project will leverage existing laser weapon technology developments such as US/Israeli Tactical High Energy Laser ACTD and the USAF Airborne Laser Program to support the evaluation and resolution of present technical issues. In addition, this project will validate potential system concepts and relevant subsystem issues to better understand potential weapon system engineering issues. The work in this program element is consistent with the Army Directed Energy Master Plan and the Army Modernization Plan. Work in this program element is related to and fully coordinated with efforts in PE 605605A (DOD High Energy Laser Systems Test Facility) and PE 0603308A (Army Missile Defense Systems Integration) in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. Work is performed by SMDC, Huntsville, AL. No contracts have been awarded to date.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program:

•	993	Identify and assess technical issues such as lethality, laser fluence degradation due to thermal blooming and atmospheric obscurants, precision optical pointing and tracking, and low-cost laser countermeasures.
Total	993	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602307A Advanced Weapons Technology

PROJECT: A042

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 / 2001 PB)	0	0	0
Appropriated Value			
Adjustments to Appropriated Value			
a. Congressional General Reductions			
b. SBIR / STTR			
c. Omnibus or Other Above Threshold Reductions			
d. Below Threshold Reprogramming			
e. Rescissions			
Adjustments to Budget Years Since (FY 2000 / 2001 PB)	0	0	+993
Current Budget Submit (FY 2001 PB)	0	0	993

Change Summary Explanation: Funds realigned for new start (+993).

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602308A Advanced Concepts and Simulations

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	20917	29677	30479	28172	30822	34748	39477	Continuing	Continuing
AC90 Advanced Distribution Simulation	8231	10219	10592	10831	10926	12249	13113	Continuing	Continuing
AC99 Advanced Concepts & Technology	10278	14553	11937	14361	15927	17542	20419	Continuing	Continuing
AD01 Photonics Research	2408	4905	0	0	0	0	0	0	7408
AD02 Modeling & Simulation for Training and Design	0	0	7950	2980	3969	4957	5945	Continuing	Continuing

A. Mission Description and Justification: Work in this program element (PE) advances the generation 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 2010 and beyond 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 show new warfighting concepts including generation 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.

U.S. Army Simulation Training and Instrumentation Command (STRICOM), located at Orlando, FL is responsible for Project AC90, which provides and demonstrates enabling technologies for advanced distributed interactive simulation to support shared synthetic environments. 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.

STRICOM is also responsible for Project DO2, which represents a restructure from Project AC90 starting in FY01. This project enables the rapid transfer and development of simulation and training technology research results to the Army from the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. ICT was designated in August 1999 by DDR&E as a University Affiliated Research Center (UARC) to support Army training and readiness through research into simulation and training technology such as mission rehearsal, leadership development, and distance learning. ICT will serve as a means for the military to learn about and benefit from entertainment technologies, and enable their transfer into military systems. This project will ensure the transition of the results of the basic research component of the UARC, sponsored through PE 0601104A/Project J08, into the Army tech base and future Army training products. Creating a true synthesis of creativity and technology and of the capabilities of industry and the R&D community will revolutionize military training and mission rehearsal by making it more effective in terms of cost, time, the types of experiences that can be trained or rehearsed, and the quality of the result. It will also allow the U.S. to maintain dominance in simulation and training technologies. STRICOM will develop new Army training systems from the transitioned technology.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A Advanced Concepts and Simulations

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. 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 displaying of mature, commercial off-the-shelf (COTS) technologies, prototypes, software, and /or systems for assessment by the TRADOC Battle Labs. Contractors include: 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.

Photonics Research is a Congressionally directed project which funds research conducted at the Boston University Photonics Center. Applications include technology for night vision and imaging equipment and devices to enable communications while on-the-move.

These programs are fully coordinated with other Army applied research 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 projects 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.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 PB)	21494	24955	24799
Appropriated Value	21653	29955	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-159		
b. SBIR / STTR	-548		
c. Omnibus or Other Above Threshold Reductions		-119	
d. Below Threshold Reprogramming	+57		
e. Rescissions	-86	-159	
Adjustments to Budget Years Since FY 1999 PB			+8223
New Army Transformation Adjustment		TBD	-2543
Current Budget Submit (FY 2000 / 2001 PB)	20917	29677	30479

Change Summary Explanation: Funding – FY 01: Projects C90 and C99 were decremented to reflect the new Army Transformation. Project D02 was enhanced in FY 2001 (+6000K) to support applied research on more effective and immersive synthetic environments.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A Advanced Concepts and Simulations		PROJECT AC90

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AC90 Advanced Distribution Simulation	8231	10219	10592	10831	10926	12249	13113	Continuing	Continuing

Mission Description and Justification: This program provides and demonstrates enabling technologies for advancing distributed interactive simulation in the synthetic environment. AC90 provides the representation of the battlefield needed to support the use of modeling and simulation as an acquisition and training development tool. AC90 provides a 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 compared to the traditional approach. The research being conducted includes embedded simulation, intelligent forces representation, rapid and cost-effective generation of synthetic environments, simulation interface and linkage technologies, and complex data modeling and interchange.

FY 1999 Accomplishments:

- 3349 - Addressed CGF (Computer Generated Forces) system architectural composability. Demonstrated advanced behavioral technology.
  - Tailored and integrated standard Embedded Simulation components to M1A2 SEP Tank program. With TRADOC, developed prototype training scenarios and databases.
- 4882 - Developed and enhanced the synthetic environment to support an Echelon Above Corps (EAC) sized battlefield. Developed and evaluated open object-oriented architecture, including methods for model definition and VV&A of networked simulations.
  - Developed the Advanced Tactical Engagement Simulations (A-TES) framework with virtual integration capability and authoritative information center.
  - Developed a prototype capability for individual and small unit synthetic forces that represent doctrinally correct Army behaviors. Identified high payoff small unit leader training applications.

Total 8231

FY 2000 Planned Program:

- 4326 - Implement the Advanced Tactical Engagement Simulations (A-TES) framework with simulation-intensive R&D of soldier-fired indirect fire weapons.
  - Conduct in-vehicle High Level Architecture (HLA) experiments in cooperation with TARDEC using Vehicle Electronics Suite.
  - Develop intelligent behavioral implementations and demonstrate significantly increased capabilities for scaleable and configurable CGF representation.
- 5641 - Develop and test a prototype distributed architecture in the STRICOM Technology Development Center (TDC) to provide networked services for an integrated synthetic environment utilizing HLA, wireless network, and high fidelity model data compression techniques.
  - Develop prototype dismounted soldier Virtual Environment (VE) night vision/sensor capability. Evaluate and refine MOUT VE training methods. Develop and evaluate advanced control system for locomotion simulator. Develop prototype dismounted soldier VE voice recognition system.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A Advanced Concepts and Simulations PROJECT AC90

FY 2000 Planned Program:

- Develop common processes in order to demonstrate a prototype infrastructure to build an integrated, interoperable, and reusable Synthetic Natural Environment (SNE).
- Foster the transition of products of basic research at the Institute for Creative Technologies into applied research programs.

•	252	-Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	10219	

FY 2001 Planned Program:

•	4350	- Enhance the Advanced Tactical Engagement Simulations (A-TES) virtual integration testbed with hybrid simulation and hardware-in-the-loop experiments. - Demonstrate an Embedded Simulation System (ESS) using a Mobile Crew Station Surrogate (MCSSL) at Ft Hood with M1A2 SEP platoon. - Study intelligent behavioral approaches. Demonstrate prototype capabilities and address technology transfer and implementation issues.
•	6242	- Extend the distributed architecture to promote interoperability of Army simulation systems including CCTT, WARSIM, and OneSAF. - Develop prototype dismounted soldier virtual environment gesture recognition system. Evaluate effectiveness of night operations simulation. - Experiment and demonstrate reduced development time/cost for a common interoperable Synthetic Natural Environment (SNE).
Total	10592	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A Advanced Concepts and Simulations PROJECT AC99

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AC99 Advanced Concepts & Technology	10278	14553	11937	14361	15927	17542	20419	Continuing	Continuing

Mission Description and Justification: This project supports the Advanced Concepts and Technology (ACT) II Program. 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 warfighter need such as Command and Control on the Move and Battlefield Digitalization from concept to demonstration to the soldier in one year. ACT II uses a yearly Broad Agency Announcement (BAA) to industry and academia, and provides a low overhead, timely mechanism for the exhibition of mature, commercial off-the-shelf (COTS) technologies, prototypes, software, and /or systems for assessment by the TRADOC Battle Labs.

FY 1999 Accomplishments:

•	10278	Conducted technology demonstrations and experiments in support of the Army Training and Doctrine Command's Battle Labs, including: Less-than-lethal munitions for peace keeping operations; advanced communications prototype; night vision system; integrated command bridge system; and advanced computing capabilities. Industry/academia participants include Northrop Grumman, Illinois; Northwest University, Signatron Technology Corporation, Massachusetts; CANVS Corporation, Florida; Optimetrics Inc., Michigan; Lockheed Martin Federal Systems, New York; Sperry Marine Inc, Virginia; and Colt's Manufacturing Co., Inc, Connecticut. Technical accomplishments include: - Direct image projection on the human retina. - Innovative less-than-lethal ammunition. - Novel chemical/biological detection techniques.
Total	10278	

FY 2000 Planned Program:

•	14161	Conduct technology demonstrations and experiments in support of Battle Labs. Projects include passive/active surveillance, cognitive decision aids, non-dedicated common battlefield sensors and shooter, tactical networking, information dissemination management, skill performance measures, and audio voice translators. Some of the industry/academia participants include TRW Inc., California; Science Applications International Corporation, Florida; Sterling Software, Inc., Virginia; Southwest Research Institute, Texas; Research Triangle Institute, North Carolina; and Cubic Defense Systems, California.
	392	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	14553	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A Advanced Concepts and Simulations	PROJECT AC99

FY 2001 Planned Program:

•	11937	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 displaying of warfighting capabilities. (3) Analyze and evaluate the results of FY 2000 efforts; identifying 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	11937	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602308A Advanced Concepts and Simulations

PROJECT: AD01

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AD01 Photonics Research	2408	4905	0	0	0	0	0	0	7408

Mission Description and Justification: This is a Congressionally funded program. This project supports photonics projects at the Boston University Photonics Center for Army smart imaging and communications applications. Key areas include magnetic and optical devices, silicon micromechanical optical components, and bio-photonic materials. Investigation of these materials and technologies, which have application in communications, data modulation, optoelectronics, and optical control of microwaves, will be leveraged with commercial developments. Potential Army applications include technology for night vision and imaging equipment and devices to enable communications while on-the-move.

FY 1999 Accomplishments:

•	2408	Investigated magnetic and optical devices, silicon micromechanical optical components, and bio-photonic materials at the Boston University Photonics Center.
Total	2408	

FY 2000 Planned Program:

•	4773	- Complete investigations of fiber lasers, silicon micromechanical optical and fluid valve components, quenched fluorescence for biodetection, Raman scattering for chemical agent detection in water, wide band gap modulators and lasers, and enhanced detection in the infrared at ARL and the Boston University Photonics Center.
•	132	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	4905	

FY 2001 Planned Program: Program not funded in FY01.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602308A Advanced Concepts and Simulations — PROJECT: AD02

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AD02 Modeling & Simulation for Training and Design	0	0	7950	2980	3969	4957	5945	Continuing	Continuing

Mission Description and Justification: This project is a restructure from Project AC90 and enables the rapid transfer and development of simulation and training technology research results to the Army from the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. ICT was designated in August 1999 by DDR&E as a University Affiliated Research Center (UARC) to support Army training and readiness through research into simulation and training technology such as mission rehearsal, leadership development, and distance learning. ICT will actively engage industry (multimedia, location-based simulation, interactive gaming) to exploit dual-use technology. ICT will serve as a means for the military to learn about, and benefit from entertainment technologies, and enable their transfer into military systems. ICT will also work with creative talent from industry in order to adapt their concepts of story and character to increasing the degree of immersion experienced by participants in synthetic experiences, and to improving the utility of the outcomes of these experiences. In return, industry will leverage the DoD sponsored research being done by the Modeling and Simulation UARC. This project will ensure the transition of the research into the Army tech base and future Army training products. Creating a true synthesis of creativity and technology and of the capabilities of industry and the R&D community will revolutionize military training and mission rehearsal by making it more effective in terms of cost, time, the types of experiences that can be trained or rehearsed, and the quality of the result. It will also allow the United States to maintain dominance in simulation and training technologies. The US Army Simulation Training and Instrumentation Command (STRICOM) in Orlando, Florida, will develop new Army training systems from the transitioned technology. STRICOM is collaborating with the Battle Command Battle Laboratory (BCBL) at Ft. Leavenworth, Kansas, which is working on the Training, Leadership Development, and Soldier Support (TLS) issues for contingency forces and operations. Funding for this program was enhanced through PBD 203C in FY 2001 to support applied research on more effective and immersive synthetic environments.

FY 1999 Accomplishments: Program not funded in FY 1999.

FY 2000 Planned Program: Program not funded in FY 2000.

FY 2001 Planned Program:

•	7950	- Generate and test a prototype for a specific training application that uses entertainment technology commercial application as a basis for one specific stimuli. - Develop an immersive, pre-visualization tool to aid in conceptualizing the Future Combat Systems (FCS) in support of the new Army Vision/Transformation. - Create an immersive virtual environment for mission training and rehearsal.
Total	7950	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602601A Combat Vehicle and Automotive Technology**

COST *(In Thousands)*	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	38139	54776	63589	64724	47677	53068	56933	Continuing	Continuing
DC05 Armor Exploratory Development	6375	8399	13456	13417	14103	15304	15891	Continuing	Continuing
DC84 AC84	854	0	0	978	976	1948	2916	Continuing	Continuing
AH58 Joint Robotic Development Program on Ground Vehicle Survivability	2890	0	0	0	0	0	0	0	2890
AH77 Advanced Automotive Technology	17830	29782	16596	16497	16610	17280	17269	Continuing	Continuing
AH82 Non-Ozone Depleting Substance Technology	1304	0	0	0	0	0	0	0	1304
AH91 Tank and Automotive Technology	8886	16595	12865	14268	15988	18536	20857	Continuing	Continuing
AHH7 Future Combat Systems (FCS)	0	0	7752	19564	0	0	0	27500	27316
AT21 21st Century Truck (T21)	0	0	12920	0	0	0	0	0	12920

A. <u>Mission Description and Budget Item Justification</u>: The Army's new vision calls for a more strategically responsive force that dominates across the full spectrum of operations. To achieve this new vision, the Army must transform itself to a force that is more strategically deployable and agile, with a smaller logistical footprint, where light forces become more lethal, survivable and tactically mobile. The work performed provides technologies that are needed to achieve this vision. The Army's top priority Science and Technology program, Future Combat Systems (FCS), is identified within this PE under a new project AHH7. This project contains funds to support concept exploration and trade studies leading to demonstrations of FCS. Activities within this program element are focused primarily on FCS; but spin-off opportunities for upgrades will be identified. Other major projects within this PE include: AH91, which provides critical enabling technologies that support FCS and other thrusts aimed at solving warfighter 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 focus benefiting military ground vehicles. This PE supports efforts to identify and evaluate non-ozone depleting, fire suppressant alternatives to Halon 1301 for combat vehicles. This PE is managed by the Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI. It 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 duplication of effort within the

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Army, or DoD. The project is coordinated with the Marine Corps office through the Naval Surface Warfare Center; and with other ground vehicle developers within the Departments of Energy, Commerce and Transportation and the Defense Advanced Research Projects Agency (DARPA).

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 PB)	39208	39749	41625
Appropriated Value	39562	55249	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-354		
b. SBIR / STTR	-694		
c. Omnibus or Other Above Threshold Reductions	-156	-159	
d. Below Threshold Reprogramming	-219		
e. Rescissions		-314	
Adjustments to Budget Years Since FY 2000 PB			+18899
New Army Vision/Transformation Adjustment		TBD	+3065
Current Budget Submit (FY 2001 PB)	38139	54776	63589

Change Summary Explanation: Funding - FY 2001 – Increase reflects restructure of funding for FCS (+7800), increase for 21st Century Truck (+12920) and other minor adjustments (this includes six minor programs totaling +1244). Funding – FY01: Project C05 was adjusted to reflect the new Army Vision/Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology		PROJECT DC05

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DC05 Armor Exploratory Development	6375	8399	13456	13417	14103	15304	15891	Continuing	Continuing

Mission Description and Justification: This project lays the technical foundation to solve critical armor deficiencies to transform the Army into a more deployable and survivable force. Emphasis is placed on armor technologies for FCS, but also their applicability to legacy systems. In addition this project researches and matures low-burden solutions to the protection of tactical vehicles in war and operations-other-than-war, focusing on applique armor for small arms and land mine protection. International cooperative research in mine blast characterization and vehicle response is also conducted within this project. Work performed under this project follows recommendations from a 1999 Army Science Board Summer Study on "Full Spectrum Protection for 2025-era Ground Vehicles." Armor technologies will be researched to complement innovative, non-armor survivability techniques, such as laser protection described in project AH91 within this PE. Technology will focus on the weight, space, performance, and cost ranges appropriate to U.S. ground combat systems, and protection of combat and tactical vehicles against such threats as Kinetic Energy (KE) projectiles, explosively formed penetrators, chemical energy warheads, and blast and fragments from land mines. This project draws upon products from Army Research Laboratory programs, e.g., PE 0602618A (Ballistic Technology project AH80) and PE 0602105 (Materials project AH84), as well as innovative armors from industry. Starting in FY01, funding in the project has been augmented to research significantly lighter armor solutions that eventually can transition to FCS in. In addition to armor concept research, this 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 researching and maturing of armor performance models to assess armor configurations against different threats, with sufficiently high fidelity to make their implementation in vehicles feasible and affordable. Major contractors include: SAIC, Albuquerque, NM; Southwest Research Institute, San Antonio, TX; University of Hawaii, Honolulu, HA; Jet Propulsion Lab, Pasadena, CA.

FY 1999 Accomplishments:

- 1468 - Investigated smart armor package defeating KE threats with 35% weight savings, providing the technological basis for protection of lighter vehicles against medium caliber automatic cannon-fired penetrators.
- 1307 - Created an armor virtual prototyping system which will use modeling and simulation to shorten the design cycle and reduce the development cost of future vehicles and armor upgrades to existing vehicles.
  - Validated methods for ceramic armor design using analytical models to extend the capabilities of the virtual prototyping system.
  - Completed research showing 25% reduction in typical test cost for armor design through use of the virtual prototyping system.
- 1050 - Completed assessment of electrodynamic armor defeat mechanisms which offers significant operational benefits for combat vehicles.
- 950 - Investigated combined armor/signature control configurations.
- 1600 - Completed fabrication of base structure of troop protection prototype demonstrator, providing enhanced small arms and mine protection to troops under movement in otherwise non-protected tactical vehicles.
  - Completed and tested survivability appliqués for tactical vehicles.

Total 6375

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT DC05

FY 2000 Planned Program:

- 1360 - Investigate armors for medium caliber KE threats that are 50% more space efficient than the 1996 state of the art, making possible more compact and deployable combat vehicles.
- 1458 - Research and define lightweight armor systems against a spectrum of threats faced by vehicles in the 18-40 ton weight range.
- 1165 - Characterize the debris produced by KE and Chemical Energy (CE) threats which have been disrupted by prototype Active Protection Systems (APS), to provide the foundation for the lightweight armors that will complement APS to protect combat vehicles.
- 971 - Define, through simulation and component test, the structural and material requirements for integrated multifunctional armor/structure systems that will dramatically reduce the weight of combat systems, making them strategically deployable.
- 1458 - Integrate armor configurations from 0602618A/AH80 and material and structure technology from 0602105A/AH84 into multiple armor/structure systems for demonstration in FY 2001.
- 1435 - Complete fabrication of troop protection prototype demonstrator.
- 361 - In partnership with United Kingdom (UK), develop a set of design tools to investigate unique electro-dynamic defeat, of anti-armor threats technology constructs, for combat vehicle upgrades and concepts.
- 191 - Small Business Innovative Research/Small Business Technology Transfer Programs.

Total 8399

FY 2001 Planned Program:

- 3027 - Part of these funds will be used in support of the New Army Vision/Transformation. Prove the feasibility of armor systems with 30% greater weight efficiency than the 1996 state of the art against horizontal KE and CE threats, and the capability to back up an APS; these armor systems will provide vehicles in the 18-40 ton range with the survivability required by the future battlefield.
- 2490 - Part of these funds will be used in support of the New Army Vision/Transformation. Investigate and test top attack armor systems to complement future APS with 30% greater weight efficiency than the 1996 state of the art.
- 2192 - Complete investigation of a series of integrated multifunctional armor/structure systems against the heavy machine gun threat that will offer 25% improved weight efficiency over the Composite Armored Vehicle (CAV), at a projected production cost less that 1.5 times that of the CAV, providing improved survivability at an affordable cost.
- 2399 - Investigate armor/structure systems with 30% improved efficiency against medium caliber KE and CE threats for validation in FY02.
- 1593 - Funds will be used in support of the New Army Vision/Transformation. Integrate existing physics- and engineering-based models and design tools to provide industry the capability to design and validate FCS armors without extensive and costly testing.
- 697 - Funds will be used in support of the New Army Vision/Transformation. Support and provide U.S. national leadership to an international cooperative research program for mine blast characterization under the Technical Cooperation Program (TCP).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT DC05

- 697 - Funds will be used in support of the New Army Vision/Transformation. Conduct safety and user assessments of the protected troop transport module

FY 2001 Planned Program: (continued)

- 361 - In partnership with UK, develop a set of design tools to investigate unique electro dynamic defeat of anti-armor threats technology constructs for combat vehicle upgrades and concepts.

Total 13456

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602601A Combat Vehicle and Automotive Technology** PROJECT **AH58**

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH58 Joint Robotic Development Program on Ground Vehicle Survivability	2890	0	0	0	0	0	0	0	2890

Mission Description and Justification: This one year Congressionally directed project researches and matures components for robotic and semi-robotic military vehicles, which were not specific to any single system. This project integrated vehicle survivability, mobility, intra-vehicular digital electronics, and other diverse vehicle technologies developed by the Army, other DoD laboratories and industry. It focused on two critical areas of deficient performance in robotic and semi-robotic vehicles: mobility and navigation. High priority components were (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). Using robotics rather than a manned crew in a vehicle greatly removes the need for armor and reduces vehicle size to present a smaller target. Robotics has payoffs for manned systems as well crew workload. Work on this project was consistent with the Joint Service Unmanned Ground Vehicle Master Plan. The project also developed 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. FY98 Intelligent Mobility Robotics contracts were awarded to Utah State University, Logan, UT; General Dynamics Land Systems, Muskegon, MI; Turing Associates, Ann Arbor, MI; and Tennessee State University, Nashville, TN. This project was completed in FY99.

FY 1999 Accomplishments:

•	2592	- Completed upgrade to contractor's 100lb. robotic vehicle to include z-axis omni-directional steering capability for complete 6-degree of freedom electric wheel control. - Completed improvement of contractor's existing 1000 lb. robotic vehicle intelligent path planning and control algorithms conditions. - Completed research showing the scalability of both (100 lb. and 1000 lb.) weight class unmanned ground vehicles (UGVs) to man-portable robot applications and follow-on programs. - Completed construction of the robotic vehicle SIL for technology test and evaluation.
•	298	- Participated in Simulation Based Acquisition demonstration for the Total Life Cycle (SIM-TLC).
Total	2890	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH77

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH77 Advanced Automotive Technology	17830	29782	16596	16497	16610	17280	17269	Continuing	Continuing

Mission Description and Justification: This project funds the NAC, which leverages commercial industry's large investment in automotive technology research and development and initiates shared technology programs that focus on benefiting military ground vehicle systems. The NAC, located at the Tank-Automotive and Armaments Command (TACOM), is part of the 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: fuel efficiency, vehicle modernization, crew safety, maintenance, and logistics improvement and manufacturing innovation 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 the Army's Dual-Use Science and Technology (DUS&T) resources. Industry joint investment under the NAC DUS&T programs exceeds $65M. 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). Major contractors include: ARCCA, Inc.; Penns Park PA; FOCUS: Hope, Detroit, MI; University of Texas, Austin, TX; Environmental Institute of Michigan, Ann Arbor, MI; Oshkosh Truck Corporation, Oshkosh, WI; Lockheed Martin Inc., Lexington, MA; Rocky Research Inc., Boulder City, NV; USCAR-PNVG/Ford, Dearborn, MI; Cummins Engine Company, Columbus, IN; ICRC Energy Inc., Oakton, VA; Radian, Inc., Alexandria, VA; Baum, Romstedt Technology Research Corp. (BRTRC Inc.), Fairfax, VA; TASC. Inc, Reading, MA; Southwest Research Institute, San Antonio, TX; Electronic Data Systems, Troy, MI; University of Wisconsin, Madison, WI; University of Iowa, Iowa City, IA; Evans and Southerland Inc., Salt Lake City, UT; AB Technologies, Alexandria, VA; Lockheed Martin Control Systems, Johnson City, N.Y; Ford Motor Company, Dearborn, MI; Continental Teves, Inc., Auburn Hills, MI; Sunline Services Group, Thousand Palms, CA; Ultramer Inc., Massillon, OH; Mobile Medical International, St. Johnsburg, VT; Oakland University, Rochester, MI, General Dynamics Land Systems (GDLS), Muskegon, MI

FY 1999 Accomplishments:

- 13788 - Under the Army's DUS&T, researched and investigated series and parallel hybrid electric drive, engine injection system and supercharger design improvements, improved engine configurations, and advanced lightweight materials; new simulation tools in a distributed interactive environment for real world simulation of ground vehicle operation and analysis of man-machine interface.
- 3622 - Integrated key commercial automotive technologies (engine, brakes, air-conditioning, diagnostics, crash protection) into light and heavy wheeled demonstrators and engine, air-conditioning, diagnostics technologies into tracked vehicle demonstrator.

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH77

FY 1999 Accomplishments: (continued)

- Integrated commercial computer aided components within the Automotive-based Product Development software Framework (APDF).
- Continued to build, test and validate redesigned 6.2 L engine, implemented changes based on testing results, and integrated redesigned engine into the High Mobility Multi-Purpose Wheeled Vehicle (HMMWV).
- Completed investigation of critical diesel fuel reforming technology for use with fuel cell power systems on a Class 8 commercial truck chassis equipped with a hybrid electric drive system.

•	420	- Participated in Simulation Through the Life Cycle (SIM-TLC).
Total	17830	

FY 2000 Planned Program:

•	12191	- Research and investigate, under the Army's DUS&T, technologies to improve fuel efficiency through engine research, hybrid -electric Family of Medium Tactical Vehicles (FMTV), Class 8 parallel hybrid electric line haul truck, manufacturing innovation through man-in-the-loop simulation and collaborative design, development of the virtual distributed collaborative environment and creating a vehicle and heavy vehicle equipment virtual proving ground, and enhancing soldier safety through the development of the personal visualization environment. - Perform HMMWV vehicle endurance tests with reconfigured 6.2L engine, perform producibility study, conduct operational & savings (O&S) cost assessment and analysis.
•	3852	- Integrate key commercial automotive technologies (engine, brakes, air conditioning, diagnostics, crash protection) into the light and heavy wheeled demonstrators and engine, air conditioning, diagnostics technologies into the tracked vehicle demonstrator.
•	9640	- This congressionally directed program will research the diesel fuel reformer for a line-haul truck, integrate the reformer with a fuel cell engine on the current test truck, and conduct extended laboratory, track and on-road tests. - Integrate and test optimized controls and subsystems with the diesel-fueled reformer and fuel cell power system. - Build two additional fuel cell powered trucks for in-service evaluations, one in military environment, and one in a commercial environment
•	3369	- This one year congressionally directed "smart truck" program will perform market analysis of emerging vehicle electronic technologies for applicability to military wheeled vehicles. - Complete investigation of integration plan for hardware, software, informational, and human interfaces for the selected technologies. - Complete definition of initial and final designs for the electronic architecture and vehicle integration. - Complete acquisition and integration of hardware and software. - Complete performance of engineering level tests and evaluations. - Complete validation of vehicles to User representatives and make recommendations based on findings.
•	730	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	29782	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology	PROJECT AH77

FY 2001 Planned Program:

•	12612	- Investigate and test automotive technologies under the DUS&T in the areas of fuel efficiency, vehicle modernization, manufacturing, automotive logistics and maintenance improvement.
•	3984	- Integrate key commercial automotive technologies (engine, brakes, air conditioning, diagnostics, crash protection) into the light and heavy wheeled demonstrators and engine, air conditioning, diagnostics technologies into the tracked vehicle demonstrator.
Total	16596	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology	PROJECT AH82

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH82 Non-Ozone Depleting Substance Technology	1304	0	0	0	0	0	0	0	1304

Mission Description and Justification: The objective of this project was to identify and evaluate non-ozone depleting fire suppression substances for application to 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 crew and vehicle survivability and supportability. Environmentally and toxicologically acceptable replacements for Halon 1301 were demonstrated in engine and crew compartment fire suppression systems. Testing was performed to meet Tier 1-3 Army Surgeon General and Environmental Protection Agency requirements. Investments have been successful in selecting two agents for ground vehicle engine compartments, and retrofits are underway. Two crew compartment agents and delivery systems have also been demonstrated. This project was completed in FY99 and recommendations will be made in 1QFY00 to affected vehicle program managers for follow-on system integration. At the end of FY99, the Army invested over $18 million in this area and succeeded in identifying acceptable fire suppressant agents for combat vehicle engine and crew compartments. This project complemented the DoD Next Generation Fire Suppression Technology Program to identify materials more suitable than currently available alternatives for mission-critical military applications. System development contractors included Santa Barbara Dual Spectrum, Goleta, CA; Primex Aerospace, Redmond, WA; Pacific Scientific, Duarte, CA; and Walter Kidde Aerospace, Wilson, NC. Alternative agents were purchased from DuPont Inc., Deepwater, NJ; Great Lakes Chemical, Lafayette, IN; and 3M, St. Paul, MN.

FY 1999 Accomplishments:

- 900 - Completed performance testing of 6 selected alternative fire extinguishing systems.
- 110 - Completed long-term toxicology studies initiated in previous year.
- 130 - Completed system design guidelines to integrate selected agent and delivery system into affected vehicles.
- 164 - Completed breakdown product studies of 8 alternative agents.

Total 1304

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology		PROJECT AH91

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH91 Tank and Automotive Technology	8886	16595	12865	14268	15988	18536	20857	Continuing	Continuing

Mission Description and Justification: This project provides innovative vehicle concepts and enabling technologies for FCS. This project also researches and matures potential product improvements to fielded equipment and develop advanced systems that will enable the Army to meet its new vision. Program activities, such as conceptual designs, virtual prototyping, performance analyses and battlefield wargaming of ground vehicle systems, identify promising emerging technologies meeting 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 ten areas: (1) vehicle concepts; (2) mobility; (3) integrated survivability; (4) vehicle electronics (VETRONICS) and intra-vehicle digitization; (5) advanced vehicle structures; (6) simulation/analysis; (7) military fuels and lubricants; (8) water purification technology; and (9) vehicle related countermine technology and (10) gap/obstacle crossing technology. Technologies are being pursued to address advanced mobility, survivability, advanced structures, and lethality requirements of lighter, digitized, more deployable vehicles, and less Petroleum, Oil and Lubricants (POL) logistic trail. Activities are closely coordinated through TRADOCs Mounted and Dismounted Battlespace Battle Labs; Program Executive Office for Ground Combat and Support Systems; Army Research Laboratory (ARL), and the Defense Advanced Projects Research Agency (DARPA), Tri-Service. 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, active protection, and damage reduction, complement, but do not duplicate, work performed under the armor exploratory development project (DC05) in this PE. Other government agencies include: Defense Advanced Research Projects Agency, Arlington, VA; 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; General Dynamics Land Systems Division, Sterling Heights, MI, Chang Ind., Salt Lake City, Utah.

FY 1999 Accomplishments:

- 5384 - Researched electric actuator for active suspension units; evaluated semi-active suspension potential via simulation for improved ride and platform stability with roll control in 25 ton combat vehicle class; supported future fuel efficient platforms through the development of more durable nitrile rubber track pads and light weight rubber band track.

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology	PROJECT AH91

- Conducted high temperature lubricant evaluations on a multi-cylinder engine; prepared for high temperature, high nickel alloy head material and coated piston tests on high temperature capable single cylinder engine; and leveraging with international cooperative research and development funds, conducted high power density test on a technology screening engine (Army part of US-Japan cooperative research agreement) all designed to accomplish low heat rejection, high fuel economy engines for future fuel efficient army platforms.

FY 1999 Accomplishments: (continued)

- Completed evaluation of fuels, lubricants, and additives for improvement in fuel economy, vehicle signature and component life requirements. Participated with DOE on fuel impacts on advanced engine system emissions. Evaluated use of biodegradable grease and hydraulic fluids, and evaluated environmentally acceptable solvent to supplement products under current Army purchase description.

•	3302	- Proved the feasibility of retrofittable wide-angle optical viewing system design which can incorporate laser-limiting materials. New contract released for fabrication of advanced vision device for unity vision. - Developed family of new, hybrid structures concepts and candidate integrated signature-ballistic armor system for light and medium weight future vehicle systems with detectability reductions; established baseline vehicle concepts, defense zones, and design criteria for each zone. - Determined constraints, performance requirements, and analyzed unique active protection hemispherical and kinetic energy countermeasures for universal threat application. - Evaluated concept alternatives for voice recognition, 3D audio, and indirect vision driving; selected approach, and conducted detailed designs for future integration into mobile reduced crew testbed.
•	200	- Conducted technology assessments in support of the Army Science Board. Conducted Army laboratory capability assessments, drafted contract solicitation and sponsored industry day in support of the joint DARPA/Army FCS program.
Total	8886	

FY 2000 Planned Program:

•	3938	- Research innovative vehicle concepts, engineering analysis, operational effectiveness evaluations and a virtual environment in support of the development of a lightweight, strategically deployable, agile, survivable and tactically mobile force for the Army. Directly supports the development of requirements and technology for the joint Army/DARPA FCS program. -Investigate advanced concepts from technology spin-offs from FSCS and FCS demonstrating the performance and cost implications of potential modifications to the Abrams Tank, Bradley Fighting Vehicle M113 family of vehicles, Crusader and Medium Brigade Vehicles. - Evaluate commercial and military technologies and systems to determine capabilities and deficiencies. Determine capability requirements for military tactical vehicles to support the future combat force. Provide technologists vehicle level and system guidance. Research and investigate concept level virtual prototypes of future heavy tactical vehicle configurations that will improve mobility, transportability, supportability, and survivability. - Complete investigation of immersive visualization environments by networking with the user to show the technology application for concept trade-off analysis. Determine the best use for the technology developed in the vehicle system development process.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH91

- 5036 - Conduct field testing of the Electromechanical Suspension System (EMS) installed in the HMMWV to evaluate active suspension under strenuous cross country conditions including steering and braking at high speeds; use the field test data to fully tune vehicle handling algorithm for safe cross country operations.

FY 2000 Planned Program: (continued)

- Investigate, test and characterize advance materials including ceramics. Continue high temperature combustion, low heat rejection and advanced friction , wear and lubricant technology development. Design and fabricate advanced componentry for demonstrator engine. Complete engine build. (Cooperative Research Program with Japan).
- Investigate differential torque steer and traction control for wheeled vehicle active suspension.
- Identify and down select fuel energy enhancement material; screen and test fuel additives. Select products to 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.
- Establish critical field-level POL testing criteria for Army vehicles. Investigate potential of available and emerging technologies for POL and equipment condition monitoring and anticipatory service/maintenance.
- Conduct baseline data gathering on composite bridging components through instrumented vehicle crossings on prototype composite bridging structures.
- Perform analysis of marking technologies and requirements to identify criteria that will support near and far term vehicle systems. Evaluate concept alternatives for active marking technologies and define architecture for integration into mobile test bed.

- 4922 - Fabricate and evaluate optical hardware for retrofittable wide-angle optical viewing system which can incorporate laser-limiting materials.
- Analyze/optimize concept alternatives for ballistic and structural loads and project weight savings for each and complete the demonstration and optimization of an integrated signature-ballistic side armor system and transition hardware designs into future vehicle programs; define alternative structural design concepts for each zone; conduct preliminary design analysis; define alternative armor attachments and integrate candidate zone design concepts into alternative "hybrid" vehicle designs.
- Complete validation of integrated signature materials/ballistic side armors and transition designs/test results to Future Scout and Cavalry System (FSCS) and other vehicle programs.
- Conduct active protection countermeasure and sensor field evaluations based on FY99 analysis, with specific emphasis on Kinetic Energy rod defeat.
- Evaluate concept alternatives for semi-autonomous driving using robotics technology, select approach, and define architecture for integration into mobile reduced crew testbed.
- Define concept for providing software security services into embedded software operating environment.

- 2587 - This congressionally directed plus-up will research and define FCS battle scenarios, model blue and red forces for CASTFORUM, JANUS, and VIC simulations.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH91

- Evaluate preliminary concept designs for FCS
- Identify areas of necessary additional technical investment for risk reduction and application to FCS and subsystems. Establish programs to address the deficiencies.
- Perform detailed technology assessments and subsystem integration studies for the FCS alternatives such as Assault, Fire Support, and robotics.

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

Total 16595

FY 2001 Planned Program:

• 4662 - Perform effectiveness, performance, cost and tradeoff analysis on innovative vehicle concepts developed in support of a strategically deployable, agile, survivable and tactically mobile force for the Army. Directly supports the development of requirements and technology for FCS .
- Complete investigation of advanced vehicle concepts validating the performance and cost implications of robotic vehicles in multiple roles, as well as potential modifications to the Abrams Tank and Bradley Family of Vehicles and Medium Brigade Vehicles.
- Supports the Army's vision of a medium brigade by developing concept level virtual prototypes of future medium tactical vehicle configurations. Conduct trade-off studies and supporting performance and supportability analysis of heavy tactical vehicle concepts.
- Complete research showing the utility of the collaboration tools using a series of experiments and pilot projects to verify the approach by applying the technology to actual vehicle system issues. Demonstrate the integration of stakeholder feedback to enhance the use of immersive visualization technology during the trade-off analysis process to reduce the risk in the vehicle development process. Continue to refine the application of technology to the vehicle system development process.

• 4500 - Complete electromechanical active suspension algorithm refinement on the HMMWV research test vehicle and investigate electromechanical active suspension application for hyper-mobility in combat vehicles with a focus on the Future Scout chassis.
- Continue developmental testing of the demonstrator engine. Continue high temperature performance and durability development. Optimize engine for high power density, low heat rejection and fuel economy (Cooperative Research Program with Japan).
- Reduce the logistic tail of the force by continuing engine-fuel-lubricant compatibility evaluations with candidate energy enhancement materials, enhance lubricants products to operate successfully with energy enhancement material, initiate field testing of energy enhanced materials; expand dynamometer tests to address other engine types; investigate onboard vehicle coalescer/filter to work with +100 additive complete particle size investigation;
- Investigate and test an oil condition monitor and/or POL quality sensor suite for possible in-line/onboard applications. Validate interfacing software. Conduct bench-level testing of breadboard prototypes and controlled field experimentation.
- Conduct materials comparison studies of composites vs. metallics and their applicability towards military bridging technologies and begin Virtual Prototyping simulations and studies of new and unique bridge launching techniques which are applicable to FCS.
- Investigate, test and characterize obstacle-marking systems based on FY2000 analysis. Perform detailed assessments in vehicle interoperability, system deployability and cost to prepare for FY2002 test bed demonstration.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology	PROJECT AH91

•	1881	- Integrate and evaluate NRDEC laser protection materials into retrofittable wide-angle optical viewing system incorporating laser-limiting materials. - Analyze structural implications of active protection systems, including effects of the impact of residual penetrators and measures for the protection of crew and sensitive components from shock damage. - Evaluate/validate performance levels via component structural and ballistic tests; perform preliminary structural and weight analysis of candidate "hybrid" vehicle designs; develop preliminary structural and ballistic performance with small element tests. - Conduct simulations to determine viable system concept designs and complete active protection component countermeasure and sensor field evaluations.

FY 2001 Planned Program: (continued)

		- Identify detection and hit avoidance technologies compatible to each other and suitable for integration on a ground combat vehicle. - Assess armor/structure concepts developed under project DC05 for future growth potential and flexibility to deal with an adaptive threat; design development program to be continued in future years for growth armors for FCS.
•	1822	- Design and test Commander's Graphical User Interface (GUI) for semi-autonomous driving for future integration into mobile reduced crew testbed. - Transfer water purification technology from DARPA to the Army; conduct developmental testing of prototype mesoscopic scale individual water purification technologies. - Prototype and integrate software security services into embedded software operating environment.
Total	12865	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AHH7

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AHH7 Future Combat Systems (FCS)	0	0	7752	19564	0	0	0	27500	27316

Mission Description and Justification: FCS, the Army's top priority Science & Technology program, is the focus of this project. The FCS will transform the Army to a more strategically deployable, agile and survivable force. The success of FCS is critical to the transformation of the Army to meet its new vision. Concept exploration and trade studies leading to FCS demonstrations will be performed in this project. This project provides the enabling mechanism for the Army, working with DARPA and industry partners, to research and provide alternative, innovative conceptual designs, virtual prototypes, modeling, simulation, wargaming, performance analysis and evaluation of emerging technologies when packaged in a ground combat system in response to the draft Mission Need Statement (MNS). The intent of that MNS is to develop a force structure around a system of systems capable of addressing a spectrum of threats from non-lethal to full combat, while sustaining itself for an extended period. Industry partners will deliver virtual designs during phase I of the contract that will be evaluated for battlefield utility, supportability, deployability and life cycle costs. A thorough evaluation of the benefits and burdens of competing emerging technologies by functional operational capability area will be completed. This project will provide an extensive evaluation of competing lethality technologies, including electromagnetic guns, missiles, electro-thermal cannon, directed energy weapons and hybrid combinations of these technologies. Advanced target acquisition and engagement sensors, and digitized electronic suites also will be researched. Emerging survivability technologies including active protection and signature management, advanced armors and lightweight structures will also be evaluated. Hypermobility technologies including , electric drive, high-density low burden diesel, turbine and advanced fuel cell engines and alternative prime power sources will be investigated. Advanced active, and semi-active suspension technologies will be researched. Command, Control and situational awareness alternative vehicle electronic architectures will be considered and investigated. These include voice and non-voice digital communications suites, anti-fratracide devices, embedded navigation, prognostics, diagnostics, sensors, embedded learning and crew aids. At the vehicle level, competing designs will be evaluated for their ability to perform combat missions across the full spectrum of operations. These include strategic transportability, peacekeeping operations, urban warfare, countermobility, amphibious operations, offensive and defensive tactical operations. Innovative solutions may include manned and unmanned special mission modules and multiple component designs. Additionally, the project is supported and sponsored by Headquarters, Training and Doctrine Command, and by its various Battle Labs. In FY03, this program transitions to PE 0603005A, project D440.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program:

- 2981 - Research and define initial force concepts as a result of tradeoff assessment process.
- 2783 - Investigate and test innovative system concepts that reflect the force concept in a system of systems structure.
- 1988 - Perform effectiveness, performance and cost analysis on system concepts to quantify the force and system performance and payoffs.

Total 7752

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602601A Combat Vehicle and Automotive Technology		PROJECT: AT21

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT21 21st Century Truck (T21)	0	0	12920	0	0	0	0	0	12920

Mission Description and Justification: This one year congressionally directed program funds research into the "21st Century Truck." Its goal is to significantly increase fuel efficiency; improve power generation performance; decrease emissions; reduce total life cycle costs; and provide for safer 21st Century trucks for the military and the nation. The NAC is the lead for this initiative. The 21st Century Initiative will research alternate fuels, advanced propulsion, advanced materials, reduced parasitic losses, vehicle intelligence and safety. The NAC will establish joint technology development projects in its five principal focus areas using its cost-shared partnerships with industry, other government agencies and academia.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program:

- 8000 - Complete research and investigation of high power density engines, lightweight engine/components, high temperature engine materials, engine coatings, coolants and cooling systems computer controlled energy management systems, electric traction motors, electric generators, high power motor controllers, integrated gate bipolar transistors, and advanced energy storage systems.
- 1800 - Complete investigation and test intelligence technologies that involve both information and control technology to improve fuel efficiency, driving efficiency, safety and quality of driving trucks.
- 1820 - Complete investigation and testing of alternative fuels to meet military requirements for fuels with high stored energy density, reduced emissions and that will facilitate the use of Solid Oxide Fuel Cell propulsion systems.
- 800 - Complete improvement and increase the application of current and new commercial materials technologies that result in increase payload, corrosion resistance, vehicle life cycle, durability and mobility.
- 500 - Complete research showing improvements in fuel cell technologies to include alternatives to diesel reformers and improvements in propulsion density, weight and cube of present generation fuel cells.

Total 12920

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602618A Ballistics Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	26839	42017	49750	52675	57407	56487	62304	Continuing	Continuing
AH03 Robotics Technology	0	0	14476	16164	18859	18863	18856	Continuing	Continuing
AH75 Electric Gun Technology	3736	11305	8952	9335	9922	9915	14753	Continuing	Continuing
AH80 Ballistics Technology	21844	30712	26322	27176	28626	27709	28695	Continuing	Continuing
AH81 Armor/Anti-Armor Technology	1259	0	0	0	0	0	0	0	1259

A. Mission Description and Justification: This program element (PE) provides ballistic technologies required for armaments and armor to support the Army Objective Force and to allow US dominance in future conflicts across a full spectrum of threats in a global context. 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 AH03 is a restructure from Project AH80 to conduct applied research for advanced autonomous mobility technology for future land combat systems of the Objective Force. There is a total $43.4 M funding from OSD to the Army's Robotics Program from FY01 to FY05. Project Projects AH03, AH75, and AH80 will enable lethality and survivability technologies for the Future Combat Systems (FCS). Project AH81 ends in FY 1999 because armor technology development has been consolidated in PE 0602601A, Project DC05. 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 Threat Reduction Agency investments for ETC technology demonstrations. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Force XXI.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602618A Ballistics Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	27229	36287	37687
Appropriated Value	27475	42287	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-246		
b. SBIR / STTR	-242		
c. Omnibus or Other Above Threshold Reductions		-109	
d. Below Threshold Reprogramming	-40		
e. Rescissions	-108	-161	
Adjustments to Budget Years Since (FY 2000/2001 PB)			+498
New Army Vision/Transformation Adjustment		TBD	+11565
Current Budget Submit (FY 2001 PB)	26839	42017	49750

Change Summary Explanation: Funding – FY 01: Project H03 is a restructuring of efforts previously supported under Project AH80. It was adjusted to increase funding for ground robotics to reflect the new Army Vision/Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602618A Ballistics Technology		PROJECT AH03

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH03 Robotics Technology	0	0	14476	16164	18859	18863	18856	Continuing	Continuing

Mission Description and Justification: This project supports the Army Vision by conducting applied research to advance autonomous mobility technology for future land combat systems of the Army Objective Force. It will develop and demonstrate robotics technology critical to the development of future tactical systems for ground combat, including unmanned elements of the Future Combat System (FCS) and crew aids for future manned systems. It will provide the basis for initiating a tri-service research consortium joining researchers from DOD, other Government Agencies, Industry and Academia in a concerted, collaborative effort to advance key enabling technologies. Achieving these goals will provide future land combat forces with significant new operational capabilities that will permit paradigm shifts in the conduct of ground warfare, including significantly enhanced survivability and deployability. Technical efforts will be focused towards advancing perception for autonomous ground mobility, intelligent vehicle behavior and control, and human supervision of unmanned ground systems. Research will be conducted at the Army Research laboratory, other DOD laboratories and research centers, NIST, NASA and DOE research laboratories, as well as Industry and academic Institutions. The applied research conducted in this program will be transitioned to technology development, demonstration and materiel acquisition programs being conducted by the OSD Joint Robotics Program and each of the Services. Robotics Technology (Project AH03) previously funded in Project AH80 prior to FY2001.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program:

- 2000 - Establish external research consortium involving Industry, Academia and HBCU/MI's conduct applied research on the topics of perception, intelligent control and man/machine interfaces supporting development of the Future Combat Systems.
- 12476 - Develop machine perception technologies to enable rapid classification of a baseline set of terrain types required for high-speed autonomous mobility.
  - Develop intelligent control strategies to enable Unmanned Ground Vehicles (UGVs) to execute a basic set of tactical behaviors.
  - Integrate perception and control technologies into a group of UGV testbed platforms.
  - Conduct Battle Lab Warfighting Experiment employing multiple UGVs to examine the maturity of autonomous mobility technologies.

Total 14476

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602618A Ballistics Technology		PROJECT AH75

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH75 Electric Gun Technology	3736	11305	8952	9335	9922	9915	14753	Continuing	Continuing

Mission Description and Justification: This project funds applied research for the Army Electromagnetic (EM) armaments technology program. To achieve the objectives of the Army Vision, future armored combat vehicles, including the Future Combat Systems (FCS), will require more lethal, yet compact main armament systems capable of defeating protection levels greatly in excess of currently experienced values. EM armaments offer the potential to field a leap-ahead capability by providing adjustable velocities, including hypervelocity, greatly above the ability of the conventional cannon. EM armaments potentially can be fully integrated with electric propulsion and electromagnetic armor systems to provide the efficient, highly mobile, and deployable armored force required by the nation. This project focuses on addressing technical challenges associated with an EM armament, in particular with pulsed power for electromagnetic (EM) launches. This project funds a contractual effort to provide an efficient pulsed power technology for electromagnetic (EM) launch. The goal is to provide pulsed power technology (rotating machines) with energy density of ten Joules per gram (J/g) and to identify a clear potential for growth required for future combat systems, expected to be greater than fifteen 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 the future, a new contractual effort will be started which develops one of the two alternative techniques for pulsed power technology; either a drum topology or a disk topology. This project funds applied research for the Army Electrothermal Chemical (ETC) gun technology program which is a joint effort with the Defense Threat Reduction Agency (DTRA) with contractual efforts by SAIC - San Diego, CA; UDLP - Minneapolis, MN; and Thiokol – Ogden, UT. The goal of the ETC effort is to demonstrate 14MJ from the 120mm, M256 Cannon. ARL, in close collaboration with the Armaments Research, Development, and Engineering Center, Picatinny NJ, will apply ETC technology to medium caliber cannon applications by FY02 with a goal of increasing muzzle energy by 25%

FY 1999 Accomplishments:

- 1352 - Measured electromagnetic signature of subscale compulsator for application to design of crew and system protection.
  - Tested effects of electromagnetic shielding on subscale compulsator performance to determine optimum design.
- 2384 - Achieved the goal of proving 14 MJ muzzle energy from a 120-mm, M256 ETC cannon. This is a significant lethality improvement over conventional gun performance.

Total 3736

FY 2000 Planned Program:

- 8512 - Design pulsed power machine for FY 2003 demonstration of 5 J/g.
  - Design switch array for multi-phase, multi-pole control of pulsed power machine.
  - Design EM railgun test launcher with robust, fieldworthy attributes.
  - Conduct systems analysis of EM gun integration into future combat vehicles.
- 2500 - In close coordination with ARDEC, design ETC ignition and propelling charge for medium caliber cannon.

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BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602618A Ballistics Technology / PROJECT: AH75

FY 2000 Planned Program: (continued)

- Show scalability, ballistic tailorability, and temperature compensation of ETC technology in medium caliber cannon.
- Identify ETC tailored propellants with reduced vulnerability.

•	293	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	11305	

FY 2001 Planned Program:

•	6952	- Conduct pulsed power component tests demonstrating material strength and machine preliminary design.
		- Devise initial switch array for multi-phase, multi-pole control of pulsed power machine.
		- Conduct experiments on sub-scale launcher designs demonstrating robust, fieldworthy attributes.
		- Devise EM Gun technology component models for conducting system level simulations
•	2000	- Show controlled step-up toward increased muzzle energy goal in medium caliber ETC cannon using tailored solid propellants.
		- Prove ETC compatibility with medium caliber conventional and cased telescope cartridges.
Total	8952	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602618A Ballistics Technology		PROJECT AH80

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH80 Ballistics Technology	21844	30712	26322	27176	28626	27709	28695	Continuing	Continuing

Mission Description and Justification: This project provides key technologies required for armor and armaments that will enable U.S dominance in future conflicts across a full spectrum of threats. The program supports the Army Vision by focussing on 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 to enable the Future Combat Systems' (FCS) lethality and survivability. This project continues to support extensive experimental programs to advance the state-of-the-art in ballistics technologies. This project also provides key technologies for a new class of vehicle control that will enable an unmanned land combat vehicle to intelligently follow a manned combat vehicle (technology will be funded and executed in Project AH03 beginning in FY01). This new capability will enable a manned crew in a lightly armored vehicle to simultaneously expand its survivability and area of influence, maneuvering and engaging enemy forces without disclosing its own location. 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 1999 Accomplishments:

- 15682 - Proved out advanced armor capable of defeating all tank gun launched threats at 65% of the weight of current Abrams armor.
  - Elucidated canard and fin flow field and developed CFD characterization for Guided Multiple Launch Rocket System (MLRS) – transitioned technology to MRDEC; Devised structural modeling capability to predict performance of onboard GN&C components-implemented on SADARM
  - Advanced technologies to provide new operational capabilities to soldiers in low intensity conflicts and operations across the threat spectrum.
  - Devised burning rate screening criteria and scaled ballistic performance/vulnerability characterization tools to be employed in optimizing future propellants with maximum energy and minimum vulnerability at affordable cost while balancing human factors, life cycle costs, erosivity and propellant performance in gun systems; Implemented Army Solid Propellant Master Plan for energetic materials (ARO, ARL and ARDEC).
  - Proved ability to track and predict hit-location of KE rod with Passive IR Tracker (PIRT); showed launcher technologies capable of successfully intercepting KE rod; evaluated advanced integrated armor technologies for effectiveness against short l/d fragments like those from a KE rod intercepted by a High Explosive/Electromagnetically-launched intercept device and downselected residual armor technology.
  - Proved out advanced lethality concepts including the use of novel missile nose cone configurations to initiate reactive armor; devised sheathed penetrator model and determined novel processing techniques; evaluated shaped charge warhead concepts and new tungsten composites for penetrators.
- 6162 - Optimized ammunition response algorithms for rocket motor ignition and explosion to more accurately predict the survivability and lethality of U.S. Army weapon systems such as Crusader, FSCS, MLRS, HIMARS, M74 & M85 bomblets, and BAT P3I.
  - Provided engineering-based predictions of the subsystem capabilities after multiple impact combinations of direct and/or indirect-fire threats.

Total 21844

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602618A Ballistics Technology	PROJECT AH80

FY 2000 Planned Program:

•	18158	- Investigate an advanced armor system capable of defeating future medium caliber KE and shaped charge threats that is compatible with the goals of Army After 2010. - Perform complex numerical simulations of launch disturbances and critical damping of initial free flight motions for future smart munitions to extend range and improve accuracy for both direct and indirect fire weaponry. - Evaluate, in conjunction with Army users, operational concepts employing technologies such as advanced lightweight artillery weapons and systems to enhance positional awareness; employ distributed interactive simulations incorporating these systems to improve training. - Evaluate candidate propellants produced by ARDEC and industry partners; establish comprehensive database for use by ammunition designers to enhance gun lethality at reduced vulnerability. - Evaluate performance of candidate sensor suite and kill mechanism technologies that will enable the development of CKE AP and begin the down-select to those with the best growth potential toward the Full Spectrum Active Protection (FSAP) STO goals. Begin integration of tracker, kill mechanism and residual armor components into a CKE brassboard demonstration. Identify, test and evaluate vehicle integratable sensor technologies and compact, command-fused Kinetic Energy penetrator counter-munition concepts - Exploit emerging technologies in the area of lethal mechanisms for direct fire applications, especially sheathed penetrators, amorphous metals, fragmenting warhead designs for medium caliber ammunition, and extending rods.
•	6737	- Verify and validate select component-level ballistic algorithms to support development and Live Fire Test & Evaluation of over ten U.S. Army weapon systems, including ground, munition, aviation, and lightly armored systems. - Optimize physically based models to predict the probability of ignition of sustained diesel and JP-8 fuel fires in U.S. group combat systems with and without fire suppression systems.
•	400	- Prove out the feasibility of future large caliber ETC guns. Evaluate and select ETC technologies, design and fabrication two ETC-gun modules, test, and evaluate modules for feasibility of an ETC-gun weapon system integration info FMVS. (NATO funds: Partner Germany) (Under Project Arrangement A-98-GE-0016)
•	5000	- Devise and prove out critical machine perception and intelligent control technologies for an unmanned ground vehicle to autonomously maneuver cross country over vegetated terrain at speeds of up to 20MPH during hours of daylight and 10 MPH during hours of darkness
•	417	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	30712	

FY 2001 Planned Program:

•	19347	- Design and characterize innovative armors, structures, protection mechanisms, and survivability concepts for future lightweight combat vehicle protection. - Conduct experimental demonstrations of multi-disciplinary designs for guidance, navigation, and control technologies applied to smart munitions.

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602618A Ballistics Technology PROJECT AH80

- Transition technologies which will provide new operational capabilities to light forces operating in low intensity conflicts and rapid deployment scenarios to Army Research, Development, Engineering Centers and the user community.

FY 2001 Planned Program: (continued)

- Implement selected gun propellant formulations (sample sizes) in scaled ballistic studies to demonstrate improved performance and propellant integrity with reduced vulnerability.
- Down select CKE technology options, complete the integration to a brassboard KEAP system and commence testing to optimize performance of the selected system; conduct experimental tests to demonstrate improved compactness and hardening of counter KE technologies with specific focus on the sensor suite/counter-munition integration and optimization.
- Explore novel lethal penetrator concepts to include explosively-assisted penetrators, hypervelocity penetrator concepts (e.g., segmented rods), and novel shaped charge liner configurations to defeat increasing levels of armor protection.

•	6565	- Implement advanced armor penetration algorithms in survivability/lethality analysis codes for sophisticated multi-layering schemes for multi-hit protection of U.S. Army ground systems (such as Crusader, FSCS, and FCV). - Implement empirically-based combined blast and fragment algorithms to more accurately model the effects of high explosive incendiary projectiles on the survivability of U.S. Army helicopters.
•	410	- Prove out the feasibility of future large caliber ETC guns. Evaluate selected ETC technologies based on FY00 downselect. (NATO funds: Partner Germany) (Under Project Arrangement A-98-GE-0016)
Total	26322	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602618A Ballistics Technology		PROJECT AH81

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH81 Armor/Anti-Armor Technology	1259	0	0	0	0	0	0	0	1259

Mission Description and Justification: The objective of this project has been 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. Anti-armor efforts develop technology to supports (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. Funding for these anti-armor efforts end in FY99. In FY 2000 and beyond, funds have been transferred to PE 0602601A, Project DC05, to consolidate armor technology development in a single project. Major contractors include: Dow Chemical Co., Midland, Miland Science Applications International Corp., Albuquerque, NM.

FY 1999 Accomplishments:

•	1259	- Showed multi-liner explosively formed penetrator ability to form ultra-long penetrator and provide enhanced armor penetration from a smaller warhead configuration.
Total	1259	

FY 2000 Planned Program: Project not funded in FY 2000

FY 2001 Planned Program: Project not funded in FY 2001

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

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

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4660	4953	3530	3550	3580	3856	3879	Continuing	Continuing
A556 Optical Microscopy	0	981	0	0	0	0	0	0	0
A552 Smoke/Novel Effects Munitions	4660	3972	3530	3550	3580	3856	3879	Continuing	Continuing

A. Mission Description and Justification: This program element researches and matures enhanced smoke and obscurant technologies to increase personnel/platform survivability, and solve critical light force needs to defeat enemy targets (i.e., non-lethal and flame/incendiary devices). The program element provides applied research in technologies to counter enemy weapon systems and to provide the ability to degrade enemy capability. Improved multispectral smokes/obscurants are explored to enhance survivability by providing effective, affordable, and efficient screening of deployed forces from threat force surveillance sensors and effective defeat of target acquisition devices, missile guidance, and directed energy weapons, 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 to Program Definition and Risk Reduction (PDRR), and Engineering and Manufacturing Development (EMD) programs. This program is managed by the U.S. Army Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	5078	3996	4042
Appropriated Value	5116	4996	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-38		
b. SBIR / STTR	-110		
c. Omnibus or Other Above Threshold Reductions			
d. Below Threshold Reprogramming	-288	-17	
e. Rescissions	-20	-26	
Adjustments to Budget Years Since FY 2000/2001 PB			-512
Current Budget Submit (FY 2001 PB)	4660	4953	3530

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602622A Chemical, Smoke and Equipment Defeating Technology / PROJECT: A556

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A556 Optical Microscopy	0	981	0	0	0	0	0	0	0

Mission Description and Justification: This one year Congressional special interest project is focused on evaluating soybean oil as a material for producing visible smoke. The project involves evaluation of material performance and its environmental properties.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	955	Characterize the key material properties, evaluate the performance, and determine the environmental effects of soybean oil as a visible smoke material.
•	26	Small Business Innovation Research / Small Business Technology Transfer Programs
Total	981	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602622A Chemical, Smoke and Equipment Defeating Technology PROJECT A552

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A552 Smoke/Novel Effects Munitions	4660	3972	3530	3550	3580	3856	3879	Continuing	Continuing

Mission Description and Justification: Project A552 provides applied research in technologies to counter enemy weapon systems and to provide the ability to degrade enemy capability. Improved multispectral smokes/obscurants are explored to enhance survivability by providing effective, affordable, and efficient screening of deployed forces from threat force surveillance sensors and effective defeat of target acquisition devices, missile guidance, and directed energy weapons, 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.

FY 1999 Accomplishments:

•	2292	- Completed design and adaptation of the Millimeter Wave (MMW) module on the M56 and M58 smoke generators; implemented cost and maintenance reduction measures. Produced first-ever results of millimeter wave obscurants versus a simulated millimeter wave fire control radar. Incorporated millimeter wave obscurant use into modern battle scenario using the Combined Arms and Support Task Force Evaluation Model (CASTFOREM) wargame. Demonstrated obscurant value-added in reduced loss exchange ratio. - Investigated vehicle smoke and obscurant acquisition and hit avoidance measures and concepts applicable to an integrated defense system for armored vehicles. - Investigated infrared screening material propellant dissemination in a smoke pot configuration.
•	2000	- Evaluated performance predictive capability for infrared (IR) materials. - Conducted initial assessment of various Distant Smoke delivery concepts. - Conducted initial smoke antimaterial feasibility assessment.
•	368	- Conducted a tech watch in flame, incendiary, antimateriel and riot control technologies. Surveyed marking materials and examined an antimateriel application. - Concluded thermite (aluminum and iron oxide pyrotectic reaction) scaling study.
Total	4660	

FY 2000 Planned Program:

•	1584	- Conduct in depth field evaluations of the cloud produced vehicle protection obscurant technologies. - Apply propellant dissemination technologies for smoke pot configuration. - Support transition of the millimeter wave material and module to PM Smoke for Pre-Planned Product Improvement.
•	2303	- Investigate new high performance obscurants for munition applications and for reduced logistics burden; continue IR material performance characterization.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602622A Chemical, Smoke and Equipment Defeating Technology PROJECT A552

FY 2000 Planned Program: (Continued)

- Assess distant smoke delivery methods.
- Conduct assessment of methodologies and requirements analysis for Smoke/Obscurant simulation infrastructure.

•	85	- Small Business Innovation Research/ Small Business Technology Transfer Program.
Total	3972	

FY 2001 Planned Program:

•	1055	- Incorporate dissemination technology in Vehicle Smoke Protection Model and Cloud Density Visualization Utility Model. - Support smoke simulation in Combined Arms Tactical Trainer, High Level Architecture and Distributed Integration Simulation. - Evaluate foreign emissive and pyrotechnic IR and multispectral concepts. - Complete IR smokepot investigation. Investigate other smokepot dissemination techniques. Assess multi-spectral capabilities and configuration schemes.
•	2475	- Determine limits of performance for improved millimeter wave obscurants. - Investigate improved infrared screening candidates for reduced logistics burden. Complete IR material performance characterization. - Down-select Obscurant/target defeat technology for Distant Smoke system. Evaluate prototype delivery systems.
Total	3530	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602623A Joint Service Small Arms Program — PROJECT: AH21

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH21 Joint Service Small Arms Program	5008	5161	5415	5589	5757	5991	6290	Continuing	Continuing

A. Mission Description and Justification: The objective of this Program Element (PE) is to develop key individual and crew-served weapon technologies that will enhance the fighting capabilities and survivability of dismounted battlefield personnel of the Services. This PE funds efforts that include: component technology for an Objective Crew-Served Weapon (OCSW) to replace selected M2 machine guns, MK19 grenade machine guns and M240 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. This PE also funds other technology advancement/enhancement efforts to 1) assure that the Objective Family of Small Arms (OFSA), the next generation of weapons systems, continues to overmatch the evolving threat; and 2) address the follow-on needs of the Army 2010 and beyond. 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 cited work 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 (ARDEC), Picatinny Arsenal, NJ. Work in this PE is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), and PE 0603607A (Joint Service Small Arms Program). JSSAP OICW and OCSW Technology Base efforts transition to PE 0604802A (Weapons and Munitions-Engineering Development) and PE 0604601A (Objective Crew Served Weapon-Engineering Development) respectively. Transition paths have been established in coordination with Product Manager (PM) Small Arms, USMC Director Ground Weapons and US Special Operations Command (SOCOM).

FY 1999 Accomplishments:

- 2729 - Applied fire control technology to OCSW and planned full integration into prototype system design.
  - Conducted design refinements on OCSW weapon, ground mount, fuze and ammunition elements.
- 1105 - Following OICW safety certification, conducted technical and user testing.
- 1174 - Established sniper baseline performance and explored new concepts/technologies to achieve future sniper requirements.
  - Evolved leading edge concepts/technologies that will assure OFSA continues to overmatch the evolving threat and to address AAN requirements.

Total 5008

FY 2000 Planned Program:

- 3381 - Complete integration of airburst, point-detonation and self-destruct functions into OCSW fuze.
  - Conduct firing demonstration tests of fully integrated OCSW fuze from 800 out to 2000 meters.
- 808 - Conduct OICW Micro-Electro-Mechanical Systems (MEMS) based safe & arming device.
- 880 - Complete preliminary error budget and feasibility analysis for light Fighter Lethality smart munition program.
- 92 - Small Business Innovation Research/ Small Business Technology Transfer (SBIR/STTR) Programs.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602623A Joint Service Small Arms Program — PROJECT: AH21

Total 5161

FY 2001 Planned Program:

- 2952 - Complete design and 1000-2000 meter firing tests of OCSW full solution fire control.
- 1415 - Demonstrate MEMS safe & arming design.
- 1048 - Complete the concept of a seeker projectile for Light Fighter Lethality After Next.

Total 5415

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 / 2001 PB)	5188	5187	5428
Appropriated Value	5229	5187	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-41		
b. SBIR / STTR	-95		
c. Omnibus or Other Above Threshold Reduction		-14	
d. Below Threshold Reprogramming	-63		
e. Rescissions	-22	-12	
Adjustments to Budget Years Since (FY 2000 / 2001 PB)			-13
Current Budget Submit (FY 2001 PB)	5008	5161	5415

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602624A Weapons and Munitions Technology**

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	28185	36521	33761	34654	36860	38050	40697	Continuing	Continuing
AH18 Artillery & Combat Support Technology	10789	14561	12230	13043	13879	15013	15193	Continuing	Continuing
AH19 Close Combat Weaponry	8425	11365	11019	10818	10538	10496	12329	Continuing	Continuing
AH28 Munitions Technology	8971	10595	10512	10793	12443	12541	13175	Continuing	Continuing

A. Mission Description and Budget Item Justification: Technologies being pursued in this Program Element (PE) will enable weapons and munitions to be more affordable, smaller and/or lighter (thus addressing their logistics burden) while maintaining or increasing their lethal effects. The PE funds technologies to provide tank main armament upgrade opportunities for fielded and future ground combat systems, precision and extended range munitions, and alternative defeat mechanisms for advanced artillery, mortars, area denial and armor systems for the Army after 2010 and Future Combat Systems (FCS) enabling technologies. The PE funds modeling and analytic codes for thermal analysis and high impetus low flame temperature propellants to reduce wear on gun tubes (which degrades accuracy and increases the system cost); high energy explosive technologies that increase projectile and warhead lethality; advanced smaller, lighter more effective shaped charge and explosively formed penetrator (EFP) warheads; advanced armament fire control, and decision aids and software architecture; advanced acoustic sensor technology to enhance performance of smart munitions, technology advances in acoustic sensors and anti-armor anti-personnel area denial systems, and smart materials to improve accuracy and reduce operational and support (O&S) costs. 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 the Army after 2010, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ primarily manages this program. Work in this PE is related to, and fully coordinated with, efforts in PE 0602618A (Ballistics Technology), PE 0602623A (Joint Service Small Arms Program (JSSAP)), and transitions to work performed in PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603607A (JSSAP) and PE 0603802A (Weapons and Munitions Advanced Development).

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 / 2001 PB)	28913	34687	37487
Appropriated Value	29189	36687	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-276		
b. SBIR/STTR	-481		
c. Omnibus or Other Above Threshold Reductions		-78	
d. Below Threshold Reprogramming	-131		
e. Rescissions	-116	-88	
Adjustments to Budget Years Since (FY 2000 / 2001 PB)			-3726
Current Budget Submit (FY 2001 PB)	28185	36521	33761

Change Summary Explanation: Funding – FY 2001: Funds reprogrammed (-3726) for higher priority requirements.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology		PROJECT: AH18

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH18 Artillery & Combat Support Technology	10789	14561	12230	13043	13879	15013	15193	Continuing	Continuing

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 the Army after 2010. Also being pursued are technologies for improving combat vehicle lethality and fire control while reducing life cycle costs with innovative applications of smart materials, advanced actuators, advanced digital stabilization and micro-electro-mechanical systems (MEMS) technology for embedded fire control sensors. Decision aid software technology is being developed to increase battlefield survivability of self-propelled howitzers, along with technologies for improving the effectiveness and affordability of next generation smart munitions. Meteorological extraction algorithms are also being developed to further improve artillery accuracy. Technology for artillery projectile rotating and obturating bands is being pursued to address cannon wear for high performance weapons. Recoil management and lightweight materials technologies are being developed to create a more lethal, yet lightweight Future Direct Support Weapon System (FDSWS). The objective of the FDSWS is to provide 155mm lethality with 105mm deployability in a 5000Lb towed howitzer, air transportable by a UH60 helicopter and towed by a heavy Highly Mobile Multi-Wheeled Vehicle (HMMWV). The application of light-weight, high-strength composites to mortar projectiles is being pursued to significantly extend range while providing increased lethal effectiveness, such as the Extended Range Mortar Cartridge (ERMC) program. This project also supports the development and evaluation of advanced area denial concepts as an alternative to current anti-vehicle/anti-personnel mining techniques. This project also funds technology to develop advanced acoustic sensors which will provide non-line of sight target queuing for a variety of weapons platforms. Technologies for reducing artillery target location error and providing real time targeting and battle damage assessment data to fire direction centers are also being developed to support information dominance strategies for the Army after 2010. Development of the Distributed Interactive Fire Mission (DIFM) software supports the Army after 2010 fire control systems. This software will enable groups of tanks, fighting vehicles, attack helicopters, etc. to fight in unison by coordinating their fires against targets; substantially improving battlefield survivability and operations tempo. Targets will be automatically assigned to individual shooters based on the most effective pattern to ensure rapid first-shot execution and progression to the next target assignment. QuickLook provides the brigade commander with real time target imagery, coordinates, and battle damage assessment (BDA). This system will utilize an artillery launched loitering munition that flies out to a maximum range of 50 km. and acquires and transmits targeting information (i.e., video, Global Positioning System (GPS)) back to the tactical operations center via a wireless link.

FY 1999 Accomplishments:

- 3500 - Fabricated a cannon for ultra lightweight 155mm FDSWS and modified soft recoil test bed; developed concepts for 5700 lb. ER fluid-controlled soft recoil weapon; designed upper carriage and tipping parts for testbed.
  - Gathered area denial intrusion sensor data in various terrain and weather conditions; developed computer algorithms; conducted simulation to evaluate operational effectiveness.
- 3347 - Developed a network accessible reference architecture data repository of reusable fire mission components; completed a baseline reusable voice natural language interface component for fire missions; developed process tools to support a "software component factory" approach to affordable embedded software development; this effort supports the Army after 2010 information dominance strategies.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602624A Weapons and Munitions Technology
	PROJECT AH18

FY 1999 Accomplishments: (continued)

- Completed implementation and battle lab evaluation of Technical Architecture-compliant fire mission and movement planning decision aid for an artillery chief-of-section.
- Completed capture of armament decision aid knowledge base; completed hardware, software and distributed interactive simulation integration efforts; tested and verified operation of new decision aid components; conducted man-in-the-loop testing.
- Analyzed and applied results of the DIFM Concept Experimentation Program conducted by the Mounted Maneuver Battle Space Battle Lab, which will develop multi-shooter long range armored fighting vehicle battle scenarios for DIFM simulations.

• 2372 - Fabricated prototype components of weapons systems using smart materials and structures technology to significantly improve functionality, reduce size/costs/weight and improve or maintain existing lethality.
- Established preliminary concepts and conducted preliminary analyses of novel indirect fire systems.
- Developed prototype environmental characterization, propagation prediction, and artificial intelligence rule-based sensor deployment algorithms; completed integration of environmental sensors (e.g., temperature and wind) with an acoustic sensor package; conducted field test.
- Fabricated test hardware and lightweight rocket motor for ERMC; conducted interior ballistics tests; performed combat utility simulations.

• 1570 - Developed tactical targeting and battle damage assessment munition (i.e. QuickLook) operational architecture and procedures; performed studies on battlefield payoffs, target location, logistics, communication architecture and system design concept; developed system design.
- Developed retrofit obturator to improve projectile accuracy and minimize cannon wear for extended range weapon systems; conducted subscale testing of advanced polymer materials for obturator application.

Total 10789

FY 2000 Planned Program:

• 5572 - Fabricate hardware and conduct preliminary tower/captive flight tests to validate common aperture laser radar infrared (LADAR/IR) sensor performance against low observable targets; fabricate prototype sensor hardware for gun-hardening experiments.
- Conduct field test of prototype area denial hardware; evaluate weapons system and sensor performance; investigate alternative delivery and recovery methods.
- Execute ER fluid research which includes fluid characterization software control methodology, material and structures modeling, and power supply design; start validation of virtual simulations through hardware designs.

• 4172 - Extend the fire mission and movement planning decision aid to a fully Technical Architecture compliant suite of decision aid components to support sustainment, situational awareness and mission rehearsal for an artillery chief-of-section; establish a baseline decision aids application software component reuse library and link with specification data library to support follow-on software component factory technology.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology / PROJECT: AH18

- Develop DIFM multi-shooter vs. multi-target algorithms.
- Develop an effective windscreen and vehicle self-noise cancellation algorithm/software for Striker (HMMWV platform); develop acoustic/seismic propagation models and relate performance to potential gains in cost and operational effectiveness of a sensor network.

FY 2000 Planned Program: (continued)

- 4604 - Fabricate QuickLook artillery fired loitering munition reconnaissance system hardware components and perform sub-system testing.
  - Complete ERMC rocket motor static testing; update interior and exterior ballistic models; conduct composite motor and fin assembly structural integrity test; conduct live-fire mass simulated range test.
- 213 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 14561

FY 2001 Planned Program:

- 4508 - Conduct system trade-off studies, fabricate sensor hardware and perform captive flight tests on alternate sensor designs with a common aperture LADAR/IR transducer for detection of low observables.
  - Perform developmental and operational testing of 5700 lb FDSWS testbed to assess stability, precision and accuracy to validate virtual simulations.
  - Further identify and develop critical technologies; update and mature modeling and simulations; pursue evaluation of ER recoil management, isogrids and load out of battery technologies.
  - Conduct integrated Area Denial System experiment.
- 3414 - Complete implementation and feasibility demonstration of an architecture-based software component factory process for rapid generation of embedded fire mission application software.
  - Complete DIFM multi-shooter algorithms development; analyze and optimize DIFM using Distributed Interactive Simulation; quantify DIFM multi-agent performance.
  - Fabricate prototype hardware and conduct full-up range flight test of the ERMC.
- 4308 - Integrate QuickLook system components and perform integrated captive flight test.
  - Exhibit improved cannon wear life (Crusader) in wear testing; verify design improvements for stockpiled ammunition.
  - Collect launch signatures on Multiple Launch Rocket System (MLRS) and mortars and add data to expand detection capability; demonstrate modeling and target location and tracking capabilities against non-real time data and assess improvements in operational effectiveness; initiate development of advanced detection, classification and tracking algorithms.

Total 12230

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602624A Weapons and Munitions Technology		PROJECT AH19

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH19 Close Combat Weaponry	8425	11365	11019	10818	10538	10496	12329	Continuing	Continuing

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 FCS Armament program funded in PE 0603004A. Included in this PE are technologies for tank projectile precursor defeat of explosive reactive armor (ERA), composite material enhancements for sabots and gun structures, trajectory correction areas of projectile design and fabrication, means to increase gun life by reducing barrel wear, thermal management of high rate launch mechanisms and munition autoloaders including feeders and storage mechanisms. This PE will develop multi-mode fuzing technologies to include lower cost self-destruct technologies for submunitions, which will reduce unexploded ordnance on the battlefield and low cost electronic safe and arm devices for single and future multi-mode warheads. The project also develops extended range munitions and alternative defeat mechanisms of advanced armor systems for the Army after 2010. This project provides opportunities for longer range, more accurate and more lethal cannon systems for armored vehicles to include enabling technologies to support FCS. The approach will be to develop both the hardware and analytical tools necessary to assess system performance, identify problem areas and to develop solutions.

FY 1999 Accomplishments:

- 5708 - Demonstrated kinetic energy (KE) radial thruster technology capability to measure and counter flight disturbances to enhance accuracy up to 70%; first thruster diversion test successfully completed; demonstrated MEMS accelerometer capability to measure KE disturbances through flight tests.
  - Conducted analytical evaluation of extended range munition capabilities; completed three system design concepts; prepared for sensor demonstration tests with two candidate system concepts.
  - Demonstrated novel penetration defeat of future threat complex armors; performed armor tests of novel penetrator concepts and then down-selected to the best candidate for integrated structural tests.
- 1738 - Completed system level trade-off analysis and developed concepts of a notional future combat vehicle armament system and a multi-role family of munitions.
- 979 - Completed adhesive test of sputter coated (tantulum) 25mm gun barrels.

Total 8425

FY 2000 Planned Program:

- 1480 - Deposit tantalum coating by cylindrical magnetron sputtering process on test coupons, cylindrical sections and a full length 25mm gun barrel.
- 2274 - Conduct simulation of existing and conceptual target defeat techniques (i.e., Institute for Advanced Technology (IAT), (University of Texas); ARDEC; and Army Research Laboratory (ARL)) for medium caliber applications.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology — PROJECT: AH19

FY 2000 Planned Program: (continued)

•	2734	- Analyze, simulate and select lethality package of advanced propulsion system for FCS; complete conceptual design of a light weight, low recoil launcher (both 60% less than 120mm M256); demonstrate recoil mitigation and composite launcher components; develop/optimize advanced propulsion for higher energy/lower vulnerability; develop a notional concept for improved automation of weapon platforms.
	2619	- Establish target set vulnerabilities for three agile target effects systems: 1) dazzler munition using an acoustic/light source to render sensors ineffective for a limited time, 2) a pulsed laser generator for Unmanned Aerial Vehicles (UAV) and sensor suppression and 3) a flat panel multi-mega/gigawatt generator demonstrating neutralization of electronic/communications equipment. Complete the technology evaluation and trade-off studies for low cost course correction technologies, which will provide a dramatic increase in, hit probability at extended ranges, up to 400%.
•	750	- Develop enhanced target defeat for medium caliber systems exploiting emerging technologies in composite sabots, novel penetrators, propulsion and bursting munitions.
•	1100	- Develop lower cost self-destruct fuze technologies for application to DPICM, which will reduce unexploded ordnance on the battlefield.
•	253	- Conduct laboratory testing of individual components to evaluate hardening and reliability requirements for a broad spectrum of low cost enhanced accuracy munitions.
•	155	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	11365	

FY 2001 Planned Program:

•	1500	- Use tantalum coating process to apply cannon bore coatings to medium (25mm) and large (120mm) caliber gun barrels and validate wear performance.
•	2218	- Optimize power consumption and output to maximize target effects for laser and microwave anti-sensor devices.
•	5461	- Complete fabrication of lightweight/low impulse launcher for FCS. - Determine feasibility of propulsion and launch system to launch a surrogate family of munitions at desired velocities.
•	1140	- Develop low cost, universal electronic safe and arm (ESA) technology for missiles and smart munitions.
•	700	- Develop enhanced target defeat mechanism of light armor targets using novel penetrators for increased penetration and behind armor effects.
Total	11019	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602624A Weapons and Munitions Technology	PROJECT AH28

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH28 Munitions Technology	8971	10595	10512	10793	12443	12541	13175	Continuing	Continuing

Mission Description and Justification: The objective of this project support advanced technologies in gun propellants with wear reducing additives, explosives, warheads, insensitive munitions (IM) and advanced materials for EFP and shaped charge (SC) warheads. Advances in warhead technology will provide improved EFP and SC warheads and advanced warhead liners to defeat and protect both 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 integrated IM efforts conducted in this project will increase the survivability of tanks, artillery, helicopters and infantry fighting vehicles, as well as the safety in manufacturing plants, storage depots, and during air and sea transport. Development and analysis of EFP for active protection systems supports work performed under PE 0603005A. The technologies developed in this project support current FCS requirements.

FY 1999 Accomplishments:

- 3030 - Conducted static warhead tests using high power explosives to show an increase in energy up to 25%.
- 3027 - Defined baseline technology for a compact warhead for missile applications.
- 1834 - Conducted 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; investigate additives to reduce gun tube wear.
- 1080 - Designed multiple explosively formed penetrator warhead for active protection against chemical energy and kinetic energy threats.

Total 8971

FY 2000 Planned Program:

- 3080 - Manufacture laboratory scale quantities of next generation, more powerful explosive and conduct sensitivity evaluation.
- 3680 - Conduct testing of combined anti-armor/anti-bunker warheads.
- 1900 - Formulate and test CL-20 based advanced propellants.
- 1800 - Design/fabricate/test a multiple EFP warhead for active protection system (APS).
- 135 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 10595

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602624A Weapons and Munitions Technology — PROJECT: AH28

FY 2001 Planned Program:

•	3000	- Scale up and characterize next generation more powerful explosives.
•	3800	- Develop compact/multiple effects warhead and design/optimize the co-linear explosively formed penetrator warhead.
•	1912	- Develop significant propulsion performance increase in scaled and large caliber guns.
•	1800	- Conduct dynamic tests of EFP warhead for active protection system against chemical and KE threats.
Total	10512	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	25004	36812	23869	27504	31257	30984	31952	Continuing	Continuing
AH11 Battery/Individual Power Technologies	6355	12446	4025	4475	4532	4410	4689	Continuing	Continuing
AH94 Electronics and Electronic Devices	18649	24366	19844	23029	26725	26574	27263	Continuing	Continuing

A. **Mission Description and Budget Item Justification:** 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 provide electronic components, power components, and low-cost, lightweight, high-energy density power sources for communications, target acquisition, and miniaturized displays, for applications such as the Future Combat Systems (FCS) and soldier systems. This program consists of research in the physical sciences essential to all land combat systems that contain electronics, photonics, magnetic materials, ferroelectrics, microwave and millimeter-wave components, batteries, electromechanical systems (engine generator sets) and fuel cells. Supported systems include FCS, soldier systems, autonomous missile systems, advanced land combat vehicles, smart anti-tank munitions, electric weapons, secure jam-resistant communications, automatic target recognition (ATR), foliage-penetrating radar, combat identification, and digitizing of the battlefield. This program supports the in-house applied research 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, and Ballistic Missile Defense Organization. It supports all of the science and technology thrust areas that employ electronic and portable power-source technology. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), and the Army Modernization Plan.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602705A Electronics and Electronic Devices

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	25238	25796	27719
Appropriated Value	25479	37096	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-241		
b. SBIR / STTR	-128		
c. Omnibus or Other Above Threshold Adjustments		-83	
d. Below Threshold Reprogramming	-6		
e. Rescissions		-201	
Adjustments to Budget Years Since (FY 2000/2001 PB)	-100		-1850
New Army Transformation Adjustments		TBD	-2000
Current Budget Submit (FY 2001 PB)	25004	36812	23869

Change Summary Explanation: Funding – FY 01: Project AH94 was adjusted to reflect the new Army Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602705A Electronics and Electronic Devices		PROJECT AH11

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH11 Battery/Individual Power Technologies	6355	12446	4025	4475	4532	4410	4689	Continuing	Continuing

Mission Description and Justification: This project provides applied research in the application of the physical sciences of energy conversion, electrochemistry, electronics, signature suppression, etc. as they apply to improving existing systems and enabling newer, more advanced battery, fuel cell, thermoelectric, hybrid, and electromechanical (including engines and permanent magnet alternators) technologies. The goal is to investigate 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. These technologies support thrusts aimed at reduced acquisition costs, reduced operation and support costs, and Army modernization.

FY 1999 Accomplishments:

•	936	- Designed a rechargeable lithium-ion liquid electrolyte (wet cell) battery and non-rechargeable metal-air battery, both with ultra high energy density and low operations and support costs. - Generated and exhibited prototype smart charging cables for forward field charging of rechargeable batteries for light infantry forces Command, Control, Communications, Computers, Intelligence and Information Warfare (C4I2W) equipment. - Generated and showed vehicle-mounted chargers that utilize vehicle power to recharge family of C4I2W batteries.
•	1216	- Performed design analysis and demonstrated proton exchange membrane (PEM) fuel cell/lithium-ion rechargeable battery hybrid power source components to provide smaller, lighter and more cost effective man-portable power systems for C4I2W equipment. - Investigated low power and power management technologies for applicability to Army C4I2W equipment, including an uncooled IR sensor.
•	525	- Designed and implemented a 350 pound portable, electronically controlled 5000 Watt engine driven generator set capable of operating on multiple fuels for tactically mobile use. The design integrated state-of-the-art commercially available engines with R&D alternator and power electronics technologies.
•	643	- Designed hydrogen cartridge with 1000 watt-hours per kilogram of fuel for 50 – 150 watt fuel cells.
•	845	- Generated very high energy density, compact zinc-air coin cells for special mission requirements.
•	845	- Generated low cost, high rate rechargeable alkaline manganese batteries for training and garrison environments.
•	697	- Generated low cost, high rate non-rechargeable alkaline batteries for portable military communications applications.
•	648	- Generated low cost, rechargeable lithium-ion coin cells for low rate and memory hold applications for communications and COMSEC devices.
Total	6355	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices — PROJECT: AH11

FY 2000 Planned Program:

•	935	- Design lithium-ion polymer electrolyte (dry cell) rechargeable battery that provides higher safety and higher capacity than wet cell batteries for C4I2W training applications. - Design and test universal smart charging cables for charging complete family of military rechargeable batteries used for C4I2W applications. - Show proof-of-concept rechargeable vest battery for the multiple integrated laser engagement simulation (MILES) 2000.
•	682	- Complete power electronics design for the next generation family of engine driven generator power systems - Install power-on-the-move system in the drive train of a tactical vehicle and perform tests to characterize electrical performance.
•	1342	- Integrate and exhibit battery/capacitor, fuel cell, or battery hybrid. - Assess approaches to kinetic active and passive power generation. - Test components researched by ARL/DARPA for system design of a thermophotovoltaic (TPV) power source and upgrade design. - Design a hybrid fuel cell for the Soldier System.
•	1054	- Generate system level design tools for integration to provide a common low power and power management design environment.
•	144	- Establish power source(s) and identify power savings technologies for an uncooled infrared (IR) sensor.
•	958	- The objective of this one year congressional special interest effort is to evaluate low cost, improved rate capable alkaline cells for use in sensor, surveillance, and monitoring applications.
•	384	- The objective of this one year congressional special interest effort is to deliver, test, and evaluate prototype reusable alkaline manganese-zinc batteries with improved power capability and cycle life for C4IEWS equipment.
•	575	- The objective of this one year congressional special interest effort is to design, develop, fabricate, and deliver prototype rechargeable lithium ion coin cells for safety and performance evaluations.
•	384	- The objective of this one year congressional special interest effort is to design, develop, and fabricate initial prototype lithium carbon monofluoride cells to characterize performance, safety, and feasibility for use in batteries.
•	1341	- The objective of this one year congressional special interest effort is to demonstrate improved rate capability, high energy "AA" zinc-air cells for use in Forward Area charger applications.
•	2875	- The objective of this one year congressional special interest effort is to evolve the micro-channel reactor and engineered catalyst technology required to reform diesel fuel/JP8 into Hydrogen suitable for use in small (soldier portable) and medium sized fuel cell systems. Laboratory prototypes of critical reformer components will be developed, fabricated, and tested.
•	1437	- The objective of this one year congressional special interest effort is to provide advanced research on hybrid power source technologies. Model, develop and fabricate prototype hybrid power systems and components.
•	335	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	12446	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602705A Electronics and Electronic Devices	PROJECT AH11

FY 2001 Planned Program:

•	906	- Establish the most cost effective, safe, high performance primary battery with greater than 300 watt-hours per kilogram. - Complete applied research of a high energy rechargeable lithium-ion battery with non-flammable electrolyte for C4I2W applications. - Complete research and test of manpack metal-air/universal smart charging cable recharging system for light infantry C4I2W equipment.
•	847	- Complete integration of power components/subassemblies in a 5 kilowatt engine driven generator system design. - Implement system tests to ensure proper operation of power electronics subsystems in a system configuration. - Integrate the power electronics subsystem into a power-on-the-move tactical vehicle.
•	1262	- Optimize battery/battery hybrid for size, weight, and cost. - Design and build kinetic system, as a charge capacity for soldier system. - Design efficient 500 watt TPV system for a recharger and soldier support applications. - Test and show fuel cell hydride model for soldier system.
•	861	- Evolve design tools to support low power/power management, system design and system improvement for Land Warrior.
•	149	- Integrate model power source for an uncooled infrared sensor into a 3 pound weapon sight prototype.
Total	4025	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602705A Electronics and Electronic Devices PROJECT AH94

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH94 Electronics and Electronic Devices	18649	24366	19844	23029	26725	26574	27263	Continuing	Continuing

Mission Description and Justification: This project supports applied research in the application of the physical sciences of physics, electrochemistry, biotechnology, and electronics for the future combat systems (FCS). These technologies support thrusts aimed at reduced acquisition cost, reduced operations and support costs, increased vehicle mobility, Army modernization, Advanced Technology Demonstrations (ATDs) and Advanced Technology Transition Demonstrations, as described in the Army Science and Technology Master Plan. This research is designed to obtain significantly improved detection and identification probabilities at extended range and for low observable targets. These capabilities in conjunction with active electro-optical protection mechanisms are essential for effective combat operation and survival of FCS.

FY 1999 Accomplishments:

- 4347 - Designed high frequency electronic components including antennas, ferroelectric materials/devices, transmit/receive modules, and microwave/millimeter wave (MW/MMW) devices to improve soldier situational awareness by enhancing the senses through communications, radar, electronic warfare (EW), surveillance, and target acquisition systems.
  - Established simulation models and new materials for power semiconductors and electromagnetic solvers for high frequency circuit design to reduce costs of high frequency electronic components.
  - Improved technical performance of Ka Band Rotman lens with 34 element linear horn array with 3.1° azimuth beam width or better.
  - Designed 5W Ka Band power amplifier in a single module < 1 cubic inch in volume for smart munitions.
- 3873 - Integrated piezoelectric microelectromechanical systems (MEMS) magnetometer, pressure sensor and resonators for guidance, sensor and radio frequency (RF) applications.
  - Designed SiC thyristors for high temperature/high power applications in Army vehicles.
  - Designed Tl-doped GaAs for device applications and innovative device types for W-band radar applications.
- 2550 - Designed an operational microprocessor (temperature) compensated digital clock circuit, produced a new type of very low phase noise microwave source, successfully grew reproducible high quality langanite boules leading to new high quality piezoelectric resonators for sensors, filters and oscillators capable of operating at higher frequencies than quartz.
- 2528 - Designed capacitor with low equivalent series resistance (ESR) (new high conductivity electrolyte, improved electrode binder technology).
  - Established thermal battery with reduced thermal losses with 2x improvement in active life for smart munitions applications.
  - Established hydrogen-PEM (proton exchange membrane) fuel cell with "strip-cell" design.
- 5351 - Investigated mid wavelength infrared (MWIR) mercury cadmium detector array on Si substrates for more affordable Forward Looking Infrared (FLIR).
  - Established dual color quantum focal plane array for improved quantum efficiency and operating temperature.
  - Performed laboratory demonstrations to show feasibility of applying ARL's ladar architecture to ARDEC submunition.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602705A Electronics and Electronic Devices — PROJECT: AH94

FY 1999 Accomplishments: (continued)

- Designed electrically pumped interband quantum cascade laser.

Total 18649

FY 2000 Planned Program:

- 3000 - Evaluate new acceleration insensitive clocks and oscillators using langasite and opto-electronic feedback to provide highly stable high data rate communications and global positioning system (GPS) to meet FCS requirements, e.g., the network centric force.
- 8766 - Investigate novel resonator structures and electronic materials to improve filtering and control of RF signals to reduce co-site interference.
  - Evaluate novel device structures, through modeling, that will provide improved low power operation for communications, high temperature operation for power conditioning, and subMMW performance for chemical agent classification and evaluate and select RF switch technology for multi beam switching Ka Band Rotman e-scan antenna for increased lethality and survivability of FCS.
  - Build drive circuit for all-electric future ground combat system to provide increased mobility.
- 6343 - Design interband quantum cascade laser with .5W/facet and 250^0K operating temperature at 3.5μm.
  - Design acousto-optic tunable filter (AOTF) hyperspectral imaging in the 3-5μm and 8-12μm bauds.
  - Design 8-12 μm and 3-5 μm HgCdTe detector array grown on Si substrate to lower cost of IRFPA allowing a more wide-spread utilization in FCS.
  - Grow and characterize InAs/GaSb/AlSb based type II LWIR superlattice detector for near-room-temperature operations, reducing logistic burdens of FCS.
- 3055 - Design and establish lithium-ion battery cell with new, more energetic anode & cathode materials, and more conductive electrolyte.
  - Design and establish methanol fuel cells with improved cathodic electrocatalyst and membrane electrolyte.
  - Design and establish capacitors with new high voltage, low temperature electrolytes.
- 3000 - Establish a Center for Display Technology Evaluation.
  - Define metrics for the evaluation of systems that include both hardware displays and operator performance.
  - Define standards for display products to meet unique Army system performance requirements and to minimize life-cycle costs.
- 202 - Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)

Total 24366

FY 2001 Planned Program:

- 3000 - Show factor of 5 improvement in acceleration insensitivity and phase noise through application of new materials and clock architectures to provide highly stable high data rate communications and GPS to meet FCS requirements, e.g., the network centric force.
- 8299 - Incorporate cross bar switching control for electronically scanned antennas to promote integration of target acquisition, combat ID, and communications in a common aperture and investigate new device structures for high power/efficiency and temperature operation through exploitation of novel semiconductors for increased lethality and survivability of FCS.
  - Optimize drive circuit all-electric vehicle drive circuit for operation at 400° C to provide increase mobility.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602705A Electronics and Electronic Devices
	PROJECT AH94

FY 2001 Planned Program: (continued)

•	2703	- Design rechargeable lithium battery with all solid-state components for 3X improvement in energy density, enhanced safety for individual soldier applications. - Design methanol fuel cell for system energy density 5X greater than batteries for long missions. - Investigate capacitors for battery/capacitor hybrids capable of full charge/discharge in minutes with energy densities >2X that of batteries.
•	5842	- Design AOTF hyperspectral imager with 70% transmission. - Establish feasibility of higher operating temperature for IR photon detectors for near-room-temperature operations, reducing logistic burden of FCS. - Design long range flash ladar at eye safe laser wavelength. - Establish feasibility of EO active protection concept for FCS.
Total	19844	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602709A Night Vision Technology		PROJECT DH95

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DH95 Night Vision and Electro-Optic Technology	18341	20021	20465	20574	20341	21503	22887	Continuing	Continuing

A. Mission Description and Budget Item Justification: This program element (PE) develops core night vision and electronic sensor technologies for Army weapons systems. Advanced next generation focal plane arrays (FPA), mega-pixel infrared (IR) and multispectral (cooled and uncooled) are being developed that will see farther, provide advanced signal processing, and improve performance on the dirty battlefield. In collaboration with industry, uncooled IR sensor technology is being developed to reduce cost and weight and increase reliability/performance. Advanced driver electronics are being developed to reduce power consumption and improve the contrast and brightness of miniature flat panel displays for future aviation, infantry, armored vehicle, and field maintenance applications. Micro-laser sources will provide affordable, high performance technology options for the individual soldier, tactical laser rangefinding, designating, obstacle avoidance, and laser radar. Distributed micro-sensor (thermal, acoustic, magnetic, etc) networks will provide a revolutionary increase in battlespace awareness that will improve soldier survivability, lethality, situation awareness, and enable commanders and staffs to plan, decide, and execute operations with greater speed and tempo. Aided/automatic target recognition (ATR) 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. Performance and utility of ATR will be quantified in the ATR Evaluation Center of Excellence. Hardware-in-the-loop multispectral sensor simulations are being developed that will allow end-to-end predictive modeling 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. Imaging sensors are being developed for the Anti-Personnel Landmine Alternative program. This program element supports Land Warrior and Army After 2010 future systems. 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), 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.

FY 1999 Accomplishments:

- 4710 – Developed architecture for partitioning smart integrated circuit processing hardware functions between on- and off-focal plane to improve sensor performance and reduce processing hardware requirements for weapons platforms.
  – Designed analog-to-digital conversion and fusion processing architectures for a monolithic infrared focal plane array (FPA) read-out integrated circuit (ROIC).
  – Evaluated data throughput, heat dissipation, 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.
  – Developed and evaluated fabrication processes for monolithic infrared focal plane arrays in experimental semiconductor microfactory and transitioned successful processes to industry consortia members.
  – Developed large staring focal plane array technology in support of SMDC's overhead sensor technology for battlefield awareness program.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602709A Night Vision Technology — PROJECT: DH95

FY 1999 Accomplishments: (Continued)

- 1489 – Demonstrated a fully registered (i.e. pixel elements for each color view exactly the same area) dual color camera, midwave infrared/longwave infrared (MWIR/LWIR), 320x240, 2 mil pixel .
  – Fabricated and tested a 1024x1024 MWIR mercury cadmium telluride (MCT) array.
  – Grew material for and processed a two color (near infrared (NIR) and SWIR/MWIR) focal plane array.
  – Completed common source laser brassboard and demonstrated multiple functions in different wavelength bands.
  – Evaluated diode pumped laser source technology and investigated new high peak power laser diode structures for a micro eyesafe laser to reduce the size, weight, and power consumption of manportable laser devices.
- 3494 – Conducted ATR evaluations of multispectral and large format staring infrared sensors in increasingly complex dynamic operational scenarios.
  – Evaluated sythetic aperture radar (SAR) ATR capability to include metrics to quantify improvements in situational awareness.
  – Developed MWIR staring sensor ATR evaluation capability.
  – Developed adaptable computing hardware to enable real-time ATR processing of multi-sensor data.
- 3694 – Demonstrated a real-time MWIR and LWIR synthetic scene rendering capability in sensor prototyping and wargame simulations.
  – Expanded predictive modeling capability to accurately predict sampled imagers.
  – Completed comparison between real and synthetic forward looking infrared (FLIR) imagery for ATR evaluation applications.
  – Demonstrated infrared simulation capability and utility in support of the Anti-Personnel Landmine Alternative (APLA) program.
- 3960 – Developed and tested an uncooled focal plane array device for a low cost solid state near infrared 320x240 camera with potential of day and night operation with sensitivity comparable to present image intensifier tube technology, and improved capability to detect camouflaged targets.
  – Debuted and demonstrated the world's smallest microsensor uncooled infrared camera weighing less than 180 grams, about the size of a D cell battery.
  – Demonstrated an uncooled sensor with an unprecedented sensitivity of approximately 8mK for a 2 mil pixel and 47 mK for a 1 mil pixel.
- 400 – Baselined sensor packaging and configuration for UAV and space application and conducted initial demonstration of on-FPA processing of spectral data.
- 594 – Designed and developed a prototype micro eyesafe solid state laser.

Total 18341

FY 2000 Planned Program:

- 3900 – Design and develop a 1024x1024 LWIR FPA for application to overhead sensor technology for battlefield awareness.
  – Integrate analog to digital conversion circuitry on an infrared FPA to reduce read-out circuit noise and improve detector response to target or background temperature differences.
  – In collaboration with industry, demonstrate an advanced ROIC with non-uniformity correction circuitry on an infrared focal plane array that will calibrate all detector pixels to provide a uniform response to target or background temperature differences.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602709A Night Vision Technology	PROJECT DH95

•	912	– Develop prototype fabrication processes for growing next generation, multi-spectral infrared detector arrays directly on a silicon semiconductor read-out circuit.

FY 2000 Planned Program: (Continued)

•	4600	– Design instant-on capability for uncooled IR micro camera. – Collect target and background signature data with dual color and near infrared cameras to support comprehensive characterization of reflectivity differences of typical "un-modified" targets, camouflaged targets, cultural background objects, and natural background materials.
•	3700	– Develop advanced physics based performance, and search/target acquisition models needed to support next Generation FLIR engineering trade studies and operational utility assessments. – Develop a multispectral simulation environment to support design trade-offs, development, and evaluation of multi-function staring sensor suite and mine hunter /killer advanced technology demonstrator programs. – Validate infrared sensor simulation. – Integrate realistic sensor simulation interactive capability into Battle Lab Warfighting Experiments.
•	1250	– Demonstrate ATR processing architecture for space/volume constrained applications and platforms using adaptable computing technology. – Develop partitioning and software translation tools to allow system/hardware specific ATR software to be ported to different processing architectures. – Establish the utility of synthetic and hybrid imagery to evaluate and quantify the performance of hyperspectral and multi-sensor mine detection ATRs.
•	1400	– Integrate IR/charge coupled device (CCD) micro-sensors with acoustic and seismic micro-sensor to provide vastly increased threat distinguishing effectiveness of the micro-sensor node. – Develop a comprehensive uncooled IR FPA model for defining theoretical performance limits. – Develop fixed network of IR micro-sensor arrays to enhance target detection capabilities, define communication links, and training requirements.
•	2000	– Develop low power 640x512 flat panel displays and associated drive electronics for dismounted soldier applications.
•	1000	– Develop a 1 lb. micro-laser that is low cost and provides 2Km range performance.
•	240	– Complete testing of the Cooperative Eyesafe Laser Project (CELRAP) (Partner: Japan).
•	700	– Develop a hyperspectral sensor with smart focal plane processing in the 1-2.5, 3-5, and 8-12 micron wavebands, and improve cueing and clutter rejection via polarization and on-FPA processing using ground test. Analyze and incorporate appropriate warfighter hyperspectral technologies.
•	319	– Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.
Total	20021	

FY 2001 Planned Program:

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602709A Night Vision Technology	PROJECT DH95

- 4125 – Develop a prototype process for fabricating on focal plane micro-lens that will focus incident radiation on small pixel detectors and provide improvements in detector sensitivity and sensor performance.
  – Develop and test prototype advanced lithography process that will reduce the number of fabrication steps for infrared focal plane arrays.
- 700 – Demonstrate on-chip neomorphic processing, hyperspectral spatial and temporal signature processing with sensor using airborne testing.

FY 2001 Planned Program: (continued)

- 1535 – Investigate and develop prototype process for semiconductor microfactory fabrication of optical readout circuitry that will be required to simultaneously readout the response from high speed, large area (640x480 and 1024x1024) dual color FPAs. Limited capacity readout circuits are a major technical barrier to higher performing next generation infrared devices.
  – Design next generation MWIR and LWIR FPA devices that provide high performance at elevated operating temperatures (120K vs current 77K).
- 4550 – Complete testing and evaluation of near infrared solid state cameras based on alternative detector materials, characterize performance, and define manufacturing yield issues for the alternative materials.
  – Define design parameters for a low cost, uncooled near infrared and far infrared sensor for dismounted soldier applications that provides a fused output of the two spectral bands to enhance the operator's perception of "color" contrast, shadows, and depth.
- 3370 – Extend physics based performance and search /target acquisition constructive modeling to support additional sensor domains including, countermine and multispectral sensors.
  – Validate multispectral models and simulations for target acquisition, driving, and pilotage applications; incorporate upgrades into interactive Battle Lab simulation environment in order to support new sensor concept evaluations and weapon systems trade studies and optimization.
- 1255 – Demonstrate an open "heterogeneous" ATR processor architecture that is capable of hosting ATR software/algorithms designed for unique or propriety hardware, thereby reducing the time and cost required to integrate ATR capability into new platforms.
  – Extend ATR evaluation capability to smart focal plane sensor systems.
- 1490 – Demonstrate small scale integrated network of acoustic, seismic, and imaging micro-sensors that will provide a significant unattended tactical sensing capability to detect, track, and classify time critical mobile and stationary targets.
  – Demonstrate low power consumption micro-sensors and support electronics that will permit unattended micro-sensor operation for up to 60 days.
  – Perform experiments utilizing prototype micro-sensor nodes in various configurations to optimize warfighter effectiveness.
- 2100 – Develop full color 640 x 512 flat panel displays to allow dismounted soldiers to utilize color maps and symbology to enhance the soldier's performance.
  – Develop color 800 x 600 flat panel displays for mounted version and aviation platforms.
- 240 – Perform final demonstration of the Cooperative Eyesafe Laser Project (CELRAP) (Partner: Japan)
- 1100 – Complete development and evaluate micro laser for performance, cost, and weight, for rangefinding and other requirements for the soldier.

Total 20465

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602709A Night Vision Technology — PROJECT: DH95

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	19008	20111	20966
Appropriated Value	19157	20111	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-149		
b. SBIR / STTR	-361		
c. Omnibus or Other Above Threshold Reductions		-49	
d. Below Threshold Reprogramming	-230		
e. Rescissions	-76	-41	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-501
Current Budget Submit (FY 2001 PB)	18341	20021	20465

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602712A Countermine Applied Research

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	10265	14380	12386	12639	12905	13340	13875	Continuing	Continuing
AH24 Countermine Technology	7976	12286	9976	10174	10385	10664	11076	Continuing	Continuing
AH35 Camouflage Technology	1956	2094	2410	2465	2520	2676	2799	Continuing	Continuing
AC61 AC61	333	0	0	0	0	0	0	0	1992

A. Mission Description and Budget Item Justification: The objective of this program element (PE) is to research advanced technologies to improve countermine, signature management, and deception capabilities. Countermine research areas include close-in detection of individual mines using manportable technologies; detection and neutralization from moving vehicles; and remote detection of minefields; while reducing false alarms and increasing operational tempo. In addition, this PE is investigating advanced robotics technologies to minimize threats to weapons systems and to personnel and detection/ neutralization techniques for both conventional and electronically activated mines. A Center of Excellence (COE) for land mine detection will coordinate and standardize the development of mine signature simulations; provide a catalogue of mine signatures; and support evaluation of mine detection algorithms. This PE also researches deception and advanced signature management techniques that will ultimately provide combat units (e.g. Digital Tactical Operations Center, Small Unit Operations, Special Forces, Theater Missile Defense) with an integrated system of devices that deliberately alter the adversary's perception of friendly force capabilities and intentions. 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 by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A Countermine Applied Research

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	10547	10321	10453
Appropriated Value	10715	14521	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-168		
b. SBIR / STTR	-178		
c. Omnibus or Other Above Threshold Reductions	-2	-50	
d. Below Threshold Reprogramming	-60		
e. Rescissions	-42	-91	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-67
New Army Transformation Adjustment		TBD	+2000
Current Budget Submit (FY 2001 PB)	10265	14380	12386

Change Summary Explanations: Funding – FY 2001: Project AH24 adjusted to reflect the new Army Vision/Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A Countermine Applied Research		PROJECT AH24

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH24 Countermine Technology	7976	12286	9976	10174	10385	10664	11076	Continuing	Continuing

A. **Mission Description and Justification:** Countermine research focuses on the remote detection of minefields, and the detection and neutralization of individual mines from vehicular and manportable platforms. Neutralization techniques will be investigated for both conventional and electronically activated mines that can be detected and neutralized at a standoff distance. Data collection platforms will be utilized for sensor and algorithm assessments and testing of advanced mine detection technologies. Mine detection and neutralization technologies and techniques will provide enhancements addressing improved probability of detection, reduced false alarms and improved operational tempo. The COE for land mine detection coordinates and standardizes the development of mine signature simulations, provides a catalogue of mine signatures, and supports evaluation of mine detection algorithms.

FY 1999 Accomplishments:

- 1465 – Completed performance trade-off analysis and evaluation of alternative multispectral imaging sensor technologies for a lightweight airborne minefield detection capability.
  – Collected mine signature data to support finalization of phenomenology studies and mine detection algorithm development.
  – Tested critical component modules for the lightweight airborne mine detection sensor.
- 4573 – Evaluated revolutionary new acoustic/laser approaches from the University of Mississippi for advanced mine detection. Evaluated the following advanced mine detection sensor technologies: 3D Synthetic Aperture Radar (SAR)/ Ground Penetrating Radar (GPR), Nuclear Quadrupole Resonance (NQR), and novel metal detector technologies.
  – Completed test and evaluation of alternative neutralization technologies and down selected the most effective approach of precision explosive emplacement.
  – Evaluated preliminary development of advanced sensor fusion/aided target recognition (ATR) processing and integrated with vehicle mounted mine detector sensors.
  – Evaluated the fundamental phenomenology for forward-looking mine detection technologies.
- 1465 – Completed preliminary research on eddy current decay analysis techniques to reduce false alarms and provided detection and classification capabilities for surface and buried metallic mines.
  – Assessed high dynamic range radar, giant magneto-resistive arrays, and acoustic mine detection techniques/capabilities to improve detection performance of hand-held and vehicular mounted mine detectors.
- 473 – Enhanced mine signature simulations, cataloguing of mine signatures, and assessments of mine detection algorithms in support of land mine detection COE.

Total 7976

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602712A Countermine Applied Research
	PROJECT: AH24

FY 2000 Planned Program:

•	1500	– Design laser illumination source with charge coupled device (CCD) camera for mine phenomenology data collections to support definition of surface mine detection approaches for an airborne platform. – Evaluate laser/CCD camera testbed and collect data and supporting ground truth with the goal of defining conditions and observable phenomena to optimize the multi-sensor approach.
•	3011	– Evaluate and assess the advanced mine detection sensors and down select to the most promising technologies and techniques. Collect and analyze data to evaluate improvements in probability of detection and reduction of false alarm rates. – Complete design and trade off analyses of a acoustic laser Doppler vibrometer breadboard prototype to determine system parameters for detecting mines at greater standoff distances with possible application into the forward looking or confirmation technology areas. – Evaluate industry/academia concepts and technologies with potential to increase probability of detection, reduce false alarms or increase standoff distances as means to enhance force mobility and survivability. – Setup standards and techniques for evaluation of these confirmation technologies at various test sites. – Design and develop processing capabilities for acoustic/laser, 3D SAR/GPR, NQR and novel metal detector technologies for the advanced mine detection sensors program to reduce false alarms and increase operational tempo.
•	500	– Enhance mine signature simulations, update database of mine signatures, and established methodology for evaluation of detection algorithms in support of land mine detection JUXOCO.
•	2800	– Evaluate forward looking detection sensor designs (GPR and infrared (IR)) through testing in temperate environments of surface and buried anti-tank (AT) mines with the goal of demonstrating improved probability of detection and reduced false alarm rates for on route mission scenarios. – Evaluate forward looking detection sensor technologies with the goal of improved probability of detection and reduced false alarm rates while increasing operational speed. – Transition technologies into data collection devices for continual evaluation and assessment of sensors and algorithms.
•	1800	- Evaluate and assess acoustic laser doppler vibrometer (LDV) against AT and anti-personnel (AP) mines on varied environmental backgrounds. Design, build and assess new laser source technologies for LDV to increase area coverage and reduce scanning time. Reduce and isolate acoustic noise at LDV receiver for increased detection of mines.
•	1400	- Evaluate standoff GPR / IR technology testbed in temperate environment against AT mines at standoff distances of 10-30 meters. Buried and surface AT mines will be the threat space for phenomenology evaluations for standoff mine detection
•	1000	- Investigate non-linear acoustic technology for AT mine detection. Testbed will be evaluated against surface and buried AT mines in realistic environments along with modeling of acoustic phenomena.
•	275	- Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.
Total	12286	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602712A Countermine Applied Research / PROJECT: AH24

FY 2001 Planned Program:

•	3776	– Complete explosive specific confirmatory sensor brassboard prototypes for field experiments and evaluation. – Complete field experiments using realistic explosive concentrations to establish the prototype's operational envelopes as a function of target type, environment, and operational speed. – Complete maturation of higher risk technologies from DARPA's chemical detection program and select the most promising approach that yields lower false alarm rates and faster operational speeds. – Demonstrate and test acoustic/laser, 3D SAR/GPR, and NQR for use as confirmation sensors.
•	500	– Enhance mine signature simulations, update database of mine signatures, and establish methodology for evaluation of detection algorithms in support of land mine detection JUXOCO.
•	3700	– Evaluate brassboard forward-looking detection systems for detection of surface and buried AT mines that will improve probability of detection and reduce false alarms. – Evaluate initial ATR and sensor fusion algorithms for forward looking detection sensors, which will improve the probability of detection and reduce false alarm rates, while increasing operational speeds. – Evaluate potential of acoustic, time domain electromagnetic induction sensors and advanced mine detection sensors for inclusion in on going downward and forward looking mine detection programs as primary detection sensor.
•	2000	- Funds will be used in support of the New Army Vision/Transformation.
Total	9976	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602712A Countermine Applied Research / PROJECT: AH35

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH35 Camouflage Technology	1956	2094	2410	2465	2520	2676	2799	Continuing	Continuing

A. **Mission Description and Justification:** This project researches advanced signature management and deception technologies that alter the threat perception of friendly force capabilities and intentions and deny acquisition of friendly force assets from threat sensors. This research will support development of systems to provide Tactical Operations Centers, and other combat units, with the capability to camouflage friendly assets and project a deceptive image of friendly forces. This improves the survivability of combat units in global battlefield conditions. Specific research areas include, holographic techniques; advanced materials and processes for visual and infrared deception devices; radar and communications approaches for deception modules; advanced modeling and simulation for signature management and deception technologies; and advanced materials, coatings, patterns, and appliques for suppression of electro-optical signatures of combat units.

FY 1999 Accomplishments:

•	1956	– Investigated holographic techniques, materials, and processes to support development of visual and infrared deception system modules. – Completed feasibility studies including evaluation of communications, situation awareness sensors, and projection technologies required for an integrated modular electronic deception system (IMEDS). – Designed modeling and simulation efforts to support design and evaluation of concepts, systems, and operational effectiveness for signature management and deception systems. – Conducted assessment of signature management and deception technologies with application to combat units.
Total	1956	

FY 2000 Planned Program:

•	2043	– Evaluate holographic techniques, materials, and processes for visual and infrared deception devices. – Develop modeling and simulation capabilities for design, development and evaluation of signature management and deception technologies – Develop and evaluate technologies to support the development of visual and electro-optic deception modules. – Demonstrate radar and communications capabilities for use in deception modules. – Investigate optical communication technologies to suppress combat unit RF signatures. – Develop and evaluate patterns, coatings, and appliques for suppression of visual and electro-optical signatures of combat units.
•	51	- Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.
Total	2094	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A Countermine Applied Research
	PROJECT AH35

FY 2001 Planned Program:

•	2410	– Demonstrate holographic techniques in the laboratory for improved deception capabilities for combat units. – Evaluate effectiveness of advanced signature management and deception technologies through modeling and simulation in laboratory demonstrations. – Demonstrate techniques that combine physical and electronic decoys with signature management technologies to improve survivability of combat and combat support units.
Total	2410	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602716A Human Factors Engineering Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	16204	19681	15786	16444	16503	16609	17254	Continuing	Continuing
AH34 Rural Health Technology	3128	3335	0	0	0	0	0	0	11483
AH70 Human Factors Engineering Systems Development	13076	16346	15786	16444	16503	16609	17254	Continuing	Continuing

A. Mission Description and 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 the researching, 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.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	16473	16392	16270
Appropriated Value	16619	19792	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-146		
b. SBIR / STTR	-203		
c. Omnibus or Other Above Threshold Reductions		-39	
d. Below Threshold Reprogramming			
e. Rescissions	-66	-72	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-484
Current Budget Submit (FY 2001 PB)	16204	19681	15786

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602716A Human Factors Engineering Technology PROJECT AH34

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH34 Rural Health Technology	3128	3335	0	0	0	0	0	0	11483

Mission Description and Justification: This is a congressionally funded program. The Medical Teams program provides for the researching, field testing, and empirical validation of methods for improving the coordinated functioning of emergency medical teams (both military and civilian). This 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 assessing the "value-added" of selected telemedicine and medical decision management technologies.

FY 1999 Accomplishments:

•	3128	- Completed the evaluation of the MedTeams training and evaluation system at each of the cooperating hospitals selected in Phase I. - Conducted an extended team test bed at Madigan Army Medical Center. - Conducted a test of an advanced intra-team communication system at Madigan Army Medical Center and Rhode Island Hospital. - Generated, in conjunction with University of Maryland Shock Trauma Center, an improved protocol for field-to-hospital communications. - Introduced MedTeams research products to civilian and emergency care facilities at selected locations in CONUS. - Executed concept development for MedTeams combat casualty care with the cooperation of Army, Navy and Air Force participating hospitals.
Total	3128	

FY 2000 Planned Program:

•	3245	- Disseminate the Emergency Team Coordination Course to military and civilian hospital emergency departments for fixed hospital facilities. - Distribute team coordination improvements throughout the military combat casualty care system. - Implement a lessons learned system.
•	90	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	3335	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602716A Human Factors Engineering Technology		PROJECT AH70

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH70 Human Factors Engineering Systems Development	13076	16346	15786	16444	16503	16609	17254	Continuing	Continuing

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 1999 Accomplishments:

- 4482 -Enhanced existing logistics data analysis capabilities to serve logisticians at appropriate echelons..
  - Refined operator workload models for unmanned ground vehicles.
  -Investigated the impact of multi-directional auditory displays on helicopter pilot performance. Published results and provided to the Aviation School and Aviation and Missile Command.
  -Generated a human performance measurement strategy to assess new command and control concepts in the distributed interactive simulation (DIS) environment.
  - Identified, in terms of soldier performance, how the application of 2-D and 3-D visualization concepts impacts the battle staff's task domain.
  - Identified and quantified which advanced visualization concepts enhance or detract from staff performance and how they support collaborative planning and problem solving by a geographically dispersed staff.
- 3997 -Verified and validated the human figure performance model (Jack), linked with physics based model, and began to incorporate data collected in 3-D.
  -Added training requirements analysis capability and enhanced performance degradation modeling to Improved Performance Research Integration Tool (IMPRINT) Version 3.
  - Collected performance data using the virtual reality capability for the individual soldier fighting systems in a DIS environment, compared results of live and virtual studies, and updated and validated the databases with actual research data. Transitioned data and guidelines to STRICOM.
- 4597 -Refined soldier system analysis and tradeoff tools and workload models for assessing soldier and unit performance and the life cycle and cost implications in concept and system designs. 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.
  -Provided human factors engineering (HFE) support to AMC, AMC RDECs, TRADOC activities, battle labs, and other laboratories.

Total 13076

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602716A Human Factors Engineering Technology PROJECT AH70

FY 2000 Planned Program:

- 5026 - Complete the simulation model of "Green Ramp" operations for the XVIII Airborne Corps. Conduct field trials on ammunition reconfiguration from single ammunition type loads to strategic configured loads (SCLs).
  - Conduct preliminary assessments of human factors issues including driver aiding, concurrent tasks, and motion sickness in support of TARDEC's Crew Integration and Automation Testbed (CAT) ATD. Design indirect vision driving experiments and participate in CAT demonstration. (Supports FCS)
  - Develop baseline task and workload models to target crew size reduction opportunities for the CAT ATD which supports FCS.
  - Conduct field study to determine the effect of advanced display technologies, e.g. 3-D audio, speech recognition and active noise reduction on dismounted soldier task performance under different levels of physical and mental workload.
  - In collaboration with Soldier Biological and Chemical Command – Natick Soldier Center (SBCCOM-NSC) and the Infantry School, define a dismounted soldier baseline day for use as an R&D standard scenario.
  - Examine effects of Objective Individual Combat Weapon (OICW) recoil on soldier shooting performance.
  - Based on previous work in support of the Virtual Environments for Dismounted Soldier STO, provide human factors design guidelines for the development of a next generation locomotion interface for a dismounted soldier simulator to STRICOM.
- 3299 Refine, validate, and provide predictive models of C2 soldier performance under varying levels of stress (degraded communications, extended shifts, information load), diverse staffing concepts, and advanced digitization technologies for medium brigade tactical operations center (TOC) for TRADOC Program Integration Office (TPIO) Army Battle Command System (ABCS), TRADOC System Manager (TSM) XXI, and TSM TOC.
  - Perform soldier focused assessments of various battlefield reasoning and multi-modal display systems to support commander and staff decision making processes.
  - Conduct human factors evaluation of ABCS functionality and maintenance of situation awareness in the battle command of light forces during the Joint Contingency Force (JCF) Advance Warfighting Experiment (AWE).
  - Complete development of a rule-based computer model of the intelligence production system which simulates how the quality of information in military intelligence databases and the soldier's ability to use that information will meet commander and staff military intelligence requirements.
- 5657 - Add the capability to model performance under stress to the Improved Performance Research Integration Tool (IMPRINT) and demonstrate links to advanced distributed simulation via high level architecture.
  - Evaluate and analyze soldier-in-the-loop operational test data and procedures to upgrade our capability to assess new technologies and systems.
  - Provide HFE support to AMC, AMC RDECs, TRADOC Centers, Schools and Battle Laboratories and other laboratories. (Includes FCS support)
- 2200 - Transition cognitive engineering STO products to address critical training, leader development and soldier support (TLS) research issues in the cognitive engineering of battle command operations.
  - Transition from the Advanced & Interactive Displays Fed Lab, the course-of-action planning tool "FOX-GA" and accompanying applications to CECOM's "CADET" for Command Post XXI ATD.
- 164 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602716A Human Factors Engineering Technology PROJECT AH70

Total 16346

FY 2001 Planned Program:

- 4999 - Provide simulation model for SCLs to Defense Ammunition Logistics Agency (DALA) and Combined Arms Support Command (CASCOM) and assist in the evaluation of the most effective and efficient SCL configuration location.
  - Analyze data from the FY 00 demo for CAT STO and provide human factors analysis to TARDEC. Develop plan for addressing new issues identified in demo to support FCS.
  - Integrate workload and crewstation design modeling results from Intra-vehicular Electronics Suite Tech Demo with FY00 CAT demo findings to develop baseline CAT ATD crew station designs which support FCS.
  - Translate research results on the effects of advanced audio display technologies on dismounted soldier tasks performance into design guidelines for use by NRDEC, the Infantry School and Dismounted Battlespace Battle Lab.
  - Validate the dismounted soldier baseline day for use in evaluating soldier equipment interface and compatibility. Transition to NRDEC and the Infantry School.
- 3798 - Expand previous soldier shooting performance research to investigate the effects of stabilizing weapon technology and provide results to Armament RDEC.
  - Expand models of C2 soldier performance during contingency, joint, strategic operations in order to specify optimum configuration of staff and digitization capabilities for these scenarios, to TPIO-ABCS, DARPA Command Post of the Future (CPOF), and Joint and Army Vision 2010 doctrinal elements.
  - Conduct follow-on human factors evaluation of ABCS functionality in the division command post exercise (DCX) to inform system integration in the first digital division.
  -Validate the intelligence production model (IPM) in intelligence field units at varying command levels.
- 5743 - Conduct proof-of-principle experiment of complex cognitive models embedded within soldier-system level models for practical system design evaluation.
  - Conduct an investigation of the integrated system behavior between the mobility interface device and the control systems for the dismounted soldier combatant simulation. Transition results to STRICOM and the Army Research Institute (ARI).
  - Provide HFE support to AMC, AMC RDECs, TRADOC Centers, Schools and Battle Laboratories and other laboratories.
- 1246 - Leverage Initial Brigade planning and experimentation to address cognitive engineering of battle command operations.
  - Transition final architecture, software and media of visualizations for multi-modal sensory computer control algorithms to the CPXXI ATD

Total 15786

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	62208	78905	13994	14238	14787	16236	17096	Continuing	Continuing
D048 Industrial Operations Pollution Control Technology	2339	2177	2382	2533	2681	3216	3395	Continuing	Continuing
A822 Facility Environmental Management and Monitoring System	1926	0	0	0	0	0	0	0	1926
A823 Hawaii Small Business Development Center	3852	0	0	0	0	0	0	0	3852
A829 National Defense Center for Environmental Excellence (NDCEE) Technology	14447	1962	0	0	0	0	0	0	16409
A835 Military Medical Environmental Criteria	2971	2408	2848	2907	3074	3345	3743	Continuing	Continuing
A876 Plasma Energy Pyrolysis System	2890	7847	0	0	0	0	0	0	10737
A877 Western Environmental Technology Office Environmental Support	3853	0	0	0	0	0	0	0	3853
A895 Pollution Prevention Technology	1	0	0	0	0	0	0	0	1
A896 Base Facility Environmental Quality	4611	4662	5190	5128	5252	5633	5723	Continuing	Continuing
A908 Commercialization of Technology to Reduce Defense Costs Initiative	5781	6866	0	0	0	0	0	0	12647
A917 Computer Based Land Management	2408	1962	0	0	0	0	0	0	4370
A946 Electronic Equipment Demanufacturing	5778	15695	0	0	0	0	0	0	21473
A947 Sustainable Green Manufacturing	2890	5395	0	0	0	0	0	0	8285
A959 Corrosion Prevention and Control	0	8828	0	0	0	0	0	0	8828
A960 Watervliet Arsenal Pollution Projects	0	3924	0	0	0	0	0	0	3924

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602720A Environmental Quality Technology**

COST *(In Thousands)*	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A961 Vessel Plating Technology	0	981	0	0	0	0	0	0	1000
AF25 Military Environmental Restoration Technology	3163	3446	3574	3670	3780	4042	4235	Continuing	Continuing
AF26 Agricultural-Based Bioremediation	3853	0	0	0	0	0	0	0	3853
AF27 ARO Chemical/Hazardous Material Disposal	1445	0	0	0	0	0	0	0	1445
AF28 Range Safe Technology Initiative	0	9809	0	0	0	0	0	0	0
AF29 Phyto-Remediation in Arid Lands	0	2943	0	0	0	0	0	0	0

A. 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 in complying 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	64386	12758	14041
Appropriated Value	64842	80258	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-456		
b. SBIR / STTR	-1531		
c. Omnibus or Other Above Threshold Reductions		-311	
d. Below Threshold Reprogramming	-389		
e. Rescissions	-258	-1042	
Adjustments to Budget Years Since FY 2000/2001 PB			-47
Current Budget Submit (FY 2001 PB)	62208	78905	13994

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology / PROJECT: D048

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D048 Industrial Operations Pollution Control Technology	2339	2177	2382	2533	2681	3216	3395	Continuing	Continuing

Mission Description and Justification: This project provides compliance & pollution control technologies required to reduce the cost of treating hazardous and non-hazardous emissions from the operation of Army installations, and to satisfy increasingly stringent environmental standards and state regulations. Federal facilities are now subject to fines and facility shutdowns for violation of federal, state, and local regulations. This new technology is essential to control and reduce generation of hazardous and non-hazardous waste, to satisfy Army waste reduction goals, and to avoid future costs and liabilities to the Army. This project will provide compliance & pollution control tools for toxic and non-toxic regulated pollutants. Technologies will be addressing water and wastewater issues, as well as noise and environmental management issues impacting industrial and troop installations. Efforts will include a focus on new materials which will enter the Army inventory within the next decade to assure that Army installations 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 Engineer Research and Development Center.

FY 1999 Accomplishments:

•	2339	- Designed technology for minimizing headloss using electrochemical reduction of energetic compounds in water.
		- Investigated biological treatment technology for munitions production.
		- Completed thermal plasma techniques for the pyrolytic destruction of organic energetic wastes and the vitrification of heavy metal-bearing wastes.
Total	2339	

FY 2000 Planned Program:

•	2153	- Identify propagation cases for assessment of long-term average noise exposure for small arms range noise model.
		- Adapt technology for electrochemical reduction of energetic compounds in water.
	24	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	2177	

FY 2001 Planned Program:

•	2382	- Evaluate algorithms for singe event noise prediction tools.
		- Investigate modified absorbent/biosorbent technology for treating Army waste streams containing heavy and toxic metals and explosives.
		- Establish guidelines for fluidized-bed granular activated carbon bioreactor to replace carbon absorption for water contaminated with explosives.
Total	2382	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT A822

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A822 Facility Environmental Management and Monitoring System	1926	0	0	0	0	0	0	0	1926

Mission Description and Justification: This was a one-year Congressionally funded project. Based on technology demonstrated at Tobyhanna Army Depot (TYAD) under the Facility Environment Management and Monitoring System (FEMMS), the technology was transferred to the Radford Army Ammunition Plant (RFAAP) as the basis for REDMAP. This Congressionally mandated pollution prevention project was 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 (P2) management and control system. In addition, since all DoD facilities are required to implement Executive Order (E.O.) 12856 by 1999 (so that Federal facilities comply with the mandated Pollution Prevention Act (PPA) of 1990 and Executive Order 12856 of August 3, 1993), these funds focused on issues related to implementation of E.O. 12856 at RFAAP.

FY 1999 Accomplishments:

•	1926	- Completed the remaining FEMMS Modules: Electrostatic Precipitator (ESP), Propellant Explosive Pyrotechnic (PEP) Tracking System, Virginia Pollutant Discharge Elimination System (VPDES, i.e., Wet Wells and Outfalls), and integrated modules into the Environmental Information System (EIS). - Completed high priority environmental management projects which had high implementation savings potential (e.g., reduction of sulfates). Also, completed requirements and alternatives analysis on a new set of environmental projects and implement highest priority, highest payback options - (e.g., recycle/reuse of energetic manufacturing process fluids, aqueous-based and acidic-based streams).
Total	1926	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology		PROJECT: A823

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A823 Hawaii Small Business Development Center	3852	0	0	0	0	0	0	0	3852

Mission Description and Justification: This was a one-year Congressionally funded project. The project had 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 involved 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 participated at the work group and oversight committee levels.

FY 1999 Accomplishments:

•	3852	- Completed the development of agricultural industrial products having potential for dual-use and commercialization, focusing on native Hawaiian agricultural crops with potential for medicine/food/bioremediation use in the military.
Total	3852	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology	PROJECT A829

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A829 National Defense Center for Environmental Excellence (NDCEE) Technology	14447	1962	0	0	0	0	0	0	16409

A. Mission Description and Justification: This is a one-year Congressionally funded project. The Materials and Processes Partnership for Pollution Prevention (MP4) project develops, demonstrates and validates pollution prevention technologies for the DoD acquisition community and the defense industrial base. These new technologies will assist DoD in reducing hazardous material usage, reducing regulatory pressure, and lowering the cost of weapon systems throughout their life cycle.

FY 1999 Accomplishments:

•	14447	- Awarded contract to the NDCEE, February 1999. - Conducted call for proposals within DoD for tasks to be executed within MP4 project which address DoD needs. - Received Phase I approval by the NDCEE DoD Working Group for twenty three proposals. - Developed specific task plans for Phase I approved projects.
Total	14447	

FY 2000 Planned Program:

•	1909	Continue execution of Congressionally-directed "Material and Processes Partnership for Pollution Prevention (MP4)" program as follows: - Identify pollution prevention technologies and management solutions to address DoD needs. - Establish goals and requirements for new technology or management solutions. - Develop, test, and demonstrate technology and management solutions including cost and health risk impacts. - Transition new technologies and processes to the Army industrial base and other DoD and commercial sites.
•	53	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	1962	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT A835

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A835 Military Medical Environmental Criteria	2971	2408	2848	2907	3074	3345	3743	Continuing	Continuing

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 Center for Environmental Health Research (CEHR), Ft. Detrick, MD, the Center for Health Promotion and Preventive Medicine (CHPPM), Edgewood, MD, and the U. S. Army Engineer Research and Development Center (ERDC).

FY 1999 Accomplishments:

•	2971	- Identified munitions biomarkers and bioeffects and conducted toxicological evaluation of munitions and degradation products. (CHPPM) - Established toxicity predictions using structure activity relationships. (CHPPM) - Performed cross-species extrapolation of mammalian and non-mammalian bioassays (CEHR/CHPPM), apply sentinel biomonitoring systems (CEHR), and apply methods for integrated environmental assessment of contaminated sites at Army installations (CEHR). - Constructed fate and transport of military-unique compounds. (ERDC) - Identified biomarkers to monitor bioattenuation and effects of military-unique compounds. (ERDC) - Constructed exposure and effects models and decision-making framework for ecological risk assessment. (ERDC)
Total	2971	

FY 2000 Planned Program:

•	1170	- Identify toxicity values for use in a Army Risk Assessment Modeling System. (ARAMS). (CHPPM) - Identify biomarkers to assess various toxic endpoints as well as bioaccumulation. (ERDC/CHPPM) - Perform inter-laboratory and field validation of specific sentinel environmental toxicity hazard assessment methods. (CEHR) - Apply specific sentinel environmental toxicity hazard assessment methods as part of integrated hazard assessment of sites at Army installations. (CEHR)
•	1173	- Construct a comprehensive exposure model and integrate with RAMS. (ERDC) - Construct a screening level model for Unexploded Ordinance (UXO). (ERDC) - Identify parameters for bioaccumulation of explosives in specific endpoints. (ERDC)
	65	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	2408	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A835

FY 2001 Planned Program:

•	1423	- Conduct comprehensive risk assessment linkages for ARAMS. (ERDC/CHPPM) - Establish information to input into comprehensive ARAMS. (CHPPM) - Perform inter-laboratory and field validation of specific sentinel environmental toxicity hazard assessment methods (CEHR) - Apply specific sentinel environmental toxicity hazard assessment methods as part of integrated hazard assessment of sites at Army installations. (CEHR)
•	1425	- Determine effects of environmental parameters on UXO chemical signatures. (ERDC) - Construct population model for assessment of environmental effects. (ERDC) - Link contaminant fate and transport with effects databases for multiple endpoints. (ERDC) -Complete development of a comprehensive link between contaminant fate and transport with effects databases for multiple environmental endpoints for incorporation into ARAMS. (ERDC/CHPPM)
Total	2848	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT A876

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A876 Plasma Energy Pyrolysis System	2890	7847	0	0	0	0	0	0	10737

Mission Description and Justification: This is a one-year Congressionally funded project. It provides a compliance and pollution control technology required reducing 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 1999 Accomplishments:

•	2890	- Completed procurement of mobile unit components and system integration. - Completed shake-down and mobility testing. - Obtained National Environmental Protection Act and other operating permits.
Total	2890	

FY 2000 Planned Program:

•	7636	- Confirm mobile Plasma Energy Pyrolysis System (PEPS) ability to destroy and dispose of hazardous waste.
	211	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	7847	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology		PROJECT: A877

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A877 Western Environmental Technology Office Environmental Support	3853	0	0	0	0	0	0	0	3853

Mission Description and Justification: This was a one-year Congressionally funded effort with the Western Environmental Technology Office (WETO) to provide 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 was the U.S. Army Construction Engineering Research Laboratories, Champaign, IL. WETO is a privatized former component of DOE (as of September 1996). WETO evaluated and demonstrated technologies to help DOE meet a requirement to clean up its sites.

FY 1999 Accomplishments:

- 3853 - Completed design services and cost-benefit analyses in support of environmental compliance at Army industrial installations.

Total 3853

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A896

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A896 Base Facility Environmental Quality	4611	4662	5190	5128	5252	5633	5723	Continuing	Continuing

Mission Description and Justification: This project supports three of the four areas of the Army's Environmental Quality (EQ) program as follows: (1) Conservation: Efforts will provide the Army with the technical capability to protect and improve the biological and physical characteristics of 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 for training heavy, medium, and light forces to the capabilities of specific land areas, and will also provide advanced methods to restore lands damaged in training and testing activities. (2) Compliance & Pollution Prevention: Efforts under this project will also enable the Army to prevent pollution and to comply with the myriad of Federal, state, and host country environmental regulations. Technologies will address the requirements in the Clean Air Act Amendment including hazardous air pollutants and particulate matter emission. Technology must also address Army Installations requirements in solid waste. Efforts target the development of environmental monitoring and modeling capabilities to support risk-based analysis of changes in training doctrine and testing activities and environmentally sustainable lands and facilities in all three EQ areas. The primary developing agency is the U.S. Army Engineer Research and Development Center (ERDC).

FY 1999 Accomplishments:

- 4611 - Incorporated a risk assessment capability into vegetation models to predict the effects of Army training and testing activities on the long-term growth and composition of plant communities.
  - Identified, for selected ecoregions, modeling tools and techniques that use both historic and predicted data on training, vegetation, and soils to match potential training throughput with the ability of soils and vegetation to withstand impacts of military use.
  - Developed a process to assess the impacts of maneuver training on threatened and endangered species and reduce restrictions on training while at the same time protect these species.
  - Completed greenhouse gas emission estimation model for the Army's mobile sources of greenhouse gases.

Total 4611

FY 2000 Planned Program:

- 3988 - Identify the information and modeling requirements to determine the risk of Army activities on threatened and endangered species.
  - Develop process-based soil erosion and deposition models that will assist in selecting sites and methods to more effectively reduce the effects of erosion and sedimentation from military activities on training lands.
  - Integrate training distribution, plant species composition, and sedimentation factors that affect land carrying capacity into the Army Training and Testing Area Carrying Capacity (ATTACC) model.
  - Validate pollution prevention simulation tool for smokes and obscurant emissions to minimize regulatory effects of smokes and obscurants on training.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology
	PROJECT A896

FY 2000 Planned Program: (continued)

•	625	- Develop activated carbon fiber cloth absorption technologies to control Hazardous Air Pollutants (HAPs) from hazardous organic solvents used in Army painting, cleaning, and degreasing operations.
	49	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	4662	

FY 2001 Planned Program:

•	4465	- Validate the use of remote monitoring instrumentation and methods to evaluate changes in animal activity that may be caused from military activities. - Incorporate information on the potential of land (soils and vegetation) to be effectively rehabilitated to reduce erosion and sustain land resources into decision support processes for land rehabilitation and maintenance. - Develop predictive model to determine raw quantities of construction/demolition material and identify potential recycle/reuse technologies for solid waste streams.
•	725	- Develop HAP control technologies for toxic combustion sources.
Total	5190	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A908

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A908 Commercialization of Technology to Reduce Defense Costs Initiative	5781	6866	0	0	0	0	0	0	12647

Mission Description and Justification: This is a one-year Congressionally funded project. The objective of this technology commercialization program is to lower Department of Defense procurement costs through integration of the technology commercialization process from the laboratory workbench to end product users. The approach involved matching of supply and demand technology requirements (utilizing Defense Technology Area Plan (DTAP), TriService Environmental Technology Requirements Strategies, Army 2010 and Beyond, and other DOD requirements documents); preliminary assessments of technology; testing, verification and demonstration; comprehensive technology and market assessments; and assistance in structuring, financing and closing of commercial transactions. An Interagency Agreement is in place with the Federal Laboratory Consortium (FLC) to assist in implementation of this program. This partnership supports 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.

FY 1999 Accomplishments:

•	5571	- Completed requirements and technology matching (using DTAP and Army/DOD environmental requirements) to develop a database of available DoD/Federal Laboratory technologies, points of contacts. Vendor/commercial technologies matrixed against manufacturing, sustainment, and environmental needs. Overarching DoD Integrated Process Team provide linkage to DOD Technology Transfer and Environmental communities. - Commercialization underway for Antifreeze Admixtures for Cold Weather Concreting to eliminated heating, High Solids Anaerobic Digester for waste disposal, Micro-Channel Heat Exchangers (MCHX) for more efficient engines, Advanced Sensors to improve chemical and biological agent detection, On-board intelligent lubrication prognostication to reduce oil use, Pulsed Laser and Remote Acoustic Doppler for Non-Destructive Testing to eliminate depainting, Terrestrial Magnetic Surveyor to assist in Underground Storage Tank and other detection, Piezoelectric Ceramic Fiber Composite Transducers and Actuators for improved sensors and Mobile Sensate Robot for operation in hazardous environments. - Market assessments and matching underway for technologies such as Autotherm to increase engine efficiency, Low-wattage Plasma Cleaning and Decontamination, Location Monitoring Technologies for tracking personnel in hazardous areas, Pulsed Ultraviolet Light for water treatment and disaffection, and Low NOx burner technology to reduce nitrogen oxide emissions. - Metrics include over 31 active technologies under active commercialization investigation, 31 Industry Transaction Agreements in place, 6 Cooperative R&D Agreements under negotiation and over 160 technologies investigated. - Expanded role of DoD Integrated Process Team in technology matching. - Prioritized DoD needs and complete qualitative and quantitative scoring for selection of DoD/Federal Laboratory technologies.
	210	- Established Laboratory Reimbursement fund to assist DoD/Federal Laboratories to provide for testing, demonstration, analysis and enhancement of Federal technologies to validate commercial applicability.
Total	5781	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A908

FY 2000 Planned Program:

•	5682	- Complete laboratory visits to develop more DoD funded environmental technologies for commercialization, continue in-depth Technology Assessments, Formal Market Assessments, CRADA's and SBIR Phase I and II Firms Involved. - Complete role expansion of DoD Integrated Process Team, Tech Transfer IPT and FLC in technology matching.
	1000.	- Complete transfer of additional funds to Laboratory Reimbursement fund for assisting DoD/Federal Laboratories in patenting, testing, demonstration, analysis and enhancement of technologies to validate commercial applicability.
	184	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	6866	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology	PROJECT A917

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A917 Computer Based Land Management	2408	1962	0	0	0	0	0	0	4370

Mission Description and Justification: This is a one-year Congressionally funded project to develop, test, and refine accurate, effective, and predictive methodologies and models, which have not been pursued by industry, for land condition assessment. These methodologies and models are needed to correlate and predict the relationship between military use and the patterns and nature of impacts associated with each type of military use under varying climatic and landscape conditions. This effort will utilize and exploit remote sensing geographic information systems and field survey and monitoring technologies. The results of this effort will improve DoD land managers' ability to characterize and monitor broad-scale changes occurring across training and testing lands through: (1) improvements in data acquisition, data display and visualization, and (2) integration of these data into dynamic landscape models. This program is managed primarily by the US Army Engineer Research and Development Center (ERDC). The primary performer for this effort is the Texas Regional Institute for Environmental Studies (TRIES).

FY 1999 Accomplishments:

• 2408 - Verified wind-erosion modeling options for integration into the Army's land capability model at sites with extensive wind erosion problems (such as Ft. Bliss, TX and Mojave Desert installations).
- Tested computer-based learning modules as elements of the decision support capabilities of the Land Management System (LMS).
- Demonstrated and revised vegetation mapping protocols for Army installations through multi-tiered vegetation mapping efforts at Ft. Hood, TX.
- Installed and tested real-time weather and soil moisture data recorders and integrated with training usage plans and training distribution model for near term damage and safety assessments.
- Held workshops (Feb & Mar 99) for the Land Management System (LMS) at Ft. Hood, TX & Palm Springs, CA with participants from across the Army & DOD.
- Developed and tested, at Ft. Hood, a protocol for field comparisons of watershed models.

Total 2408

FY 2000 Planned Program:

• 1909 - Complete integration and testing of a suite of Web-enabled models for military land management, use, analysis, and simulation.
- Extend modeling capabilities to link ecological, wind erosion, noise, and watershed models.
- Complete testing of prototype modeling suites at three test locations (Ft. Hood, TX; Ft. Benning, GA; and Marine Corps Air Guard Combat Center, 29 Palms, CA).
- Design, develop, and test a Web-enabled data repository for three test locations (Ft. Hood, TX; Ft. Benning, GA; and Marine Corps Air Guard Combat Center, 29 Palms, CA).
- Design, develop, and complete testing of Web-based linkages between data repositories and modeling suites.
- Develop technology transfer package for Web-based modeling tools, mapping tools, instruction tools, and data repository developed over three-year effort.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A917

FY 2000 Planned Program: (continued)

	53	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	1962	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A946

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A946 Electronic Equipment Demanufacturing	5778	15695	0	0	0	0	0	0	21473

Mission Description and Justification: This is a one-year Congressionally funded project. The objective of Electronics Equipment Demanufacturing program is to develop and demonstrate technologies and processes for the reuse, recycle, or disposal of manufactured electronic equipment used by the Department of Defense and its suppliers. Shortened electronics equipment product life cycles have led to early obsolescence and the 20-year accumulation of hundreds of millions of tons of scrap or surplus commercial and Government electronic equipment. Some of this equipment is classified. Although there are several commercial electronic demanufacturers, much end of life electronic equipment is sent to landfills. The managed reuse of electronic equipment may reduce future procurement costs and will reduce landfill and disposal costs through the separation of hazardous materials. Additionally, a further objective of this effort is to establish a demanufacturing recycling pilot site at Johnstown, PA to develop a cost-effective operational site that will integrate and apply the demanufacturing technology enhancements including state-of-the-art products and materials from the Demanufacturing of Electronic Equipment for Reuse and Recycling (DEER2) tasking and develop the material distribution system, education and training programs.

FY 1999 Accomplishments:

- 5778 - Awarded task awarded on 11 Feb 99 and initiated program development.
  - Established Demanufacturing of Electronic Equipment for Reuse and Recycling (DEER2) Web Site Program Repository (approved May 1999)
  - Established a DoD and Stakeholders group to identify demanufacturing needs and technology gaps.
  - Completed Program Management Plan (PMP) (approved June 1999)
  - Held first Stakeholder Meeting at NJIT as part of the Multi-Lifecycle Engineering Research Center (July 1999)
  - Completed Mission Need Statement (MNS) (approved October 1999)
  - Held a DEER2 Information Exchange 26-27 October 99.
  - Presented an overview of the DEER2 program to stakeholder groups on multiple occasions.
  - Conducted approximately 50 site visits.
  - Began task of analyzing the Defense Reutilization and Marketing Service (DRMS) contracts with DM Electronics Corporation (DMC) and Handy & Harmon for recycling of material/components from DoD electrical equipment/systems.

Total 5778

FY 2000 Planned Program:

- 15272 - Complete review and approval of system concept papers.
  - Procure state-of-the-art demanufacturing demonstration/validation equipment .
  - Complete installation of equipment at Largo, Florida, demonstration factory.
  - Report progress at stakeholder meeting to be held in Largo, Florida in February 2000.
  - Complete stakeholder meeting at SUMMIT 2000 in California in May 2000.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology	PROJECT A946

FY 2000 Planned Program: (continued)

- Complete establishment of a demanufacturing demonstration facility in Largo, Florida; open in summer of 2000.
- Initiate the establishment of the recycling pilot site at Johnstown, PA
- Develop, demonstrate, evaluate and deploy advanced, environmentally acceptable demanufacturing processes/technologies.
- Complete plan for Information Exchange to be held in Florida in October 2000.
- Complete provision of technology updates to DoD agencies and private industry through Information Exchanges, Stakeholder meetings, conference presentation and technical papers.

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

Total 15695

FY 2001 Planned Program: Program not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT A947

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A947 Sustainable Green Manufacturing	2890	5395	0	0	0	0	0	0	8285

Mission Description and Justification: This is a one-year Congressionally funded project. The objective is to help the Army reduce pollution in its key manufacturing processes by introducing clean technologies and techniques onto weapon system and related production lines. This is a Congressionally mandated program managed by the Army and consisting of team members that include the National Defense Center for Environmental Excellence, New Mexico State University, and the New Jersey Institute of Technology. New Mexico State University will leverage experiences with predictive modeling and micro-sensor technologies. This program augments efforts to comply with Executive Orders 12856 Greening the Government through Waste Prevention and 13101 Recycling and Federal Acquisition which mandate use of environmentally preferable products and services in all Federal acquisition programs.

FY 1999 Accomplishments:

- 2890 These efforts will be completed with FY 99 funds:
  - Develop a fate and transport model for hazardous metals liberated during testing at Proving Grounds. The model will use depleted uranium (DU) as the test species.
  - Implement corrosion/wear protection technologies to include High velocity oxygen fuel (HVOF) and ion beam deposition processing.
  - Develop techniques for mixing and measuring the quality of mixedness of meta-stable intermolecular composite (MIC) materials.
  - Develop an environmentally friendly process for the synthesis of trinitroazetidine (TNAZ).
  - Generate a handbook for a systematic approach to developing environmentally friendly processes for chemical synthesis.
  - Assist Benet labs in developing process parameter for the pilot plant CMS through the use of the bench scale cylindrical magnetron sputtering (CMS) unit and X-ray sorbing/scattering techniques.
  - Develop a computer-based tool for design engineers such that consideration of Demil/disassembly can be addressed in the design process.
  - Implement a powder coating process at Corpus Christi Army Depot.

Total 2890

FY 2000 Planned Program:

- 4010 - Complete efforts in detection, prevention and control of corrosion in DoD systems. This will include modeling and sensor technology development to make life predictions and better assessments of the effects of use and exposure on the life of material.
  - Complete efforts in the development of environmentally friendly techniques for the synthesis and mixing of energetic and pyrotechnic materials.
  - Complete training development efforts that address the needs of the DoD and industry to raise awareness, interest, and competence in managing environmental technologies and concerns.
  - Complete efforts in the implementation and training of reduced volatile organic compounds (VOC) painting technologies and corrosion protection processes in Army's maintenance facilities.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology
	PROJECT A947

FY 2000 Planned Program: (continued)

	280	- Compete development of powder coat application for 20mm/25mm objective individual combat weapon (OICW)/ objective combat squad weapon (OCSW) ammunition projectile bodies.
	280	- Replace hazardous materials in propellants for the M865E3 and M831A1 cartridges.
	280	- Complete initial evaluation of Ion Beam processing for corrosion prevention and control.
	200	- Complete provision of target design support for the cylindrical magnetron sputtering program.
	200	- Complete characterization of low VOC polymeric coatings corrosion resistance.
	145	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	5395	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT A959

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A959 Corrosion Prevention and Control	0	8828	0	0	0	0	0	0	8828

Mission Description and Justification: This is a one-year Congressionally funded project. The objective is to assist the DOD in addressing corrosion related issues by conducting research on techniques for detecting, inhibiting and reporting corrosion on weapon systems. This is a Congressionally mandated program managed by the Army. The program will perform several functions. Research will be conducted on materials and coatings, techniques for measuring corrosion and predictive model development to aid design and maintenance engineers. Test protocols and surveillance methodologies for assessing and reporting corrosion of fielded systems and new systems will be developed. Standardized test protocols will be developed and tests will be conducted to determine suitability of materials, corrosion inhibitors and coatings for DOD applications. Technology transfer will be conducted through training and a web based data exchange. The stated mission will be completed by a team consisting of Government, Industry and Academia.

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

FY 2000 Planned Program:

•	8591	- Complete research on materials and techniques for inhibiting and detecting corrosion. Information will aid design engineers in the selection of materials and coatings for weapon systems. In addition, techniques for predictive modeling of components and systems with regard to their corrosion resistance will be generated. - Demonstrate the "producibility" and or "manufacturibility" of the technologies researched. In addition, develop methodologies for testing and surveillance of fielded items and items under development. Correlation between corrosion testing and actual field conditions will be established. - Create and periodically update, DOD joint test protocols (JTPs) for classes of items/products. These JTPs would outline test requirements, including specific tests, test procedures, acceptance criteria, and reference industry/government specifications/standards, that must be met in order for any candidate material/process to be deemed acceptable as an alternative to what is currently called for in the technical data package (TDP), depot maintenance work request (DMWR), maintenance procedures, SOP, and/or is currently being used. These classes of items/products would be mostly generic in nature (i.e. lubricants, paints, coatings, etc.) and would have subcategories to classify the types of systems on which they are intended to be used (i.e. armaments, ground vehicles, air vehicles, etc.). - Develop a dual purpose training center for technology transfer. One aspect of the training will be to inform design engineers of the developed technologies. The second will be to demonstrate coating and surveillance techniques to maintenance and surveillance personnel: A web-based information exchange system will be developed and maintained to keep design personnel abreast of emerging technologies.
•	237	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	8828	

FY 2001 Planned Program: Project not funded in FY2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A960

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A960 Watervliet Arsenal Pollution Projects	0	3924	0	0	0	0	0	0	3924

Mission Description and Justification: This is a one-year Congressionally funded project. The objective is to provide for the transfer of environmental pollution prevention/compliance technologies through the Western Environmental Technology Office (WETO) for testing and demonstration at Watervliet Arsenal. These technologies are required to reduce the cost for treating hazardous and toxic pollutants from Army operations 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 Engineer Research and Development Center (ERDC) works closely with Watervliet Arsenal and Army Installation representatives to transfer environmental compliance and pollution prevention technologies that are successful at Watervliet Arsenal. This project will support the transfer of environmental technologies to Army 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 Army operations with environmental compliance, which will help accelerate technology transfer to similar operations within DoD. The primary technology transfer agency is the U.S. Army Engineer Research and Development Center (ERDC). 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 1999 Planned Program: Project not funded in FY 1999.

FY 2000 Planned Program:

•	3818	- Complete transfer of specific compliance/pollution prevention technologies to Army industrial installations.
	106	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	3924	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT A961

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A961 Vessel Plating Technology	0	981	0	0	0	0	0	0	1000

Mission Description and Justification: This is a one-year Congressionally funded project. Chrome plating of gun tubes provides substrate protection from harmful effects experienced during firing. This protection increases the life of the gun barrel, and ultimately improves the performance, durability and operational readiness of the weapons platform on which it is deployed. Using traditional technology, the chrome plating process is performed in large, open tanks containing carcinogenic compounds and highly concentrated acids. During processing, gun tubes are immersed into a series of these tanks. The length of some gun tubes requires tanks up to four stories tall containing thousands of gallons. This project funds vessel plating technology which reduces both environmental hazards and worker safety hazards, and provides enhanced chromium surfaces to be used in future advanced weapons systems. Vessel plating technology essentially utilizes the gun tube itself as the plating tank, without exposing the workers or the environment to the toxic compounds. Throughout the processing cycle, the gun tube is sealed from the outside environment. Additionally, the volume of chemicals used is reduced by 85% over the traditional process. This new vessel plating technology represents a significant advance in chrome plating and is now ready to be moved into military production.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	955	- Identify hazardous waste contamination at the proposed site and complete a remediation plan to remove all chemical hazards. - Complete an environmental assessment to determine the impact of a new process on the environment at this site. - Establish air emission, waste water discharge and solid waste and environmental monitoring requirements for a new process/facility at this site. preliminary design of new facility. - Complete mechanical, chemical, structural and safety system design criteria for a full scale vessel plating facility.
	26	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	981	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology — PROJECT: AF25

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AF25 Military Environmental Restoration Technology	3163	3446	3574	3670	3780	4042	4235	Continuing	Continuing

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 Research And Development Center (ERDC).

FY 1999 Accomplishments:

•	3163	- Developed an enhanced instrumentation package for the SCAPS and continue development of UXO detection technologies and of on-site data visualization and analysis capabilities.
•		- Incorporated in-situ bioremediation and electrokinetics design modules into the GMS version 2 model.
		- Developed advanced biological ex-situ (bioreactors) and in-situ treatment of contaminated soils and physical/chemical methods for groundwater.
Total	3163	

FY 2000 Planned Program:

•	3354	Complete multi-sensor UXO data collection and demonstrate 50% reduction of false alarms at well characterized UXO test sites.
		- Develop engineering approach for delivery of amendments for in situ treatment or for hydrological modifications to groundwater systems to affect enhanced biodegradation and complete bench scale parameter optimization for reactive barrier enhancement.
		- Complete vapor-phase biological activity enhancing amendment delivery (proof-of-concept) in soil columns, develop engineering approach for delivery of amendments to the vadose zone, and complete correlation of soil/sediment characteristics with contaminant bioavailability.
		- Demonstrate first generation electro-kinetic treatment technologies for lead and Develop prototype instrumentation for on line detection of metal contaminated soils.
	92	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	3446	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT AF25

FY 2001 Planned Program:

•	3574	- Develop predictive models for advanced UXO detection sensors (multi- frequency electromagnetic, GPR, vector magnetic, seismic/acoustic, and microgravimetry) and complete advanced UXO sensor data collection effort at a well documented site. - Complete pilot-scale demonstration in-situ biodegradation for TNT and demonstrate in-situ reactive barriers and/or reactive barriers coupled with biodegradation for explosives in groundwater. - Complete pilot-scale demonstration of in-situ biodegradation for explosives in soils and sediment. - Develop aggressive chemical metal treatment for small arms training ranges demonstrate the recycle of metal contaminated extracts for soils treatment systems.
Total	3574	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT AF26

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AF26 Agricultural-Based Bioremediation	3853	0	0	0	0	0	0	0	3853

Mission Description and Justification: This was a one-year Congressionally funded project. The Agriculture-Based Bioremediation project, worked jointly by the U.S. Army Environmental Center (AEC) and the U.S. Army Engineer Waterways Experiment Station (WES), demonstrated technologies to restore contaminated military and civilian sites, especially those located in fragile Pacific island ecosystems. AEC provided user input and assistance. Demonstration of 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 1999 Accomplishments:

•	3853	- Extended the BAA to solicit additional and complimentary projects. Completed DoD projects that emphasize agricultural remediation of petroleum contaminated soils and remediation of contaminated sediments using manufactured soil technology.
Total	3853	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT AF27

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AF27 ARO Chemical/Hazardous Material Disposal	1445	0	0	0	0	0	0	0	1445

Mission Description and Justification: This Congressionally-funded project provided resources to the Army Research Laboratory (ARL) to investigate and integrate technologies to conduct on-site chemical and hazardous materials remediation and disposal in an environmentally acceptable manner. ARL identified projects that had promise for on-site disposal (i.e. restoration/remediation) that could be evaluated with a one-time investment. The project emphasized collaboration with Army scientists and engineers and addressed technology transfer strategies for implementation at the end of the project.

FY 1999 Accomplishments:

•	1445	- Identified requirements and prepared Scope of Work (SOW) for a Self-Contained Chemical Remediation capability for the treatment and disposal of chemical munitions. - Evaluated technical and budget proposal from ICRC Energy, Inc. and awarded 18 month contract.
Total	1445	

FY 2000 Planned Program: Program not funded in FY 2000.

FY 2001 Planned Program: Program not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602720A Environmental Quality Technology		PROJECT: AF28

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AF28 Range Safe Technology Initiative	0	9809	0	0	0	0	0	0	0

Mission Description and Justification: This project, being executed by the U.S. Army Engineer Research and Development Center and the U.S. Army Environmental Center, has been established based upon Congressional interest in the demonstration of site cleanup technologies for the remediation of military firing ranges containing lead and low level radioactive materials. The objective of the work is to investigate emerging and current heavy metals remediation processes such as soil washing can lower the levels of toxic and/or hazardous heavy metals on military firing ranges to acceptable regulatory limits. This would be followed by the use of a continuous remediation process such as phyto-remediation (plants) to aid in maintaining acceptable heavy metals concentrations on range floors. Technology investigations are intended to be conducted at five separate military sites.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	4772	Investigate remediation of lead at Fort Dix, NJ.
•		Investigate remediation of low level radioactive materials such as depleted uranium at Aberdeen Proving Grounds, MD.
•		Investigate remediation of thorium at Kirkland AFB, NM.
•	1909	Investigate remediation of a new, low cost process for cesium-strontium at Fort Greely, AK.
•	2864	Investigate remediation for small arms firing ranges for lead and other heavy metals at Fort Irwin, CA.
	264	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	9809	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology		PROJECT AF29

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AF29 Phyto-Remediation in Arid Lands	0	2943	0	0	0	0	0	0	0

Mission Description and Justification: It was not specified in Congressional language the exact nature of this project. The overall objective of this program, being executed by the U.S. Army Engineer Research and Development Center and the U.S. Army Environmental Center, is to develop and evaluate new technologies specific to remediation of hazardous and toxic contaminants in arid environments by the use of plants (phyto-remediation). To reduce the burgeoning costs of restoration of contaminated sites at Army installations, the Army is investing RDT&E resources for the development of advanced treatment technologies with primary focus on in-place treatment processes. Phyto-remediation, specifically for inorganics, is a major contributor to the development of this technology development effort. Research, development, test and evaluation is being conducted to cover a wide range of site environmental conditions, including arid environments. Education provided in the area of phyto-remediation can make a positive contribution in the development, technology transition, use, and regulatory acceptance of this area of contaminant remediation.

FY 1999 Accomplishments: New start in FY 2000.

FY 2000 Planned Program:

•	2864	Investigate the fundamental phenomena of phyto-remediation and demonstrate innovative technologies in an arid region in the U.S.
	79	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	2943	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602782A Command, Control, Communications Technology**

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	21597	19519	23314	20796	20772	21844	22876	Continuing	Continuing
AH92 Communications Technology	12327	11832	13490	11715	10827	11416	11807	Continuing	Continuing
A779 Command/Control (C2) and Platform Electronics Technology	6574	7687	9824	9081	9945	10428	11069	Continuing	Continuing
AJ06 Multimedia Tactical Adapter	2696	0	0	0	0	0	0	0	2696

A. Mission Description and Justification: This program element researches advanced communications technology and expands scientific knowledge for demonstration of command and control (C2) and electronic systems/subsystems. The intent is to continuously enhance and secure information transport and presentation by improving the command, control, and communication system (e.g. man-machine interface, mobility, security, capacity, safety, reliability, survivability) for all Army air and ground platforms, including the soldier. Commercial technologies are continuously investigated and leveraged whenever possible. Research includes investigation of an infrastructure that will allow timely distribution, display, and use of C2 data on Army platforms, making the global positioning system more robust and minimizing the registration errors and improving man-machine interfaces and decision aids for a digitized battlefield. These technologies will provide field commanders with the capability to communicate on-the-move (OTM) to and from virtually any place on earth in a seamless, secure, self organizing, self healing, networked fashion. In addition, parts of this research also are directed toward supporting the Joint Tactical Radio System (JTRS) concept. Technology in this PE also supports the objectives of the Future Combat Systems (FCS). The US Army Communications- Electronics Command (CECOM), Fort Monmouth, NJ, primarily manages this PE. 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), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and PE 0603734A (Military Engineering Advanced Technology).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602782A Command, Control, Communications Technology**

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	22359	19613	21010
Appropriated Value	22546	19613	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-187		
b. SBIR / STTR	-449		
c. Omnibus or Other Above Threshold Reductions		-51	
d. Below Threshold Reprogramming	-223		
e. Rescissions	-90	-43	
Adjustments to Budget Years Since (FY 2000/2001 PB)			+2304
Current Budget Submit (FY 2001 PB)	21597	19519	23314

Change Summary Explanation: Funding increase in FY 2001 due to reprogramming for higher priority activities (e.g. information assurance).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology PROJECT AH92

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH92 Communications Technology	12327	11832	13490	11715	10827	11416	11807	Continuing	Continuing

Mission Description and Justification: The focus of this project is to research communications and network technologies required to meet the network centric battlefield needs of the FCS, the dismounted soldier, Army 2010 and beyond. The strategy is based on leveraging and adapting commercial technology to the maximum extent possible and focusing development efforts on those areas not addressed by the commercial industry (e.g. mobile radio based infrastructures and backbones, security in narrowband environments, multiband on-the-move transmit and receive antennas, adaptive protocols, low probability of interception/low probability of detection). Maximum use is made of the Dual Use Science & Technology program. Key areas of research include: adaptation of Asynchronous Transfer Mode (ATM) technology for hostile mobile environments; quality of service techniques for mobile wireless internet protocol (IP) and IP/ATM-based networks; the adaptation and interface with commercial personal communications technology, and development of realistic models for emerging communications services systems in dynamic field environments. In addition, this project investigates tactical antenna technologies; photonic controls and ferroelectric materials for phased array antennas; and mobile internet protocols operating across different networks. These efforts directly support the information systems and defense technology objectives outlined in the Defense Technology Area Plan.

FY 1999 Accomplishments:

- 3451 – Designed and documented analytic and computer models, selections and detailed specifications of dynamic resource allocation based mobile routing, protocols, controls and reconfiguration algorithms for advanced mobile wireless mixed multimedia systems using airborne base stations.
  – Designed and documented enhanced IP multicasting, IP over ATM multicasting, and ATM multicasting protocols for IP and ATM based mobile backbone and mobile subscriber networks in support of wireless mobile multimedia subscribers.
  – Integrated initial intelligent, rule-based modules with commercial off-the-shelf (COTS) network node manager and conducted laboratory prototype testing.
  – Tested three JTRS prototype antennas and started development of JTRS multiband mobile antenna in the 30 to 450 MHz frequency bands.
  – Conducted a cosite performance test and evaluation of very high frequency (VHF) multiplexer.
  – Conducted proof of principle demo for a single loop for the soldier Body Borne antenna.
  – Finalized a technical approach, fabricated and tested the mechanical inertial positioner and antenna for the super high frequency (SHF) communications on-the-move (COTM) antenna.
- 3362 – Completed breadboard development of the integrated photonic control system for single/multi-panel phased arrays.
  – Investigated and began development of ultra high frequency (UHF) radio frequency multiplexer and wideband power amplifier technologies to reduce interference from co-located radios, reduce noise induced bit errors, and improve radio range performance.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology PROJECT AH92

– Installed and integrated Defense Advanced Research Projects Agency (DARPA) sponsored Simulation and Evaluation on Adaptive Mobile Large Scale Network Systems (SEAMLESS) hardware and software that has provided a powerful and flexible simulation environment to enable the conduct of experiments and evaluation of mobile communications technologies.

FY 1999 Accomplishments: (continued)

- 2114 - Implemented emerging technologies to demonstrate advanced system concepts for future generation dismounted soldier personal communications. Tested and evaluated dismounted soldier personal communications technologies in laboratory test and field experiment environments under representative terrain conditions, and analyzed vulnerabilities to hostile communication threats.
  - Implemented advanced wireless mobile networking protocols on commercially available, portable computing hosts and radio platforms to demonstrate peer-to-peer and multi-hop packet relay communications networking capabilities.
  - Generated advanced future generation dismounted soldier personal communications by leveraging DARPA Small Unit Operations Situation Awareness System (SUO SAS) Program.
- 3400 – Generated protection techniques for the tactical internet expanding the effort to address intrusion detection and host level protection.

Total 12327

FY 2000 Planned Program:

- 4786 - Integrate, assess, prototype, demonstrate in testbed and document enhanced dynamic resource allocation based mobile routing, protocols, controls and reconfiguration algorithms for advanced mobile wireless mixed multimedia systems using airborne base stations.
  - Integrate, assess, prototype, demonstrate in testbed and document enhanced IP multicasting, IP over ATM multicasting protocols for IP and ATM based mobile backbone and mobile subscriber networks in support of wireless mobile multimedia subscribers.
  - Design advanced intelligent modules that inter-operate with fielded network node managers and conduct field testing.
  - Design UHF band for the Body Borne antenna concept/technologies in support of potential dismounted applications.
  - Generate an extremely high frequency (EHF) OTM satellite communications (SATCOM) antenna self-steering positioner/tracker.
  - Test JTRS multiband OTM antenna prototypes.
  - Complete design and initial development of a communications on-the-move phased array antenna using reduced cost techniques .
  - Model and simulate photo injection pin diode switch off-state capacitance effects upon the voltage standing wave ration (VSWR) performance of a structure tuned VHF folded monopole antenna.
- 1748 -Transition virtual simulations and performance transition models to Common Modeling Environment (CME) to facilitate model enhancements for evolving digitized Army communications (FCS and Army 2010).
- 5082 - Generate protection techniques for the tactical internet with emphasis on malicious code detection and eradication.
  - Generate future generation dismounted soldier personal communications to provide soldier alert functional requirements, assess situation awareness applications, and acquire advanced development prototypes for engineering analysis and system test and evaluation under DARPA SUO SAS Program. Complete development of technology transition strategies to JTRS ground forces domain (Handheld and Dismounted Warrior configurations).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology PROJECT AH92

- Test and evaluate advanced wireless mobile networking protocols for dismounted soldier personal communications using laboratory test and field experiment environments. Implement networking protocols in computer modeling and simulation environment for evaluation of system scalability and performance issues.

FY 2000 Planned Program: (continued)

- Analyze and evaluate design and engineering approaches for reducing power, weight and size requirements while improving performance of future generation dismounted soldier personal communications.
- Assess, characterize, and mature DARPA Global Mobile (GloMo) network protocol routing algorithms.

•	216	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	11832	

FY 2001 Planned Program:

•	5430	- Conduct and document detailed technical assessment and high level design of mobile agent based dynamic addressing algorithms and protocols, and dynamic network constitution and reconstitution algorithms and protocols for tactical survivable dynamic mixed networks. - Design a distributed network management architecture, which utilizes intelligent 'super agents" for semi-automated end-to-end network management. - Exhibit capability of JTRS compatible OTM multiband antenna, and begin development of expanded bandwidth OTM antenna (2 GHz). - Complete development and integration of communications on-the-move Phased Array Antenna. - Test prototype soldier body borne antenna.
•	1972	- Complete transition to common modeling environment (CME) and demonstrate next-generation simulation aids for initialization, management and data reduction. - Complete development, fabricate and demonstrate EHF positioner/tracker for EHF OTM low profile antenna.
•	6088	- Evolve protection techniques for the tactical internet with focus on automated security management. - Test and evaluate DARPA SUO SAS advanced development prototypes in laboratory test and computer modeling and simulation environments. - Demonstrate future generation dismounted soldier communications advanced system concepts in field experiment. - Evaluate engineering approaches for implementing second and third generation personal communication system (PCS) air interface standards in DARPA SUO SAS advanced development prototypes. - Investigate open system architecture hardware/software design requirements for future generation dismounted soldier communications to ensure JTRS compliance. - Analyze future generation dismounted soldier communications and mobile computing system advanced development prototypes to reduce power, weight and size requirements while improving performance of dismounted soldier personal communications. - Integrate DARPA GloMo routing algorithms into the Multifunctional OTM Secure Adaptive Integrated Communications (MOSAIC) ATD.
Total	13490	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology PROJECT A779

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A779 Command/Control (C2) and Platform Electronics Technology	6574	7687	9824	9081	9945	10428	11069	Continuing	Continuing

Mission Description and Justification: The objective of this project is to explore new concepts and techniques in command and control (C2) 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; C2; and integration with the evolving digital battlefield. New enabling technologies that support the current thrusts also are explored, such as advanced controls and displays, multi-modal interactive technology, 4D visualization, decision aids and tactical planning tools, data transfer, distributed data bases, advanced open system architectures, visionics technology, and integration concepts which contribute to digitization of the battlefield and provide C2 on-the-move. The project serves as a direct technology feed to advanced warfighting experiments (AWEs), ATDs, advanced concept technology demonstrations (ACTDs) and defense technology objectives (DTOs), including the following: Battlespace C2 (BC2) ATD; Logistics C2 (Log C2) ATD; Command Post XXI (CP XXI) ATD; Consistent Battlespace Understanding DTO; Forecasting, Planning, and Resource Allocation DTO; Integrated Force Management DTO, Future Command Post Technologies DTO; and Forecasting, Planning and Resource Allocation DTO.

FY 1999 Accomplishments:

- 1188 – Generated models and simulated battlespace tactical navigation (BTN) system architecture concepts that provide robust and precise platform positioning.
  – Researched and evaluated Global Positioning System (GPS) pseudolites, anti-jam GPS, video/imagery registration and small, low cost self-contained sensor technologies. The system concept will be scalable in that it will support multiple platform types at all echelons.
  – Generated prototype designs for the evaluation of BTN concepts.
- 4136 – Developed and demonstrated 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. Completed and transitioned the collaboration infrastructure to the BC2 ATD.
  – Tested and evaluated forecasting, continuous planning/scheduling, interactive 3-D exploration of the battlespace, speech/natural language interaction and other advanced capabilities in battlelab/field experiments.
- 750 – Specified and generated a modeling and simulation/stimulation (MSS) environment to support man-in-the-loop evaluation and warfighter training for advanced C2 protect and attack (C2 P/A) capabilities. Evaluated the effects of C2 attack on tactical internet operations.
- 500 – Improved modeling environment to support analysis of C4ISR. Improved execution time of simulation runs. Developed low fidelity quick turn around modeling capability.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology PROJECT A779

Total 6574

FY 2000 Planned Program:

- 1049 – Evaluate GPS enhancement technologies (e.g., advanced filters, low power clocks, advanced antennas) and prepare for the demonstration of these technologies in air and ground platforms. Conclude simulation of navigation system/database registration error minimization.
- 4881 – Develop a common operating environment (COE) compliant 3D visualization capability for the First Digitized Division. Develop a next generation graphics terrain engine for future battlespace visualization applications.
  – Develop course-of-action (COA) development enhancements to include optimization routines and forecasting. Transition to the BC2 ATD and the CP XXI ATD the initial increment of mobile/autonomous intelligent agents to support hasty planning and COA analysis.
  – Integrate voice recognition and natural language processing (NLP) into the collaboration environment. Develop techniques to speed up the donor enrollment process for speech recognition.
- 701 – Integrate a C2 attack simulator with CECOM's digital integrated laboratory and core distributed interactive simulation (DIS) facilities (CDFs). Conduct a distributed simulation to support development and training for integrated C2P capabilities.
- 482 – Develop future TOC information and process models in support of the CP XXI ATD.
- 456 – Develop an experimentation plan and testbed environment to evaluate future C2 needs of tactical commanders from battalion through platoon.
- 118 - Small Business Innovation Research/Small Business Technology Transfer Programs.

Total 7687

FY 2001 Planned Program:

- 2050 – Develop and demonstrate a real-time prototype of the navigation sensor/database error registration minimization algorithm.
- 2294 – Evaluate improved C2P capabilities against each other in a virtual environment to support development and training for C2P capabilities. Integrate brigade and above communications models. Conduct a distributed simulation using live troops and multiple sites to support development and training for integrated C2P capabilities.
- 500 – Complete transition of all virtual and systems performance mission planning/training models to high level architecture (HLA) and provide a leave behind capability that supports early warfighter evaluation.
- 1800 – Conduct laboratory and field experiments with candidate collaborative planning, tactical display, and man-machine interface concepts, built within a portable testbed. Concepts will show proof-of-principle improvement in battlespace situation awareness and decision-making processes for commanders from battalion to squad levels. Concepts will be evaluated toward feasible solutions for smaller, lighter, energy efficient, and software reprogrammable applications.
- 2653 – Develop an on-line analytical processing information mining prototype that queries the maneuver data in the Joint Common Data Base for decision support. Develop intelligent agent applications.
- 527 – Flight test developmental C4IEW systems.

Total 9824

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology PROJECT AJ06

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AJ06 Multimedia Tactical Adapter	2696	0	0	0	0	0	0	0	2696

Mission Description and Justification: The objective of this one year Congressional special interest project is to investigate methods that provide a seamless interface from standards/commercial based communications products to the Warfighters Information Network (WIN). The Multimedia Tactical Adapter program will develop an operational prototype to address the interoperability of voice, data and video over a single military communications infrastructure. It will provide the soldier with state of the art technology, while adapting commercial technology for use in the tactical environment. The Multimedia Tactical Adapter program will develop a means to a more reliable, efficient, and cost effective multimedia communications system. A Multimedia Inter-Working Functions (IWF) will be developed to provide gateway and gatekeeper functions for various standards-based (H320 and H323) interoperability technologies. Methods to control available bandwidth usage for these technologies will be investigated, as well as defining and implementing a scheme to allow for preemption and prioritization of the users multimedia communications. This effort will give the warfighter an enhanced capability that will save setup time, prioritize usage, and conserve precious tactical bandwidth based upon network traffic.

FY 1999 Accomplishments:

- 848 -Completed investigation of approaches to integrate and control various standards based video teleconferencing techniques into tactical communications networks.
- 1848 -Completed design and development of the appropriate hardware and software required prototypes to interface and control Multimedia Communications on tactical Networks.

Total 2696

FY 2000 Planned Program: Project not funded in FY 2000

FY 2001 Planned Program: Project not funded in FY 2001

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602783A Information and Communication Technology	PROJECT DY10

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DY10 Computer and Information Science Technology	3777	5173	3987	4141	4258	4354	4369	Continuing	Continuing

A. **Mission Description and Justification:** This project enables the Army to conduct applied research in information and communication technology to enhance situational awareness and speed the decision cycle for commanders of the Future Combat Systems (FCS). Efforts capitalize on computationally intensive approaches that exploit the rapidly evolving capabilities of emerging information technology. Focus is on providing general solutions that can be applied to a wide variety of command and control (C2) problems. Work in this project is consistent with the updated version of the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. Research is concentrated in information technologies that support C2 in a distributed environment and analysis tools that support the C2 process.

FY 1999 Accomplishments:

- 2077 - Completed techniques for distributed and collaborative group support environment that enable geographically separated commanders to collaborate in real-time and conduct battle planning, rehearsal and management tasks.
  - Evaluated collaborative tool set capabilities.
  - Established metrics to assess effectiveness of collaboration tools and environment.
  - Provided network monitoring capability with commercial tools (e.g. Operations Network (OPNET)) and built evaluation capability for tactical internet protocol.
  - Investigated interfaces between information management and network management systems to support intelligent tuning of information distribution process.
- 1700 Conducted quantitative and qualitative analyses and evaluations of Y2K data on DoD computer systems by applying mathematical, statistical, and knowledge based formal methods. Provided assurance metric on Y2K compliance.

Total 3777

FY 2000 Planned Program:

- 3726 - Conduct experiments on distributed and collaborative group support environment in concert with Army Battle Labs.
  - Modify collaborative tool set capabilities based on evaluations.
  - Incorporate multimodal interfaces into collaboration tools to facilitate operations on the move (from Displays Fed Lab Program).
  - Incorporate course of action development and analysis tools (from Displays Federated Laboratory Program) into collaboration tools.
  - Incorporate low bandwidth technology for Video Teleconferencing (VTC) from Displays Fed Lab into collaboration tools to bring capability down to dismounted commander.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602783A Information and Communication Technology PROJECT DY10

FY 2000 Planned Program: (continued)

- Describe techniques that will allow the Army user to access internet protocol network management information on tactical wireless networks to determine the availability of bandwidth at any given time. Based on this data, generate active database triggering mechanisms that prioritize data packages to be sent.
- Provide alternative approaches to Tactical Internet / Intranet routing protocol layer.
- Integrate collaboration technologies and transition to CECOM.

•	1316	-Evaluate performance of mobile ad hoc network algorithms and self-configuring mobility protocols that support secure multicast streaming for mobile wireless nodes. -Evaluate performance of energy-efficient, self-configuring, ad hoc routing and medium access control algorithms that support unattended ground sensors. -Evaluate performance of automated vulnerability assessment tools that perform continuous assessments of bandwidth-constrained mobile wireless networks and identifies a set of known configuration errors and susceptibilities.
•	131	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	5173	

FY 2001 Planned Program:

•	2625	- Conduct Battle Lab experiments with second generation collaborative technologies and identify technology gaps. - Integrate intelligent agent technologies into collaboration tools. - Utilize planning metrics for display design (developed in Display Fed Lab) to enhance assimilation of information by commanders. - Measure and evaluate performance improvement of information management algorithms responding to network delay feedback. - Conduct experiment to empirically measure overhead due to intranet routing protocols and compare to simulation results. - Provide upgraded collaboration technology modules to CECOM's Command Post XXI Advanced Technology Demonstration (ATD).
•	1362	-Evaluate mobile ad hoc network algorithms and protocols integrated with self-configuring mobility protocols that support secure multicast streaming for mobile wireless nodes. -Enhance energy-efficient, self-configuring, ad hoc routing and medium access control algorithms integrated with localization algorithms that support unattended ground sensors. -Enhance automated vulnerability assessment tools with the capability to perform directed assessments of bandwidth-constrained wireless networks to confirm the existence of a set of known configuration errors and susceptibilities. - Transition communications technology to CERDEC in support of FCS ATDs.
Total	3987	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602783A Information and Communication Technology

PROJECT: DY10

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	2170	5210	4012
Appropriated Value	2185	5210	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-15		
b. SBIR / STTR	-49		
c. Omnibus or Other Above Threshold Reprogramming	+1700	-20	
d. Below Threshold Reprogramming	-36		
e. Rescissions	-8	-17	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-25
Current Budget Submit (FY 2001 PB)	3777	5173	3987

Change Summary Explanation: Funding – FY 1999: Emergency Supplemental increase (+1700) for Y2K compliance.

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	51203	47639	42344	44571	46161	48292	50832	Continuing	Continuing
A855 Topography, Image Intelligence, and Space Technology	8742	9448	9699	10272	10696	11336	11933	Continuing	Continuing
AH71 Atmospheric Investigations	5598	6259	6362	6755	7262	7795	8159	Continuing	Continuing
AT40 Mobility & Weapons Effects Technology	12532	14870	15535	16276	16418	16760	17643	Continuing	Continuing
AT41 Military Facilities Engineering Technology	3966	4154	4204	4493	4683	4959	5245	Continuing	Continuing
AT42 Cold Regions Engineering Technology	4618	4935	3747	3930	4106	4248	4480	Continuing	Continuing
AT45 Energy Technology Applied to Military Facilities	2276	2578	2797	2845	2996	3194	3372	Continuing	Continuing
AT46 Climate Change Fuel Cell Technology	2877	2452	0	0	0	0	0	0	5329
AT49 University Partnering for Operational Support	2890	2943	0	0	0	0	0	0	5833
AT50 Enhanced Geographic Synthetic Aperture	7704	0	0	0	0	0	0	0	7704

A. 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 science & technology is provided 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 provides 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	52074	41085	42820
Appropriated Value	52688	47885	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-614		
b. SBIR / STTR	-567		
c. Omnibus or Other Above Threshold Reductions		-90	
d. Below Threshold Reprogramming	-96		
e. Rescissions	-208	-156	
Adjustments to Budget Years Since FY 2000/2001 PB			-476
Current Budget Submit (FY 2001 PB)	51203	47639	42344

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology		PROJECT A855

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A855 Topography, Image Intelligence, and Space Technology	8742	9448	9699	10272	10696	11336	11933	Continuing	Continuing

Mission Description and Justification: This project funds technology that will help those who move, shoot, and communicate on the battlefield to "fight smarter" through superior knowledge of the total battlefield terrain and environment. 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 enhance the tactical commander's ability to exploit his knowledge of combat relevant intelligence as a force multiplier to conduct and win Force XXI operations. Information dominance is a key enabler for Army/Joint Vision 2010 concepts. Using tactical/strategic/space sensor data, together with terrain data bases as input, the technology program emphasizes automating the processes of detecting change 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. Work in this project significantly enhances the Army's geospatial data management and dissemination capabilities by providing advanced technologies for storing, transforming, updating and disseminating extremely large volumes of terrain data at, or near, real-time. Weather/atmospheric effects data is provided for this project by the Army Research Laboratory Project AH71 in this PE. This project is managed by the U.S. Army Engineer Research and Development Center.

FY 1999 Accomplishments:

- 8742 - Tested and evaluated initial spectral imagery and synthetic aperture radar automated feature extraction capabilities.
  - Developed software to improve transportation network analysis using multi-source feature data; demonstrated advanced management, dissemination, and integration of multi-source geospatial data.
  - Investigated capabilities to support weapon selection by applying physics-based models to simulate applications and visualization capabilities.
  - Developed and explored processes to utilize a disparate array of geospatial information to support a family of common geospatial information representations.
  - Completed competitive government selection of automated terrain-reasoning analytic solution for inclusion in USAF C4 systems.
  - Completed "The Future Positioning/Navigation (POS/NAV) Technologies Study" which projected a cost, weight/size and performance improvements timeline for different POS/NAV sensors and supporting technologies that will be used to guide future POS/NAV development projects.

Total 8742

FY 2000 Planned Program:

- 9286 -Incorporate automated feature extraction techniques from spectral, synthetic aperture radar and electro-optical sources into the digital stereo photogrammetric workstation.
  - Demonstrate a capability to manage, disseminate and integrate topographic point, line and area feature data using advanced on-line warehouse technology.
  - Extend physics-based models and visualization capability to passive and active millimeter wave.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology	PROJECT A855

FY 2000 Planned Program: (continued)

- Complete design of a concept model for a low cost wheeled vehicle tactical navigator.
- Identify performance baseline criteria and complete initial design of appropriate spectral/spatial algorithms.
- Develop and implement a thorough test and evaluation protocol for algorithms used to generate slope information from elevation data.
- Deliver validated terrain analytics to Joint Terrain Analysis Tool (JTAT) and reengineered tactical decision aids to Combat Terrain Information System (CTIS).

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

Total 9448

FY 2001 Planned Program:

• 9699
- Develop capability for automated feature attribution using knowledge based rules.
-Extend advanced geospatial data management technology to support rapid update of terrain information using best available sources.
- Integrate model derived from infrared and millimeter wave sensor performance overlays into 3D visualization.
- Develop the design for hardware and software for future land navigation capability.
- Complete implementation of spectral/spatial algorithms for detection and identification.
- Develop and test prototype model of low-cost wheeled vehicle tactical navigator.
- Extend the spatial analysis tool to support course of action analysis for ground order of battle.
- Deliver enhanced analytical terrain-reasoning tools to Army Battle Command Systems ASAS (All-Source Analysis System) and CTIS (Combat Terrain Information System).
- Build concept model of a low cost wheeled vehicle tactical navigator and assess when available.

Total 9699

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology		PROJECT AH71

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AH71 Atmospheric Investigations	5598	6259	6362	6755	7262	7795	8159	Continuing	Continuing

A. Mission Description and Justification: This project performs the applied research for tactical weather and atmospheric effects algorithms, and for the integration of battlefield atmospheric environments into simulations. It accomplishes this mission by transitioning technology to the Project Director Integrated Meteorological System (PD-IMETS), through support to the Program Manager for Night Vision/Reconnaissance Surveillance and Target Acquisition (PM-NV/RSTA) for field artillery systems, and to the DoD modeling community. It provides weather decision aids for the digital battlefield commander by applying advanced computer techniques; incorporating new technology in meteorological sensor and system designs; researching data fusion techniques to horizontally integrate data from advanced weather sensors and non-weather sensors into decision aids for enhanced combat power on the battlefield and enhanced effectiveness of field artillery and deep attack assets. This project supports Defense Technology Objectives, Weather/Atmospheric Impacts on Sensor Systems, and On-Scene Weather Sensing and Prediction Capability.

FY 1999 Accomplishments:

- 3305 - Established a capability for the Integrated Meteorological System (IMETS) to ingest Air Force MM5 meteorological forecasts and improved the Battlescale Forecast Model's (BFM) ability to provide higher resolution weather forecasts and decision aids for Army situation awareness and mission planning.
  - Integrated the IMETS Integrated Weather Effects Decision Aids (IWEDA) into the joint service, rule-based tactical weather decision aid that includes Air Force and Navy systems, rules and critical weather values.
  - Enhanced weather forecaster decision aids with improved algorithms for the prediction of icing, turbulence, visibility, low cloud, and precipitation to provide the commander with improved tactical forecasts of hazardous weather conditions.
  - Implemented existing and new meteorological satellite data extraction algorithms for soil moisture, surface state, precipitation and surface temperature into algorithms for use in weather intelligence applications.
  - Integrated flat earth acoustic detection algorithms to IMETS 3-D gridded meteorological data to compute weather effects on acoustic propagation as an initial step to integrating tactical acoustic forecasting into IMETS.
  - Integrated latest IMETS 3-D gridded meteorological database to a modeling and simulation interface to support weather effects in combat simulation and training using a tactical C4I weather system.
- 1464 - Delivered a beta version of Met Kernel to ARDEC to correct for met effects at the midpoint of the projectile trajectory.
  - Compiled a retrieval coefficient database using selected climatic regions for the microwave radiometer to be used in the Mobile Meteorological System-Profiler (MMS-Profiler), thereby increasing accuracy of a trajectory forecast in multiple climatic regions.
  - Completed, evaluated, and transitioned the MMS-Profiler, algorithms, models, designs, and documentation to the Program Manager NV/RSTA in preparation for engineering and materiel development.
- 829 - Investigated visualization techniques for fusing multiple information sources into a unified visualization of weather with the rapid dynamic, 3-D battlefield environment/terrain visualization capabilities.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology
	PROJECT AH71

FY 1999 Accomplishments: (continued)

- Completed Battlefield Acoustic Sensor Evaluator (BASE) for flat terrain; incorporated turbulence effects into BASE for enhanced acoustic target acquisition.
- Augmented commercialized Electro-Optical Systems Atmospheric Effects Library (EOSAEL) model suite with a turbulence model (CN2MAR) with documentation for improved military analysis studies.

Total 5598

FY 2000 Planned Program:

- 3301 Develop improved numerical weather prediction and high resolution forecast modeling capabilities to enhance the assessment of environmental effects on operations.
  -Integrate IMETS applications including weather data visualization, rule-based and physics-based weather impact models as client applications to provide interactive capability for Battlefield Functional Area C4I systems to retrieve data on demand from IMETS meteorological databases.
  - Use transient turbulence theory and other parameterizations to research a high resolution, complex terrain transport and dispersion model for hazard prediction that reduces the computational complexity to improve the near real-time capability.
  - Complete theory and software to link the 3-D atmospheric models to standard simulation interfaces, such as the Total Atmospheric and Oceans Server (TAOS), for enhanced DoD simulations, virtual testing and analysis.
  - Augment the commercialized EOSAEL model suite with an acoustics model, complete with documentation, for improved military analysis studies.
  - Evaluate algorithms and complete an aerosol scavenging by precipitation model for improved military smoke modeling for simulations, virtual testing, and analysis.
- 1485 - Complete the preliminary neural network method for retrieval of wind profiles from met satellite sounder data that, when implemented, will allow near real time wind data to be obtained over target areas for more effective use of smart munitions and sub-munitions.
  - Deliver Met Kernel with documentation to the ARDEC for enhanced fire support effectiveness.
  - Verify the capability of the Army's Battlescale Forecast Model (BFM) to forecast weather and hazards in the lowest levels of the atmosphere through inter-comparison with two university weather prediction models and with current Navy and Air Force larger scale models.
  - Complete a combined temperature retrieval method that uses data from a ground-based microwave radiometer and met satellite sounders for more accurate remotely sensed temperature soundings along a projectile trajectory.
- 1435 - Incorporate limited terrain effects into the Battlefield Acoustic Sensor Evaluation (BASE) for enhanced acoustic target acquisition calculations.
  -Incorporate turbulent scattering into scanning acoustic wave propagation models for enhanced acoustic target acquisition.
  -Incorporate BASE output over a 3-D terrain to enhance acoustic target acquisition calculations.

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

Total 6259

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology
	PROJECT AH71

FY 2001 Planned Program:

•	3487	-Integrate joint weather impacts into decision aids for First Digitized Division weather capability. -Upgrade Weather Impact Decision Aid models with the characteristics and the impacts of weather on threat platforms, weapons, sensors and operations to forecast the deltas between threat and friendly systems. -Implement a capability for IMETS to participate with both live and synthetic weather scenarios in live, virtual and constructive simulation exercises supporting the First Digitized Corps.
•		-Establish a weather data server for distributing gridded meteorological data and weather impacts for Battle Command clients at lower echelons providing additional reach back weather support. - Complete a 3-D atmospheric propagation and simulation model that includes the effects of absorption, scattering, and radiative transfer, turbulence, clouds, aerosols, and smoke for improved simulations, virtual testing and analysis.
•	2875	-Conduct verification and validation of neural network method for retrieval of wind profiles from met satellite sounder data and integrate combined temperature retrieval method to prototype MMS-Profiler processors to achieve better temperature sounding capability for improved artillery accuracy. -Incorporate full complex terrain/turbulent scattering acoustic propagation model into next generation weather decision aid systems. -Conduct verification and validation of battlescale forecast model (BFM) modules for icing, low level clouds, and precipitation that will be used to improve target area met for more effective use of smart munitions and sub-munitions in target areas. -Deliver to ARDEC a new method of aiming artillery by applying met corrections along the entire trajectory for better accuracy and enhanced fire support effectiveness.
Total	6362	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology		PROJECT AT40

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT40 Mobility & Weapons Effects Technology	12532	14870	15535	16276	16418	16760	17643	Continuing	Continuing

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 U.S. force deployment; designs, materials, and construction methods for battlefield, fixed, and forward base survivability against advanced conventional weapons and terrorist weapons; methodologies to predict and mitigate coastal effects on logistics –over-the-shore (LOTS) operations; reliable and cost-efficient roadways and airfields for CONUS installations to support force projection; camouflage, concealment, and deception for fixed and semi-fixed facilities to deny accurate acquisition and engagement by threat weapon systems; rapid obstacle and barrier creation; and accurate assessments of battlefield mobility for maneuver commanders (and materiel developers during virtual prototyping). Civil engineering science and technology 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 Research and Development Center (ERDC).

FY 1999 Accomplishments:

•	12532	- Identified techniques for troop evaluations of the structural integrity of small protective emplacements; evaluated concepts for application of sprayable multispectral camouflage, cover, and deception (CCD) tonedown agents for large area signature reduction; correlated target structural damage with target type, geometry, and materials and demolition method. - Selected analytic methodologies to predict down-axis ground shock from fully coupled detonations in slabs; completed static and dynamic laboratory experiments and associated analyses of square concrete structural components with large span-to-thickness ratios; developed and validated hardening techniques for roofs to resist vehicle bomb threats. - Designed specifications for rapidly installed breakwater; incorporated algorithms into Riverine Analysis Model to calculate probability bands for hydrologic predictions; incorporated real-time nowcast data analyses into logistics-over-the-shore planning model. - Established criteria and procedures for the use of local materials and equipment for construction of expedient airfields; validated analytic models capable of replicating material and pavement system response under vehicle loading. - Developed an analytic capability for automated assessment and load classification of bridges; identified new non-traditional soil stabilization agents; completed initial software for synergistic allocation of engineer assets within resource constraints to transportation infrastructure maintenance, repair, and construction tasks - Derived soil constitutive relationships describing the traction performance of tires operating in coarse-grained soils; developed stress distribution
Total	12532	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology
	PROJECT AT40

FY 2000 Planned Program:

•	13781	- Identify infrared signature manipulation techniques for use in expedient decoy construction; perform survivability analysis of protective concepts for key assets in forward logistic nodes. - Derive methodologies to predict down axis ground shock from detonation partially above and in burster slab; develop and validate methods for hardening walls to resist terrorist mortar threats. - Complete final version of Coastal Integrated Throughput Model; incorporate snow melt capabilities into military hydrologic model. - Analyze methodologies for making short-term forecasts of soil strength based on predicted weather changes. - Integrate Improved Bridge Assessment Rehabilitation and Repair (IBARR) code with road assessment algorithms; establish criteria for off-road/bypass evaluation around damaged road networks. - Incorporate multiple-wheel interaction and rate dependent response analysis into an advanced pavement analysis model.
•	1000	- Evaluate techniques to predict the effects of asymmetric terrorist threats against dams and dam support structures.
	89	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	14870	

FY 2001 Planned Program:

•	14535	- Upgrade survivability analysis algorithms for blast and fragmentation effects to include CCD measures; troop evaluation of protective concepts for base clusters and forward logistic nodes. - Select analytic methodologies to predict down-axis ground shock from detonation partially in and below burster slab; complete dynamic experiments and analyses of square concrete structural components with intermediate span to thickness ratios; develop methods for hardening roofs to resist terrorist mortar threats. - Incorporate Coastal Integrated Throughput Model into military hydrologic models and a tactical logistics planning exercise to validate improved, robust basin delineation computer sub-routines. - Derive operational unit level movement algorithms for representation of maneuver in Army models and simulations. - Determine techniques for use of indigenous materials in maintenance, repair, and construction of roadways; develop procedures/guidance for engineer resourcing in repair/maintenance of roadways; develop bridge repair/retrofit materials and components; develop methodologies for assessment of impact on roadway components of vehicle speeds, tire pressures, loadings, etc. - Incorporate fracture concepts into the pavement performance model, incorporate long-term behavior analysis into the advanced pavement analysis model.
•	1000	- Analyze prediction techniques for effects of asymmetric terrorists' threats against locks, levees, and flood control structures.
Total	15535	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology		PROJECT AT41

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT41 Military Facilities Engineering Technology	3966	4154	4204	4493	4683	4959	5245	Continuing	Continuing

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 cost alone is 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 US Army Engineer Research and Development Center (ERDC).

FY 1999 Accomplishments:

•	3966	- Enhanced the Modular Design for Systems to accommodate 80% of Army facility types. - Initiated development of self-repairing facings, coatings, and membranes for military buildings containing distributed reactive materials in inert casings which when released enable self-repair. - Generated criteria for upgrading seismically vulnerable, concrete frame, barracks structures.
Total	3966	

FY 2000 Planned Program:

•	4117	- Advance structural integrity monitoring systems to provide information for assessing structural health, safety and remaining service life. - Generate design criteria for non-specific Electro-osmotic Pulse (EOP) system to prevent structural damage from chronic water seepage through floors, walls, and roofs. - Model corrosion degradation mechanism for coated steel and steel reinforced concrete in water and soil. - Characterize diaphragm design deficiencies in existing Army buildings under earthquake loadings.
	37	-Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	4154	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology	PROJECT AT41

FY 2001 Planned Program:

•	4204	-Create testbed infrastructure to support collaborative facility design and installation management processes in a distributed, heterogeneous environment. - Evaluate infrastructure to support collaborative processes (e.g., engineering activities in the facility design and installation management processes) with the Modular Design System (MDS) version 3.0. - Generate design guidance for cost effective seismic rehabilitation of unreinforced masonry walls typically found at DoD installations. - Evaluate a corrosion control selection system that will assist in the proper selection and use of corrosion control materials and technologies based on site conditions and design. - Test earthquake hazard mitigation techniques for diaphragms in existing Army buildings. -Complete optimization model using probabilistic condition prediction tools for the maintenance and repair of facilities.
Total	4204	

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602784A Military Engineering Technology

PROJECT: AT42

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT42 Cold Regions Engineering Technology	4618	4935	3747	3930	4106	4248	4480	Continuing	Continuing

Mission Description and Justification: This project is the only DoD applied research program focused on the knowledge base and engineering principles needed to efficiently sustain an effective force in winter and the cold regions of the world. This research supports DoD forces conducting combat support, combat engineering and base/facility construction, operation and maintenance missions across the spectrum of operations. This program provides the basis for extending the operability of forces and materiel in cold weather and increasing their deployability while directly lowering high life-cycle costs and extending the service life of DoD facilities. 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 U.S. Army Engineer Research and Development Center (ERDC) manages the work.

FY 1999 Accomplishments:

• 3418	Prepared guidance for soil modifiers and geosynthetics for expedient, low-volume roads in thawing soils.
•	Identified engineering activities most sensitive to the winter environment in future combat simulations.
•	Completed finite element models of tires operating in wet, trafficked snow.
•	Provided map-based products for millimeter wave and infrared sensor performance for battlespace planning and operations.
•	Formulated asphalt pavement temperature model.
• 1200	Evolved technology for detection of in-flight, aircraft icing conditions.
•	Advanced technology to improve mobility and mine detection along lines of communication in cold regions.
Total 4618	

FY 2000 Planned Program:

• 3541	Formulate an integrated seismic/acoustic signature simulation model that will generate acoustic and seismic signatures for heavy tracked and wheeled vehicles in a variety of terrains.
•	Confirm application of physics-based models and visualization to support weapons selection and mission rehearsal for weapon systems equipped with infrared targeting sensors.
•	Provide winter climate index characterization manual for snow and soil freezing effects.
•	Originate model for predicting the effect of moisture and temperature gradients on pavement strength and roughness during freezing and thawing for airfields and pavements in cold regions.
1300	Grow technologies for forecasting winter/seasonal impacts on Objective Force logistics and mobility.
94	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total 4935	

FY 2001 Planned Program:

•	3747	Confirm modeling and target location and tracking capabilities against non-real time data to improve operational effectiveness.
•		Integrate multispectral (infrared and millimeter wave) sensor performance products into 3-dimensional terrain visualization.
•		Advance innovative thawed soil stabilization techniques for base camps and expedient roadways in austere/remote theaters.
•		Incorporate the freeze-thaw model into the 3-D finite element pavement model in order to predict pavement performance during freeze-thaw periods.
Total	3747	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology
	PROJECT AT45

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT45 Energy Technology Applied to Military Facilities	2276	2578	2797	2845	2996	3194	3372	Continuing	Continuing

Mission Description Justification: 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. The new Executive Order 13123 (signed 6/4/99). Greening the Government Through Efficient Energy Management" requires a 35% energy reduction by 2010, a 30% carbon reduction by 2010, greater use of renewables and sustainable building design and development. New technologies and procedures also support Army goals for improved air quality, sustainable design, and expanding the use of energy savings performance contracts. This project is managed by the U.S. Army Engineer Research and Development Center (ERDC).

FY 1999 Accomplishments:

•	2276	- Completed self-tuning adaptive control algorithms for utility plant automation. - Completed condition assessment methodology for HVAC systems. - Validated concurrent engineering principles for community design concepts between electrical and mechanical building systems.
Total	2276	

FY 2000 Planned Program:

•	2560	- Investigate screening, design and application tools for hybrid cooling systems. - Confirm methodology for integrated strategic planning for Army Installations. - Confirm automated procedures for heat system inventory, inspection, condition assessment, and condition prediction for systematic maintenance and repair of heat distribution systems.
	18	-Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	2578	

FY 2001 Planned Program:

•	2797	- Complete process for maintaining technology for improving energy system performance for building energy systems. - Automate selection/design practice for hybrid cooling systems. - Complete process energy and pollution reduction (PEPR) program with expert system capability.
Total	2797	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology		PROJECT AT46

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT46 Climate Change Fuel Cell Technology	2877	2452	0	0	0	0	0	0	5329

Mission Description and Justification: Funds for this project were provided by Congress in FY98 and FY99. Recent DoD demonstrations of stationary phosphoric acid fuel cells (PAFC) have shown them to be clean, reliable, efficient and high quality sources of energy. The purpose of this project is to provide additional research to reduce system capital cost, expand applications to megawatt size systems, and to develop a capability to use available fuels. This funding will increase DOD's ability to more effectively use clean and efficient combined heat and power technology and accelerate the use of fuel cell technology for military deployment and in-theater operations. The research will be jointly executed by the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Armament Research Development Center, U.S. Air Force Research Laboratory, and the National Defense Center for Environmental Excellence (NDCEE).

FY 1999 Accomplishments:

•	2877	- Implemented component testing at NDCEE -Validated methods of reforming available fuels (no non-DoD fuels) - Analyzed power plant deficiencies and identified research area for improved performance of fuel cell technology.
Total	2877	

FY 2000 Planned Program:

•	2386	- Completion of reforming available fuels (no non-DoD fuels). - Complete investigation and recommend technology for on-site stack refurbishment which will prolong stack life, reducing costs.
	66	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	2452	

FY 2001 Planned Program: Program not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology PROJECT AT49

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT49 University Partnering for Operational Support	2890	2943	0	0	0	0	0	0	5833

Mission Description and Justification: This program provides applied research for operational, fine-scale forecast models of basic meteorological variables for inclusion in Air Force Weather Agency (AFWA) modeling capabilities supporting Army tactical requirements. These efforts include enhancements to operational mesoscale prediction models that predict and forecast icing, turbulence, soil moisture, surface fluxes as well as chemical/biological and smoke plume dispersion.

FY 1999 Accomplishments:

•	2890	- Completed enhanced fine scale arctic weather prediction using current models upgraded for use at higher resolutions for Army applications. - Completed improved methods of forecasting icing and turbulence for Army air operations. - Completed improved modeling of surface fluxes and soil moisture that affect army logistics operations. - Completed improved high latitude bio/chem plume dispersion techniques that will enhance the capability to identify and predict chemical/biological agents atmospheric flow patterns. - Completed improvements in the atmospheric path characterization capabilities that will enhance target detection and tracking.
Total	2890	

FY 2000 Planned Program:

•	2864	- Complete research and evaluation of the effectiveness of the Mesoscale Model 5th Generation (MM5) numerical forecast model in arctic environments. - Research improved methods for forecasting icing conditions in an arctic environment - Perform analysis of volcanic eruption data to parameterize and extend the existing ash cloud models. - Complete investigation using the upgraded agriculture meteorology (AGRMET) model for use in improving surface flux and soil moisture modeling to improve trafficability forecasts. - Complete investigation of cloud microphysics to improve the forecasting of cloud evolution and contrails.
	79	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	2943	

FY 2001 Planned Program: Program not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602784A Military Engineering Technology		PROJECT AT50

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT50 Enhanced Geographic Synthetic Aperture	7704	0	0	0	0	0	0	0	7704

A. Mission Description and Justification: At congressional direction, this project was transferred to the National Imagery and Mapping Agency (NIMA) in October 1999 for execution. This project was to develop and build a unique, dual frequency (X-band and P-band) airborne interferometric Synthetic Aperture Radar (SAR) and associated processing system for terrain mapping. The project was to provide all-weather mapping under foliage and/or bare earth. Resulting products were to enhance military operations dependent on timely, accurate, true ground surface elevation data. The effect of terrain on mobility could have been evaluated more precisely with this capability. The project may have yielded a civil capability in land use, flood prediction, and environmental impact analyses.

FY 1999 Accomplishments: FY99 Congressional add of $7704 was moved from PE 0602784, through Congressional direction, to NIMA.

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2000.

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602785A Manpower/Personnel/Training Technology PROJECT A790

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A790 Personnel Performance and Training Technologies	8249	12005	11869	11903	12094	12275	12453	Continuing	Continuing

A. Mission Description and Justification: The objectives of this program 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, to evaluate the impact of deployments on personnel issues (e.g., career commitment, retention, etc.), and to provide the behavioral technologies required for the development of effective individual and collective (unit) training strategies. Research topics include training strategies for the digitized battlefield, training strategies in simulated environments, optimum designs and utilization of simulators and training devices to achieve maximum learning at minimum cost, and modernization of the selection and classification systems to maintain warfighting capabilities 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 and supports the Human Systems – Personnel Performance and Training – Defense Technology Area. This PE is managed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences.

FY 1999 Accomplishments:

- 8249
  - Developed and evaluated prototype training and performance assessment methods for Force XXI.
  - Developed and evaluated instructional modules for versatile thinking skills required by brigade staff.
  - Developed definitions and models of PERSTEMPO impact on soldier commitment, morale, and retention.
  - Assessed the impact of Land Warrior Systems on institutional training.
  - Completed readiness and cohesion data collection on battalions with key command staff positions stabilized for 24-months and similar battalions that did not have staff positions stabilized.
  - Identified the role of simulation devices, instructors, and instructional processes in a model simulator training program for Initial Entry Rotary Wing (IERW) flight training.
  - Implemented and evaluated model IERW simulator-based training program for TH-67.
  - Identified representative 21st century noncommissioned officer (NCO) performance requirements and attributes needed for effective performance.
  - Developed preliminary version of small unit leader training for Military Operations in Urban Terrain (MOUT) or other contingency operations using an immersive virtual environment system.

Total 8249

FY 2000 Planned Program:

- 11770
  - Develop measurement concepts and metrics to compare standard procedural training with innovative problem solving for managing large amounts of information.
  - Define characteristics of virtual environments for realistic portrayal of conditions in the dismounted soldier's environment.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602785A Manpower/Personnel/Training Technology PROJECT A790

FY 2000 Planned Program: (continued)

- Prepare final report on the effects of stabilizing the assignments of key battalion staff members.
- Identify performance measurement technologies for determining training outcomes in advanced aircraft qualification courses.
- Develop prototype 21st century NCO performance measures.
- Develop models that incorporate realistic computer-generated forces in virtual and constructive simulations.
- Implement and evaluate instructional feature and training strategy enhancements to the MOUT/contingency operations trainer.
- Conduct trend analysis on computer experiences and skills possessed by the typical Infantry soldier and leader.
- Identify individual and team leadership characteristics likely to be required over the next 5-25 years for effective management of change in volatile, unstructured, complex, and ambiguous environments.

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

Total 12005

FY 2001 Planned Program:

• 11869
- Develop, demonstrate, and evaluate extended instructional modules for versatile thinking skills required by division staff.
- Document lessons learned on cognitive skill enrichment for command and staff.
- Examine simulator training task requirements for future Army aircraft.
- Determine the relationships between 21st century NCO attributes and mission performance measures to identify best predictors of success.
- Incorporate prototype system for computer recognition of human gestures into VE for dismounted soldier training and mission rehearsal.
- Develop "best practices" for leading organizational change at different command levels.
- Assess effectiveness of virtual environment (VE) interface improvements for training and mission rehearsal.
- Develop preliminary training methods to enhance the processing/integration of visual, aural, and digital information by Infantry small unit leaders.

Total 11869

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602785A Manpower/Personnel/Training Technology PROJECT A790

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	8533	12071	11904
Appropriated Value	8602	12071	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-69		
b. SBIR / STTR	-148		
c. Omnibus or Other Above Threshold Reductions		-36	
d. Below Threshold Reprogramming	-102		
e. Rescissions	-34	-30	
Adjustments to Budget Years Since FY 2000/2001 PB			-35
Current Budget Submit (FY 2001 PB)	8249	12005	11869

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	18075	25831	24659	26429	24934	23848	23444	Continuing	Continuing
AC60 AC60	1856	2048	905	2083	1706	1031	1080	Continuing	Continuing
AH98 Clothing and Equipment Technology	10032	16120	16477	17107	15947	15877	14609	Continuing	Continuing
AH99 Joint Services Combat Feeding Technology	4526	4853	5077	5043	5383	5283	5493	Continuing	Continuing
D283 Airdrop Advanced Technology	1661	2810	2200	2196	1898	1657	2262	Continuing	Continuing

A. Mission Description and Justification: The goal of this program element is to improve soldier survivability and performance by providing research and technologies for: combat clothing and personal equipment; combat rations and combat feeding equipment; and the air delivery of personnel and cargo. The Clothing and Equipment Technology project provides cutting edge research and technologies for clothing, equipment, and high-pressure airbeam supported shelters. Technologies will enhance warfighter protection from both combat threats (e.g., ballistics, lasers, flame) and the field environment; enhance signature management and integration; and significantly lighten the soldiers load. Human science is incorporated into modeling and analysis tools that will enable technologists and military users to trade-off potential warrior system capabilities and develop a human-centered warrior system design. The Joint Services Combat Feeding 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 performance enhancing combat rations, packaging, and combat feeding equipment/systems. Research will enhance nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; minimize physical, chemical and nutritional degradation of combat rations during storage; meet the needs of individual soldiers in highly mobile battlefield situations; and provide equipment and energy technologies to reduce the logistics of field feeding while improving the quality of food service. Similarly, the Airdrop Advanced Technology project 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. Providing technologies for safer, more combat efficient personnel parachutes addresses 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, the Warrior Systems Technology Base Executive Steering Committee, 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 Soldier Center, Natick, MA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	18420	23971	23405
Appropriated Value	18661	25971	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-241		
b. SBIR / STTR	-211		
c. Omnibus or Other Above Threshold Reductions		-63	
d. Below Threshold Reprogramming	-60		
e. Rescissions	-74	-77	
Adjustments to Budget Years Since FY 2000/2001 PB			+1954
New Army Transformation Adjustment		TBD	-700
Current Budget Submit (FY 2001 PB)	18075	25831	24659

Change Summary Explanation: Funding FY01 Project D283 was adjusted to reflect the new Army Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology		PROJECT AH98

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AH98 Clothing and Equipment Technology	10032	16120	16477	17107	15947	15877	14609	Continuing	Continuing

Mission Description and Justification: This project researches and matures technology to improve soldier survivability and performance. Areas of emphasis include: research to significantly lighten the soldier's load; lightweight materials for personal survivability (e.g., improved ballistic, flame, and directed energy protection, enhanced signature management); human science, modeling and analysis tools for optimizing soldier system clothing and equipment; three-dimensional textiles for achieving rapidly deployable wide-span airbeam supported shelters. The program was restructured due to increased priority for ballistic protection in FY00, and for human science, modeling and analysis aspects of the soldier system in FY01.

FY 1999 Accomplishments:

- 3662 - Completed integration of improved small arms protective material systems and began transition to enhance individual armor items; transitioned high strength fiber composite technology for lightweight fragmentation protective helmet; and expanded fundamental understanding of key property requirements for optimization of new materials for next generation multiple ballistic threat protection (increases small arms, advanced fragmentation, and improved blast protection).
  - Demonstrated improved corrosion resistance using a novel conductive polymer in coatings on steel; developed silk fabrics and blends of silk/kevlar and silk/spectra for evaluation for ballistic impact resistance; developed methods to create composite of nanoscale ceramic and metal particles and polymers including electrospun membranes of nanofibers for soldier protective items; demonstrated that metal nanoparticulate coatings increased the toughness of surface treated fibers; nylons compounded with nanoclay have been obtained and melt spun into nanocomposite fiber for the first time for flame resistance testing.
- 3355 - Defined the effects of a range of load weights on biomechanical performance of the soldier including walking gait and the forces to which the soldiers' body is exposed to while carrying loads; demonstrated that biomechanically enhanced combat boots improve performance and are highly acceptable and durable for use under military field conditions; expanded anthropometric data extraction software capabilities to include a larger number of critical body measurements required for clothing/equipment system design and evaluation.
  - Expanded current physiological model capabilities from restricted laboratory settings into more representative virtual combat environments by incorporating the Surgeon General's SCENARIO model into the Integrated Unit Simulation System (version 3.1) individual/small unit combat model. This provides more accurate representation of the effects of heat stress and hydration on warrior performance in mission simulations.
- 3015 - Established performance based protection criteria for flame resistant combat clothing.
  - Demonstrated in a dismounted operational setting, six passive thermal signature management technologies integrated into breadboard prototype combat uniforms.
  - Designed optical limiting cells that can be used in breadboard tunable laser eye protective device.
  - Researched methods to scale up three-dimensional textile technology using subscale prototypes that will ultimately provide highly mobile maintenance shelter capability for large weapons platforms, such as attack helicopters and tanks.

Total 10032

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology	PROJECT AH98

FY 2000 Planned Program:

•	4220	- Validate ability of virtual prototyping tools to analyze form, fit, function, and assist in infantry warrior system design; demonstrate the ability to disperse nano-particles in a variety of polymer structures likely to be applied in the warrior system as the first step towards significant weight reduction of the heaviest components. - Develop battlefield scenarios to appropriately model the combat effectiveness of warrior systems and components in the Integrated Unit Simulation System (IUSS).
•	4490	- Mature and transition technology to the PM-Soldier that reduces the system weight of the individual countermine protective system (fielded in FY96) by 35%, while providing equal protection; define requirements for assessment criteria and test methodology to determine ballistic casualty reduction potential of emerging technology; evaluate novel materials/systems demonstrating concepts to increase protection and reduce weight of personnel armor, for both head and torso, against emerging ballistic threats.
•	2251	- Quantify the effects of load-carrying gear, clothing, and individual equipment configured for specific squad positions on human performance; complete and successfully demonstrate a passive dynamic gait model; support integration of automated measurement and data extraction system for human-system interface analysis and military clothing sizing and issue. - Synthesize new polymers that have shown great potential for application in the development of lightweight, flexible and wearable power generating devices for soldier systems. - Research novel techniques for integrating electronic components, such as cables, connectors, sensors and antennae, into textile material systems to enable more effective integration of electronics in the soldier system, reducing weight and enhancing reliability and fightability.
•	1960	- Design a dismounted soldier system signature evaluation and analysis plan to determine the baseline total system signature (i.e., visual, near-, mid-, and far-infrared, acoustic, electromagnetic); analyze experimental thermal signature reducing facepaint formulations to provide safe and effective means to manage the thermal signature of exposed skin. - Increase the level of achievable laser eye protection using polymer-based limiters to support all warrior, both mounted and infantry, in the Future Combat Systems (FCS). - Develop and demonstrate a test methodology for flame resistant material systems. - Conduct advanced helmet design and capability trade study with the infantry user that will lead to future helmet design concepts with integrated situational awareness, system control, and survivability capabilities.
•	2924	- Optimize the wide span airbeam textile construction and complete the full-scale shelter design; begin fabrication of a breadboard full-scale 60 ft wide airbeam supported shelter for field demonstrations. - Investigate technical issues related to improving the reliability, affordability and safety of airbeam technology; determine failure mechanisms of high pressure airbeams and improve manufacturing techniques for continuous braiding and weaving processes.
•	275	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).
Total	16120	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology
	PROJECT AH98

FY 2001 Planned Program:

•	5785	- Evaluate and mature technology for virtual prototyping tools to develop warrior system designs, with a focus on integrated load carriage and helmet design, component/capability placement on the torso and head; demonstrate the feasibility of incorporating nano-scale materials in soldier system components to reduce weight. - Determine adequate level of human system data points required to enable quantitative measures of soldier system performance, validation of small unit combat analysis models, and development of soldier system virtual prototyping and design tools; begin focused effort to collect required human system data.
•	5845	- Extend the IUSS individual/small unit combat model to develop the initial ability to assess the effects of restricted terrain (e.g., rooms, hallways, trenches) on warrior system performance. - Transition improved test methodology/assessment criteria for personnel armor systems to the acquisition community to enable the trade-off of protection, weight, mobility and affordability; mature novel concepts to increase protection and decrease the weight of personnel armor components.
•	2392	- Determine effects of varied topographic and terrain conditions on human performance through biomechanical evaluations; extend the passive dynamic gait model to encompass terrain data; augment 3-D anthropometric scanning capabilities to include tools for applications supporting human-based modeling/simulation and novel uniform and equipment virtual prototyping and design concepts. - Research and process conductive polymers, using novel electrospinning techniques, into a material structure with very high surface area; assess photovoltaic and energy density potential for future power generating devices. - Demonstrate breadboard prototype concepts for integrating electronic components into textile material systems as an initial integrated personal body local area network for soldier systems.
•	2455	- Demonstrate 30-50% cost decrease compared to the cost of existing flame-resistant clothing systems while maintaining multiple threat protection levels. - Demonstrate baseline dismounted soldier full spectrum system signature evaluation and analysis. Recommend corrective actions, if necessary. Down-select face paint formulations and prepare an evaluation plan to determine effectiveness of these materials as a safe means to manage the thermal signature of exposed skin area. - Modify the brassband prototype design of millimeter-lens arrays for laser eye protection devices to decrease the length of the optical assembly to make them more compatible with human factors criteria. This supports all warriors, including mounted and infantry, in the Future Combat Systems (FCS). - Demonstrate the ability of an airbeam supported structure to span a cross section exceeding 60 feet in width to enable the development of a rapidly deployable large weapons platform maintenance shelter.
Total	16477	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology		PROJECT AH99

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AH99 Joint Services Combat Feeding Technology	4526	4853	5077	5043	5383	5283	5493	Continuing	Continuing

Mission Description and Justification: The goals of the Joint Services Combat Feeding Technology project are to provide combat feeding and food system technologies to enhance the survivability, sustainability, and supportability of the Armed Forces by ensuring optimal nutritional intake. Thrust areas include applied research of combat rations, packaging, and combat feeding equipment/systems. Near-term goals include: enhancing nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; reducing ration weight/volume and food packaging waste to minimize the logistics footprint; tailoring rations to the combat situation and radically improving mobility; reducing replenishment demand by extending shelf-life; permitting more extensive prepositioning of stocks, while maintaining initial quality; and providing equipment and energy technologies to reduce the logistics of field feeding while improving the quality of food service. The work in this project supports all military Services, Special Operations Command, and the Defense Logistics Agency. This is a DoD program for which the Army has Executive Agency responsibility.

FY 1999 Accomplishments:

- 770 - Completed field trials of prototype individual beverage heaters to ensure warrior hydration, and transitioned to ration improvement program for large-scale field test.
  - Completed testing of mini-tube and autothermal reformer critical subsystems for logistically improved fuel cell based cogenerator.
  - Down-selected micro fuel atomizer approaches, and designed and fabricated a 1-2 k British Thermal Unit/hr burner weighing less than 4 oz which provides individual soldier water and food heating capacity.
- 902 - Completed test and evaluation of waterless kitchen sanitation nonstick coatings and environmentally acceptable grease separation of wastewater, and transitioned these logistics improvements to advanced field food sanitation center.
  - Developed concept and subsystems for reliable passive cold storage and frozen food handling systems for field kitchens to enable more fresh and frozen foods while ensuring food safety.
  - Investigated Liquid-Injection Cogeneration (heat and electric from one process) for applications with potential dual use in military field services (kitchen, showers, laundries, space heating, etc.), significantly reducing logistical footprint and replenishment demands.
- 1233 - Evaluated evolving advanced dehydration technologies for ration components to exploit novel ingredients/processes for stabilizing structure and for controlling microbial growth to increase variety of shelf stable ration components; optimized processing and defined packaging specifications for shelf-stable vegetables and fruit combat ration components; transitioned osmotic dehydrated fruit to Meals Ready to Eat (MRE).
  - Conceptualized the composition and configuration of a tailorable and modular combat ration, and designed packaging concepts compatible with the tailoring of modules for either minimally or fully sustaining rations which reduce soldier load.
- 1621 - Evaluated and developed nutraceutical prototypes containing glutamine, caffeine and tyrosine for ration supplementation to optimize combat effectiveness.
  - Evaluated concepts for bioengineering of high energy ration components including incorporation of complex "nutri-fuels" into rations for improved performance/stress reduction and protein enhancement of ration components for improved nutritional quality.

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology
	PROJECT AH99

FY 1999 Accomplishments: (continued)

- Evaluated concepts for bioengineering of high energy ration components including incorporation of complex "nutri-fuels" into rations for improved performance/stress reduction and protein enhancement of ration components for improved nutritional quality.
- Developed four new irradiated meat entrees for the National Aeronautics and Space Administration, evaluated laminate packaging films, and transitioned program to Advanced Technology Development.

Total 4526

FY 2000 Planned Program:

- 2139 - Downselect or combine competing reformer approaches and integrate with fuel cell and field kitchen thermal fluid heater to substantially increase heat transfer efficiencies by converting waste heat to useful energy; test and evaluate reformer with fuel cell and field kitchen thermal fluid heater and transition to Advanced Technology Development for field kitchen technology demonstrations.
- Mature technology on critical subsystems for Liquid-Injection Cogeneration (fluid, heat exchanger and expander) to reduce the logistics footprint; weight, and field kitchen fuel requirements.
- Prototype and test reliable passive cold storage and frozen food handling systems for field kitchens to reduce requirement for fuel and enhance Class I logistics/distribution; transition to Advanced Technology Development.
- Design and fabricate prototype Pocket Stoves to provide warrior light weight capability to heat beverages, conduct bench level performance tests and collect early user feedback.
- Conduct material research on thermal fluid heat transfer systems which reduce the burner requirement from, as many as 6, to as few as 1, reducing weight of deploying forces and substantially reducing Operations & Support costs; transition data to Kitchen Performance Specification.
- Conduct concept analysis and design of Self Heated Meals for Remote Site Feeding including module size, chemical heater and activator, and methods for efficient heat transfer to provide enhanced forward positioning capabilities and quality group meals without food service equipment.
- Conduct front end analysis of food and packaging field waste management methods and provide field management alternatives for implementation by appropriate agency.

- 1408 - Complete product development and mature technology for microwave sterilized meals through a commercial contract to improve nutritional/sensory quality.
- Complete demonstration studies on enhancers/antioxidants and packaging models for combat optimized ration components which enhance cognitive/physical performance.
- Conduct field evaluations on items produced by novel dehydration technologies in combat ration products, demonstrating significant reduction in weight and cube of combat ration components.
- Research and test of engineering processes for production of carrier matrices for bioengineered protein systems to enhance nutrition value for optimized future combat rations.
- Conduct initial testing and mature technology for methodologies/carriers for smart food components optimizing metabolic transfer conversion to energy sources to enhance the combat performance of troops.

FY 2000 Planned Program: (continued)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology
	PROJECT AH99

•	1266	- Research the feasibility of accelerating the osmotic dehydration of fruits by sugar solutions and by employing both single and repeat cycles of high pressure to reduce processing cost of these ration components. - Research the feasibility of incorporating nano-sized fillers into commercially available packaging materials optimizing barrier properties to extend ration shelf-life. - Identify technologies for the conversion of native cellulose to foodstuffs for revolutionary survival ration; conduct a market/literature survey to assess current conversion/digestion systems. - Investigate the production of volatile compound(s) that are unique to specific foodborne pathogens; grow bacteria on selected food models (protein, fat, carbohydrate) to determine the effects of food composition on chemical volatile distribution to provide handheld biosensor for field/combat use.
•	40	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).
Total	4853	

FY 2001 Planned Program:

•	1624	- Integrate and test subsystems for Liquid-Injection Cogeneration, optimizing waste heat conversion and user safety, and transition to Advanced Technology Development for field kitchens. - Develop packaging for Self Heated Meals for Remote Site Feeding including integration of food and heaters, and heat transfer modeling and testing to ensure environmental compliance and optimum performance at lowest cost. - Complete development of Soldier Pocket Stove technology and transition to Advanced Technology Development to validate revolutionary non-powered combustion technology.
•	2182	- Mature technology and test combat optimized ration components to increase cognitive/physical performance. - Complete study on engineered carrier matrices for bioengineered proteins which provide performance enhancing nutrients for military rations in a portable, easily consumed, acceptable form and transition to Advanced Technology Development. - Complete field test of products produced with advanced dehydration technologies which reduce ration weight, volume and total logistics costs; transition to fielded individual/group ration improvement program. - Fabricate prototype ration quality status indicators that can be monitored externally by logistics personnel to ensure least fresh, first out. - Research and design ration packaging systems that will respond to the environment to provide a single packaging system for all rations with reduced signature. - Develop totally integrated Class I supply/requisition/distribution concepts that support DoD/DA logistic initiatives and minimize Class I logistical support impacts and theater stockpiles. - Mature encapsulation technology and finalize selection of methodologies/carriers for smart food ration components and prepare for FY02 validation testing. - Engineer new delivery systems (i.e., gels) for the incorporation of performance enhancing agents. - Research and mature packaging technology that prevent lipid oxidation, minimize undesirable odors, and help prolong quality retention of shelf stable ration items.

FY 2001 Planned Program: (continued)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology	PROJECT AH99

		- Determine requirements and test the efficacy of intercomponent films of multi component ration items to increase product quality and menu variety
•	1271	- Evaluate pressure effects on texture mediated by activation/release of native enzymes in fresh vegetables (pectin esterases) or meats (proteases) as a pretreatment to reduce dehydration or thermal processing requirements for ration components, while maintaining initial quality - Conduct processing trials to determine feasibility of utilizing and/or modifying existing methods and techniques; optimize processing parameters to enhance orientation of nano-composite fillers, such that gas diffusion will be minimized, extending barrier protection for combat rations - Explore the feasibility of non-enzymatic hydrolysis techniques, such as acid or alkaline hydrolysis, alone or as a pretreatment to enzyme hydrolysis for potential conversion of biomass to food stuff which would support soldiers in survival situations. - Conduct tests with mixed culture samples to evaluate the potential and time for detecting and differentiating specific volatile compounds from food pathogens for use in easy-to-use, lightweight, field biosensor.
Total	5077	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602786A Warfighter Technology		PROJECT: D283

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D283 Airdrop Advanced Technology	1661	2810	2200	2196	1898	1657	2262	Continuing	Continuing

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, more survivable and more accurate cargo delivery and reduced personnel, aircraft, and cargo vulnerability. All the aforesaid will enhance the military's capability for global precision delivery and rapid force projection.

FY 1999 Accomplishments:

•	1160	- Constructed new prototype cargo parachutes based on the new design for a lightweight, low bulk, low altitude, affordable cargo parachute. - Downselected an air release valve and designed and constructed an airbag system prototype for roll-on/roll-off cargo airdrop. - Tested the pneumatic muscle for soft landing of payloads. - Investigated the new parafoil inflation method for cargo airdrop to increase reliability of full parafoil deployment.
•	501	- Applied state-of-the-art parachute system models to analyze performance, minimize full-scale airdrop testing, and assist in design trade-off decisions. Models included: soft landing; trajectory; and guidance navigation and control models. - Completed first generation simulations of fully coupled 3D parachute inflation model on round systems and disreefing models of cross and gliding wing systems; validated results with experimental data. - Demonstrated parachute/wind interaction model and validated from on-going science and technology programs in the Army and Air Force.
Total	1661	

FY 2000 Planned Program:

•	1184	- Mature smart airbag technologies for roll-on/roll-off cargo airdrop and transition to technology integration in 0603001A (Project D242). - Research advancement of soft landing of personnel by a combined parachute and pneumatic muscle system. - Research a concept for a pneumatic muscle soft landing system for heavy cargo using subscale testing and modeling and simulation. - Investigate advanced, low-cost parafoil designs for improved flight and landing flare performance.
•	608	- Apply state-of-the-art airdrop system models to reduce (by as much as 10%) the life cycle costs by: minimizing feasibility testing; providing predictions of system limitations; shortening development cycle times; and predicting the effects of system modifications.
•	975	- Research concepts for an advanced precision air delivery system for future combat vehicles; conduct trade-off analysis and lab testing.
•	43	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).
Total	2810	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Warfighter Technology
	PROJECT D283

FY 2001 Planned Program:

•	1252	- Identify and analyze candidate concepts for a low cost, precision airdrop resupply capability for humanitarian and other one-time-use operations. - Conduct feasibility experiments with candidate low cost precision concepts. - Construct and experiment with an advanced, low-cost parafoil with improved flight and landing flare performance.
•	648	- Incorporate additional advanced features into a second generation 3D high performance airdrop system model and validate with concurrent experimentation. - Simulate airdrop systems of interest to DoD, transition results and package software into a user-friendly graphical user interface environment for use as an "airdrop virtual proving ground".
•	300	- Evaluate multiple design concepts for advanced precision aerial delivery of future combat vehicles and identify best candidate for testing.
Total	2200	

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)							DATE: February 2000		
BUDGET ACTIVITY: 2 - Applied Research					PE NUMBER AND TITLE: 0602787A Medical Technology				
COST *(In Thousands)*	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	134002	174199	75729	70269	74136	79047	82780	Continuing	Continuing
A838 Neurotoxin Exposure Treatment	19261	9809	0	0	0	0	0	0	29070
A841 Minimally Invasive Surgery	11079	9809	0	0	0	0	0	0	20888
A843 Health Technology Roadmaps	1925	0	0	0	0	0	0	0	1925
A845 Bone Disease Research	2408	6404	0	0	0	0	0	0	8812
A863 Battlefield Surgical Replacement	0	2452	0	0	0	0	0	0	2452
A869 Telemedicine/Advanced Technology	3183	5213	4467	4480	3306	3499	3566	Continuing	Continuing
A870 DoD Medical Defense Against Infectious Diseases	23055	23674	24840	25611	28574	30324	32178	Continuing	Continuing
A872 Neurofibromatosis Research	11079	14714	0	0	0	0	0	0	25793
A873 HIV Exploratory Research	13813	12541	11579	11021	10890	11372	11586	Continuing	Continuing
A874 Combat Casualty Care Technology	10440	8537	8806	9063	10633	11456	12011	Continuing	Continuing
A878 Health Hazards of Military Materiel	8329	9267	10642	11369	11718	12182	12700	Continuing	Continuing
A879 Medical Factors Enhancing Soldier Effectiveness	7759	8019	8438	8725	9015	10214	10739	Continuing	Continuing
A921 Ovarian Cancer Research	0	11771	0	0	0	0	0	0	11771
A948 Portable Cardiopulmonary Bypass Pump and Oxygenator	1925	0	0	0	0	0	0	0	1925
A949 Advanced Cancer Detection	3374	0	0	0	0	0	0	0	3374
A950 Teleradiology	2890	0	0	0	0	0	0	0	2890

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A951 Diagnostic and Surgical Breast Imaging	1926	0	0	0	0	0	0	0	1926
A952 Musculoskeletal Injuries	1926	5885	0	0	0	0	0	0	7811
A953 Disaster Relief and Emergency Medical Services	9630	9809	0	0	0	0	0	0	19439
A962 Polynitroxylated Hemoglobin	0	1962	0	0	0	0	0	0	1962
A963 National Medical Testbed	0	14714	0	0	0	0	0	0	14714
A964 Infomatics-based Medical Emergency Tools	0	4414	0	0	0	0	0	0	4414
A965 Eye Research	0	1962	0	0	0	0	0	0	1962
A966 Blood Research	0	5395	0	0	0	0	0	0	5395
A967 Dye Targeted Laser Fusion	0	2943	0	0	0	0	0	0	2943
A968 Synchrotron-based High Energy Radiation Beam	0	4905	0	0	0	0	0	0	4905
A977 Emerging Infectious Diseases	0	0	6957	0	0	0	0	0	6957

A. Mission Description and Budget Item Justification: 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 funds applied research in Department of Defense (DOD) medical protection against naturally occurring diseases of military importance and combat dentistry, as well as applied research for Department of Army care of combat casualties, health hazard assessment of military materiel, and medical factors enhancing soldier effectiveness. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	138264	70136	68014
Appropriated Value	139255	176636	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-991		
b. SBIR / STTR	-3209		
c. Omnibus or Other Above Threshold Reductions		-652	
d. Below Threshold Reprogramming	-501		
e. Rescissions	-552	-1785	
Adjustments to Budget Years Since FY 2001/2001 PB			+7715
Current Budget Submit (FY 2001 PB)	134022	174199	75729

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A838

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A838 Neurotoxin Exposure Treatment	19261	9809	0	0	0	0	0	0	29070

Mission Description and Justification: By Congressional direction, the purpose of this project is to conduct a research program on pathophysiology and treatment of neurodegenerative diseases, including Parkinson's Disease, including environmental and stress-exposure factors encountered in military operations that may be neurotoxic or lead to neurodegenerative diseases. An improved understanding of the pathophysiology of neurodegenerative diseases will form the basis of potential preventive measures against the effects of military threat agents and military operational hazards, and also lead to treatment interventions for Parkinson's Disease.

FY 1999 Accomplishments:

•	19261	- Completed identification of research areas most relevant to neurodegenerative risk, including acquired Parkinsonism, and initiated studies to clarify etiologies, pathologies, and therapeutic strategies (metabolic interventions, neuroprotectants, and restorative therapies) most likely to yield tangible results.
Total	19261	

FY 2000 Planned Program:

•	9545	Expand and continue the program in these six thrust areas: - Conduct a strong basic research program to understand the fundamental nature of neural cell death and dysfunction underlying neurodegenerative diseases. - Identify protective agents that may be useful in neural cell dysfunction. - Develop improved methods for early detection of neurodegenerative disease. - Explore feasibility of new therapeutic strategies for neurodegenerative disease involving transplantation and neuroprotection. - Explore feasibility of new therapeutic strategies for neurodegenerative disease involving gene replication and other novel methods. - Investigate environmental factors that may be associated with neurodegenerative diseases.
•	264	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	9809	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A841

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A841 Minimally Invasive Surgery	11079	9809	0	0	0	0	0	0	20888

Mission Description and Justification: By Congressional direction, this program supports continuation of development of sophisticated computer-based surgery devices. This program will improve technologies developed under the Computer Assisted Minimally Invasive Surgery (CAMIS) program, including integration of an intraoperative ultrasound imaging device, a small fiber endoscope, and application of an intraoperative magnetic resonance imaging device.

FY 1999 Accomplishments:

•	11079	- Developed minimally invasive surgical technologies at the Center for Minimally Invasive Technology (CMIT) at Massachusetts General Hospital.
Total	11079	

FY 2000 Planned Program:

•	9545	- Continue development of minimally invasive surgical technologies at CMIT at Massachusetts General Hospital.
•	264	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	9809	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A843

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A843 Health Technology Roadmaps	1925	0	0	0	0	0	0	0	1925

Mission Description and Justification: By Congressional direction, this program funds the creation of technology roadmaps (e.g., plans for technologies and policies) that will facilitate efficient (advanced medical) technology development, transfer, and science-technology conversion.

FY 1999 Accomplishments:

•	1925	- Completed, at the Department of Energy Sandia National laboratories, plans for technologies and policies that maximize the value of various outputs of advanced technology research and development programs. - Developed a methodology for determining medical applications for which technology can drive down Department of Defense (DOD) medical infrastructure costs. - Demonstrated cost reduction potential and information security aspects of telemedicine applications and efforts by the DOD.
Total	1925	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A845

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A845 Bone Disease Research	2408	6404	0	0	0	0	0	0	8812

Mission Description and Justification: This program is intended to advance bone physiology research that may lead to strategies to improve bone health of young men and women, thereby enhancing military readiness by reducing the incidence of stress fracture during physically intensive training, and reducing the incidence of osteoporosis later in life. Individual health habits that can be encouraged in young recruits may have significant effects on achievement of peak bone mineral accretion and affect other aspects of short- and long-term bone health. Understanding bone remodeling processes triggered by physical training and the relationship to injury susceptibility will reveal appropriate training and other interventions that can reduce bone injuries in military personnel. Identification of predictors of stress fracture susceptibility, efficacious interventions, and treatment strategies for susceptible and injured service members can further reduce the impact of stress fractures on readiness. The ultimate benefits of this program include establishing optimal approaches to bone health of importance to all young Americans, reduction in lost duty time from skeletal injuries, and significant medical cost avoidance for the Department of Defense and the Department of Veterans Affairs. This program fills a specific and previously neglected niche in bone physiology research, supporting a wide range of basic science through applied clinical studies on biomechanical stress on the skeleton. This is also likely to leverage related areas of importance to the military such as muscle remodeling and it supports researchers who can address other questions fundamental to bone physiology and the understanding of bone diseases; research into the pathogenesis of bone diseases substantially supports understanding of normal processes.

FY 1999 Accomplishments:

•	2408	- Determined initial populations at risk for increased bone injuries impacting military readiness. - Conducted studies to clarify individual risk factors for stress fractures, restorative interventions (nutritional, training, and medical treatment) and for predictive biomarkers for field assessment of metabolic status and impending injury. - Laid foundation for longitudinal study of military risk factors for bone injury and body composition changes.
Total	2408	

FY 2000 Planned Program:

•	6231	Expand and continue the program in these six thrust areas: - Conduct a strong basic research program to understand the fundamental nature of mechanical influences on bone cells. - Develop methodology to overcome technological barriers in imaging that will enable sequential studies of functional changes in bone. - Define the role of bone remodeling in stress fracture pathogenesis to determine if it would be beneficial or harmful to block remodeling in recruit training. - Investigate interventions (e.g., calcium-nutrient drinks, weak androgens, oral contraceptives) to improve bone health in men and/or women. - Describe changes in bone density and health in longitudinal studies of young men and women engaged in demanding training program. - Investigate treatments that increase rates of healing after stress fracture.
•	173	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	6404	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology	PROJECT A845

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology		PROJECT: A863

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A863 Battlefield Surgical Replacement	0	2452	0	0	0	0	0	0	2452

Mission Description and Justification: By Congressional direction, the purpose of this program is to establish a process to select medical research projects of clear scientific merit and direct relevance to military health including tissue regeneration for combat casualty care.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 2386 - Awaiting proposal submission for evaluation to be followed by contract award.
- 66 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 2452

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A869

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A869 Telemedicine/Advanced Technology	3183	5213	4467	4480	3306	3499	3566	Continuing	Continuing

Mission Description and Justification: Applied research contributing to casualty avoidance, casualty detection, and evacuation and treatment of casualties through application of physiological status monitoring technologies (biophysical and biochemical sensors and fusion). Research will focus on developing a wearable, integrated system to determine soldier physiological status. This will include developing the ability to quickly and accurately determine when a soldier is minimally impaired but still capable of functioning. By extension, work will also focus on identification and initial development of parallel and supporting technologies and systems, including telecommunications networks, teleconsultation technologies, and telerobotics.

FY 1999 Accomplishments:

- 940 - Began to modify the Land Warrior System to allow wound detection and remote triage communication between individual soldiers and the medic. - Evaluated a miniaturized eye oximeter to assess cerebral blood oxygen content for measures of brain perfusion. Explored use of a miniaturized microimpulse radar unit to assess cardiovascular function.
- 864 - Supported Joint Medical Operations-Telemedicine Advanced Concept Technology Demonstration.
- 1379 - Evaluated a prototype wearable Warfighter Physiological Status Monitoring (WPSM) system for use at the Dismounted Battlespace Battle Lab that has a wireless sensor network (activity, core and skin temperature, geolocation) that collects and stores information in an open, standardized format. Committed funding for basic technology development of a flexible ureteroscopic simulator with various anatomical variations, e.g., normal, benign, cancer, etc. for Endoscopic Simulator Development, Minimally Invasive Surgical Research.

Total 3183

FY 2000 Planned Program:

- 928 - Investigate an advanced pulse oximetry signal analysis capability as a component of a real-time soldier monitoring system. Begin evaluation of a noninvasive physiologic monitoring system for use by medics in the battlefield. Continue exploration of a microimpulse radar unit for noninvasive cardiac output monitoring.
- 1166 - Evaluate acoustic methods to diagnose tension pneumothoraces on the battlefield. Test a first-generation eye oximeter to non-invasively measure blood oxygen saturation and organ perfusion. Begin investigation into a noninvasive intracranial pressure monitor to assess intracranial pressure in closed head trauma.
- 2239 - Test first-generation WPSM for physiological monitoring of soldier status. Interface WPSM system with Land Warrior Dead Reckoning Module to collect mission-specific physiological data from soldiers during field testing.
- 740 - Support Joint Medical Operations-Telemedicine Advanced Concept Technology Demonstration.
- 140 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 5213

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology
	PROJECT A869

FY 2001 Planned Program:

•	2036	- Continue testing noninvasive sensors for Warrior Medic to assist in far-forward remote triage. Continue evaluating Warrior Medic and WPSM electronics. Continue testing intelligent instructional systems to facilitate adaptive learning.
•	927	- Utilize WPSM database, and data acquisition and management capabilities, to support the formulation and testing of modeling strategies to predict individual warfighter status.
•	1504	- Explore and test a variety of medical technology overlays to tactical computing/communicating capability in order to assess performance without injury and to compare data post-injury to pre-injury. Test artificial intelligence/sensor fusion protocols for WPSM.
Total	4467	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A870

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A870 DoD Medical Defense Against Infectious Diseases	23055	23674	24840	25611	28574	30324	32178	Continuing	Continuing

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 1999 Accomplishments:

- 2934 Conducted applied research on vaccines to prevent hepatitis E and to prevent meningitis caused by Group B meningococcus, on a diagnostic device for scrub typhus, on a natural insecticide, and on control of insect vectors of disease.
  - Conducted epidemiological studies of hepatitis E at multiple sites around the world to help assess risk to deployed military forces.
  - Conducted the first human evaluation of a vaccine to prevent hepatitis E.
  - Evaluated a rapid test to detect scrub typhus infection.
  - Conducted animal studies to compare two vaccine candidates for prevention of Group B meningococcal infection needed for further down-selection prior to human clinical studies.
  - Characterized a candidate insecticide that incorporates a chemical naturally produced by bacteria that is toxic to insects.
  - Characterized insect populations and bite rates at field sites for vaccine and drug studies.
- 2201 Conducted applied research on vaccines to prevent the most common causes of bacterial diarrhea.
  - Modified *Shigella* vaccine candidate antigens to try to improve their safety.
  - Evaluated the efficacy of combined *Shigella flexneri* 2a and *Shigella sonnei* vaccine in an animal model and demonstrated feasibility of protection from diverse *Shigella* types using a combination vaccine.
  - Studied proteins involved in the ability of *Campylobacter* to produce diarrheal disease, providing a systematic rationale for vaccine development.
  - Conducted studies to define which toxins and other bacterial factors are associated with disease caused by enterotoxigenic *Escherichia coli* (ETEC), important for design of vaccine candidates.
  - Established laboratory assays to measure intestinal immune response to candidate ETEC vaccines.
  - Identified four new colonization factors that may be important for ultimate development of a protective ETEC vaccine.
  - Cloned and expressed a colonization factor, CS3, for use in an ETEC vaccine based on multiple colonization factors.
  - Completed preclinical studies of CS6 (a candidate ETEC vaccine) necessary for an Investigational New Drug (IND) application to the Food and Drug Administration and ultimate clinical testing.
- 2840 Conducted applied research on vaccines to prevent viral diseases capable of interrupting combat operations.
  - Evaluated the effect of adding compounds to candidate dengue vaccines that target immune cells, necessary for designing optimal vaccine systems for stimulation of a protective immune response in recipients.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology
	PROJECT A870

FY 1999 Accomplishments: (continued)

- Made and characterized two candidate DNA vaccines for two of the four serotypes of dengue.
- Demonstrated the efficacy of candidate vaccines against hantaviruses in an animal model.
- In animal models, demonstrated the safety and the capability to produce an immune response of candidate vaccines against Lassa Fever, Crimean-Congo Hemorrhagic Fever and tickborne encephalitis viruses.

• 4025 Conducted applied research on candidate vaccines for prevention of malaria and on antimalarial drugs to prevent or treat malaria.

- Conducted immunological studies to identify components of the malaria parasite to be used in engineered vaccines, either protein or DNA.
- Used a common bacteria to produce three malaria proteins to use in evaluating the immune response to naturally occurring malaria infections or to use in vaccines to protect against malaria.
- Studied novel routes of immunization with malaria protein and DNA vaccines to determine the impact of immunization route on immune response in the recipient.
- Developed improved methods for immunization with DNA-based vaccines, important for eliciting a more effective immune response in recipients.
- Established and validated a rhesus monkey model for malaria for assessing vaccine strategies for malaria.
- Demonstrated that synthetic compounds of nucleic acids (oligodeoxynucleotides or ODNs) of specific composition are potent inducers of nonspecific immunity and excellent additives for enhancing the immunizing effects of protein-based vaccines.
- Expressed and purified recombinant proteins for five different target proteins for structure-based drug design of novel antimalarial drugs, a necessary step in the rational design of new candidate drugs.
- Expanded existing capabilities to screen antimalarial drugs by developing new animal models. Analyzed the antimalarial activity of novel candidate compounds.
- Developed tests to monitor the development and spread of drug-resistant malaria, important for guiding new drug development and the use of currently available drugs.

• 11055 - Paid administrative overhead costs at the Walter Reed Army Institute of Research (WRAIR).

Total 23055

FY 2000 Planned Program:

• 4051 Conduct applied research on candidate vaccines for prevention of malaria and on antimalarial drugs to prevent or treat malaria.

- Develop standardized methods to reliably measure immune responses to candidate malaria vaccines.
- Conduct preclinical studies of candidate vaccines to support an IND application.
- Develop a method to perform human experiments where the *Plasmodium vivax* parasite can be introduced into human volunteers to test the ability of candidate vaccines to prevent disease caused by *Plasmodium vivax*, the second-most important cause of malaria.
- Synthesize candidate antimalarial drugs or isolate candidate drugs from natural products.
- Develop techniques for the cultivation and drug sensitivity testing of vivax malaria.
- Express target proteins for structure-based drug design and determine modes of action and resistance of parasites to antimalarial drugs.
- Create a deployable field test to assay drug sensitivity patterns in malaria for use in monitoring parasite development of drug resistance.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology — PROJECT: A870

FY 2000 Planned Program: (continued)

- Conduct screening to measure activity or cytotoxicity of candidate drugs.
- Prepare radiolabelled drug candidates for preclinical studies of drug distribution, pharmacokinetics, and metabolism.
- Perform preclinical toxicology studies of new drugs.

• 2254 Conduct applied research on vaccines to prevent the most common causes of bacterial diarrhea.

- Modify candidate live *Shigella* vaccines to reduce vaccine-induced toxicity and/or fecal excretion vaccine organisms while retaining efficacy in prevention of diarrhea.
- Improve candidate live vaccines so that orally administered vaccine organisms can be rapidly identified if they are excreted.
- Devise polyvalent vaccines so that service members can be protected against the many different types of *Shigella* bacteria that could cause diarrhea.
- Characterize ETEC virulence factors to find new potential vaccine components.
- Devise methods to boost mucosal immune responses to oral vaccines.
- Develop an improved animal model for ETEC infection to enable testing of vaccine candidates and prediction of efficacy in animals.
- Improve methods to diagnose ETEC infections, which are needed for testing efficacy of the candidate vaccines in humans.
- Explore new and/or improved animal models of *Campylobacter* enteritis and immunity, including the ferret, the pig, and nonhuman primates.
- Improve methods to diagnose *Campylobacter* infections, which are needed for testing efficacy of candidate vaccines in humans.

• 3045 Conduct applied research on the components of diagnostic tests to be applied to a common diagnostic device for biological defense and infectious disease threats; on vaccines to prevent hepatitis E, scrub typhus, and meningitis caused by Group B meningococcus; and on control of insect vectors of disease.

- Develop infectious disease-specific reagents for malaria, enteric diseases, dengue viruses, and the hemorrhagic fever viruses so they are compatible for use on the portable Common Diagnostic Platform for Biological Defense and Endemic Infectious Diseases capable of detecting and identifying nucleic acids.
- Establish the magnitude of the immune response to hepatitis E virus (HEV) antibody that is necessary to prevent disease.
- Further characterize the human immune responses to HEV infection, disease, and vaccine.
- Refine epidemiology of HEV in Asia and Africa.
- Sustain or refute presence of hepatitis E disease among humans in Latin America.
- Characterize the animal host (particularly rodents) of HEV and the HEV isolates obtained.
- Determine the feasibility of vaccine development against scrub typhus.
- Optimize Group B meningitis candidate vaccine strains.
- Complete animal immunogenicity and safety studies to determine the optimal presentation and formulation of Group B meningitis vaccine.
- Conduct a detailed analysis of the animal and human immune responses to the Group B meningitis candidate vaccines to determine the best antigens.
- Establish a standard insecticide resistance and susceptibility test and test insects capable of transmitting disease to determine if the military insecticides are still effective.
- Evaluate the threat of tick- and chigger-borne diseases to the U.S. military.

FY 2000 Planned Program: (continued)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology
	PROJECT A870

- Begin development and evaluation of a dengue mosquito vector control system consisting of integrated tools and information that can be physically packaged for a preventive medicine detachment (or service equivalent).
- Conduct preliminary development of devices and techniques that may serve as components of a vector control system for mosquitoes that transmit malaria, including a field device for detecting *Plasmodium* in mosquitoes.

• 2844 Conduct applied research on vaccines to prevent viral diseases capable of interrupting combat operations.
- Test candidate dengue vaccines to determine if they will be effective in protecting recipients of diverse genetic backgrounds.
- Validate measures of immune T cell memory and assess the relevance of these immune cells to protection against dengue disease.
- Validate a method for quantifying antibodies that exacerbate dengue disease.
- Characterize determinants leading to severe dengue disease.
- Determine the feasibility of second-generation live dengue vaccines.
- Characterize mechanisms of viral hemorrhagic fever (VHF) and encephalitis pathogenesis.
- Develop candidate VHF and encephalitis vaccines and test in animal models.
- Evaluate antiviral drug candidates for efficacy in vitro and in animal models.
- Develop and evaluate primate monoclonal antibodies for passive protective efficacy in animal models including primates.
- Improve capability to rapidly identify VHF and encephalitis agents in the field and to provide definitive confirmation in reference labs.
- Develop candidate vaccines against one or more hantaviruses and test in animals to assess immune responses and protection.
- Improve capability to rapidly identify, assess risk, and formulate control strategies for hantaviruses to include evaluating therapeutic agents (e.g., human monoclonal antibodies or antiviral drugs) and testing them in cell culture and animals and also isolating and characterizing novel hantaviruses.

• 11056 - Pay administrative overhead costs at WRAIR.

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

Total 23674

FY 2001 Planned Program:

• 5579 Conduct applied research on candidate vaccines for prevention of malaria and on antimalarial drugs to prevent or treat malaria.
- Conduct preclinical studies of DNA vaccines to prevent *P. falciparum* malaria.
- Express proteins encoded by the *Plasmodium vivax* gene homologs of the *P. falciparum* candidate vaccine components and test their ability to induce an immune response in an animal model.
- Develop field sites for *P. vivax* human vaccine trials.
- Develop a field site for testing a drug for treatment of multidrug-resistant malaria.
- Determine a strategy to render the *P. falciparum* multidrug-resistant gene ineffective.

• 2409 Conduct applied research on vaccines to prevent the most common causes of bacterial diarrhea.
- Complete animal trials of candidate *S. dysenteriae* vaccines.

FY 2001 Planned Program: (continued)
- Characterize enteric bacterial proteins identified through genomic sequence data analysis to assess their possible application to vaccine development.

ARMY RDT&E COST ANALYSIS (R-3)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology	PROJECT A870

- Construct candidate polyvalent *Shigella* vaccines and screen in an animal model.
- Characterize the optimal formulation of the ETEC components of the combined enteric vaccine.
- Prepare field sites for the evaluation of the candidate ETEC vaccine.
- Characterize the immune responses associated with recovery from *Campylobacter* infection and subsequent protection from this organism.

•	3066	Conduct applied research on the components of diagnostic tests to be applied to a common diagnostic device for biological defense and infectious disease threats; on vaccines to prevent hepatitis E, scrub typhus, and meningitis caused by Group B meningococcus; and on control of insect vectors of disease. - Transition components of the DNA tests for malaria and dengue to functional use on the common diagnostic platform for biodefense and infectious disease threats. - Assess the threat of hepatitis E to U.S. service members in Africa and Latin America. - Demonstrate the feasibility of immunologic protection against scrub typhus in an animal model and demonstrate efficacy of a candidate scrub typhus vaccine in an animal model. - Genetically alter the Group B meningococcal candidate vaccine strain to enhance the ability to produce it in a vaccine manufacturing process. - Develop a rapid immunological method for detecting Leishmania-infected sand flies. - Test a synthetic replacement for the insect repellent DEET.
•	2730	Conduct applied research on vaccines to prevent viral diseases capable of interrupting combat operations. - Assess the threat of hemorrhagic fever and other highly lethal viruses on military operations. - Define strategies for countering the threat of hemorrhagic fever viruses and other highly lethal viruses. - Develop a cytotoxic T cell technology to evaluate dengue vaccine candidates. - Design generic hemorrhagic fever intervention strategies to interrupt vascular endothelial cell infection and ultimate hemorrhage. - Transition to advanced development a multivalent Hantavirus vaccine to prevent infection with viruses causing hemorrhagic fever with renal syndrome in immunized personnel.
•	11056	- Pay administrative overhead costs at WRAIR.
Total	24840	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A872

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A872 Neurofibromatosis Research	11079	14714	0	0	0	0	0	0	25793

Mission Description and Justification: By Congressional direction, the purpose of this appropriation is only for neurofibromatosis research.

FY 1999 Accomplishments:

- 11079 - Received 21 proposals in October 1998 for the FY 1998 program.
  - Completed peer and programmatic review by April 1999. Awarded nine grants. Received 2-year funds in January 1999 for the FY 1999 program.
  - Held vision setting meeting in April 1999. Published a program announcement in June 1999 and received 48 proposals in September 1999.

Total 11079

FY 2000 Planned Program:

- 14318 - Complete peer and programmatic review by January 2000 and negotiate awards by September 2000 for the FY 1999 program. Receive funds in January 2000, hold vision setting meeting in January 2000, and publish a program announcement in February 2000 for the FY 2000 program. Receive proposals in May 2000 and conduct peer review in August 2000.
- 396 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 14714

FY 2001 Planned Program: Project not funded in FY 2001. Programmatically review and award proposals from the FY 2000 program.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A873

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A873 HIV Exploratory Research	13813	12541	11579	11021	10890	11372	11586	Continuing	Continuing

Mission Description and Justification: This project provides for applied research 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 deployment outside the continental United States. A safe and effective vaccine for prevention of infection and intervention techniques will permit all service members to become worldwide deployable.

FY 1999 Accomplishments:

- 12033 Conducted applied research on novel candidate vaccines to prevent HIV infection, on the human immune response factors that predict protection from HIV infection or disease, on human cohorts for potential testing of HIV vaccines, and on animal models for testing candidate vaccines.
  - Conducted preclinical studies of clade B oligomeric protein vaccine candidates, necessary for advancement to clinical testing.
  - Established domestic and Thai laboratory infrastructure for support of vaccine efficacy trials, important for developing and standardizing measures of vaccine performance in future clinical studies of vaccine candidates.
  - Successfully established a rhesus macaque challenge model for human HIV infection using a simian-human immunodeficiency virus chimeric virus; the model is useful for assessing immunogenicity and protective efficacy of candidate HIV envelope-based vaccines.
  - Constructed and tested a DNA vaccine and demonstrated induction of antibody that is both quantitatively and qualitatively superior to recombinant protein vaccines used alone. The findings are promising and may lead to future vaccines that induce protective responses in recipients.
  - Conducted a vaccine study in baboons that suggests cross-protection of subtype B HIV infection using a single subtype E rgp120 vaccine, important for design of vaccines capable of protecting against multiple subtypes of HIV.
  - Studied viral correlates of HIV transmission and pathogenesis, important for design of vaccines and for selection of measures to be used in clinical studies to characterize and assess vaccine effectiveness.
  - Characterized HIV-specific protective epitopes of vaccine products for national and international use, important for selection and production of candidate vaccine components.
- 1780 - Paid administrative overhead costs at the Walter Reed Army Institute of Research (WRAIR).

Total 13813

FY 2000 Planned Program:

- 10432 Conduct applied research on novel candidate vaccines to prevent HIV infection, on the human immune response factors that predict protection from HIV infection or disease, on human cohorts for potential testing of HIV vaccines, and on animal models for testing candidate vaccines.
  - Evaluate the importance of HIV genotypes in predicting HIV immunotypes necessary for inclusion in an HIV vaccine.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology	PROJECT A873

FY 2000 Planned Program: (continued)

- Define the correlates of immunity to HIV, necessary for vaccine design.
- Establish genetic and phenotypic correlates of drug resistance among HIV-1 clinical isolates, necessary for establishing drug treatment strategies for military dependents.
- Conduct animal studies of candidate HIV vaccines to prevent HIV infection.
- Evaluate and validate a rapid test for field diagnosis of HIV infection.

•	1780	- Paid administrative overhead costs at WRAIR.
•	329	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	12541	

FY 2001 Planned Program:

•	9859	Conduct applied research on novel candidate vaccines to prevent HIV infection, on the human immune response factors that predict protection from HIV infection or disease, on human cohorts for potential testing of HIV vaccines, and on animal models for testing candidate vaccines. - Clinically validate novel diagnostic and prognostic measurements of HIV-1 virological markers, necessary for establishing and standardizing measures of vaccine effectiveness for clinical efficacy studies. - Conduct preclinical studies of novel vaccine candidates.
•	1720	- Pay administrative overhead costs at WRAIR.
Total	11579	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A874

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A874 Combat Casualty Care Technology	10440	8537	8806	9063	10633	11456	12011	Continuing	Continuing

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 1999 Accomplishments:

- 1000 - Awarded contract to study pain management to Guthrie Research Institute for research into sodium channel proteins as potential pain modulators.
- 2250 - Formulated a storage solution that will support refrigerated storage of red blood cells for 10 weeks. Transitioned fibrin bandage/hemostatic dressing to Milestone 0. Tested foam-based hemostatic agents in preclinical animal models. Developed and tested animal models for evaluating the life span and functionality of platelets after liquid storage for 5 days. Assessed the effects of hemolyzed red blood cells on nitric oxide production by leukocytes and survival in hemorrhage and reinfusion.
- 1916 - Established reverse transcriptase/polymerase chain reaction assay for the quantification of tissue cytokine mRNA synthesis after hemorrhagic shock. Established human bronchial/tracheal and small airway epithelial cell model and determined that the toxicity of smoke is unrelated to carbon monoxide poisoning. Investigated the effects of heme proteins on nitric oxide levels and cell viability in polymorphonuclear leukocytes. Studied the apoptotic response of skin epithelial cells to burns and identified apoptotic markers and kinetics. Continued development of a miniature version of the Combat Support Trauma and Transport (CSTAT) – the miniSTAT – as a far-forward intensive care and diagnostic support platform. Evaluated methods to treat tension pneumothoraces. Investigated microencapsulated antioxidants and their effects on wound healing in animal models.
- 2383 - Supplemented Life Support for Trauma and Transport (LSTAT) platform.
- 2891 - Completed study demonstrating antimicrobial efficacy of coated stainless steel external fixator pins in an animal model of bone fracture. Received Food and Drug Administration (FDA) approval and concluded study on 5% aqueous sulfamylon soaks used in topical treatment of burns. Supported Joint Medical Operations-Telemedicine Advanced Concept Technology Demonstration. Paid general and administrative expenses for the Institute of Surgical Research.

Total 10440

FY 2000 Planned Program:

- 1168 - Evaluate the enhancement of clot expression and integrity with procoagulant and antifibrinolytic agents during hypothermia. Examine the potential for transfusion-related multiple organ failure after transfusion of extended storage-life red blood cells. Evaluate the potential use of FDA-approved drugs to decrease blood loss after severe liver injury. Assess the importance of hypothermia as an inducer of coagulopathy during hemorrhage. Continue to develop liquid red blood cell storage system to achieve 12-week storage. Begin evaluation of techniques for the formulation and assessment of efficacy and safety of dried plasma products.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology
	PROJECT A874

FY2000 Planned Program: (continued)

•	1223	- Evaluate hypotensive resuscitation after hemorrhage as an optimal resuscitation strategy on the battlefield. Determine arterial pressure at which rebleeding occurs during resuscitation in an aortotomy model to identify an important resuscitation parameter. Evaluate hypertonic fluid therapy for resuscitation after combined brain trauma and hemorrhage. Investigate methods to protect endothelial cell integrity after ischemia/reperfusion injury. Investigate the use of cytofluorometric measures to select combined therapies to inhibit inflammation after hemorrhage and resuscitation. Test efficacy of lisofylline to protect hepatic function and plasma volume following severe trauma and delayed resuscitation.
•	1355	- Examine antioxidative neuroprotective efficacy of polynitroxyl hetastarch and the oxygen-carrying red blood cell substitute polynitroxyl hemoglobin. Test n-acetylaspartylglutamate and n-acetylated linked acidic dipeptidase inhibitors to protect against ischemia/reperfusion injury. Investigate poly (ADP-ribose) polymerase as a target for neuroprotective therapies following traumatic brain injury. Undertake a pharmacodynamic study of lisofylline in burn patients with inhalation injury. Investigate defective immune responses following exposure to heat. Establish models to examine protection from smoke inhalation injury in human bronchial/tracheal and small airway epithelial cells. Identify and quantitate inflammatory mediator mRNA alterations after hemorrhage by cDNA microarray assay. Develop inhibitors of constitutive nitric oxide synthase to prevent injury caused by ischemia.
•	4638	- Develop methods for sterilization of dental equipment at far-forward locations. Continue development of mini-STAT to provide casualty monitoring and support in far-forward localities. Pay general and administrative expenses for the Institute of Surgical Research. Support Joint Medical Operations-Telemedicine Advanced Concept Technology Demonstration.
•	153	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	8537	

FY 2001 Planned Program:

•	1900	- Test miniature version of the CSTAT – the miniSTAT – as a far-forward intensive care and diagnostic support platform. Continue development of a noninvasive physiologic monitoring system for use by medics on the battlefield. Continue development of in vivo models and testing of therapies for ischemia/reperfusion injury in brain, spinal cord, and other organs. Complete preclinical evaluation of anticaries and antiplaque peptides. Complete evaluations of topical anti-infective agents.
•	1965	- Continue to evaluate treatments for smoke and thermal inhalation injuries. Continue research into the treatment of burns. Conduct evaluations of wound and injury repair techniques to correct battle or training injuries. Investigate the diagnosis and treatment of blunt trauma injuries. Continue development of medical surgical devices to simplify treatment of trauma in austere environments.
•	1841	- Continue evaluation of techniques for the formulation and assessment of efficacy and safety of dried plasma products that will replace frozen product. Evaluate non-fibrin-based hemostatic dressings. Continue testing of fibrin foam-based hemostatic agent. Complete testing of storage solution for 10-week storage of red blood cells.
•	3100	- Pay general and administrative expenses for the Institute of Surgical Research.
Total	8806	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A878

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A878 Health Hazards of Military Materiel	8329	9267	10642	11369	11718	12182	12700	Continuing	Continuing

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 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 1999 Accomplishments:

- 2518 - Identified a safe range of helmet weights and centers of mass that can be tolerated by female helicopter pilots without affecting health or performance. Discovered that helmet mass design criteria for female and male helicopter aviators are the same based on head motion but may be different based on performance indicators.
- 1111 - Confirmed the validity of the U.S. Army Fluid Replacement Guidelines for hot weather training to ensure prevention of dehydration without causing overhydration problems.
- 1376 - Refined predictive model of toxic combustion gas incapacitation with incorporation of results from halon fire suppressant alternatives and injury biomarker studies.
- 1488 - Developed and beta tested an initial version of the Laser Accident and Incident Registry. Developed data query system for analysis of laser accidents and incidents.
- 1836 - Completed first phase of a low-cost method for identifying coliform bacterial growth on membrane filters that reduces time to identification by about 75% (2-4 hours).

Total 8329

FY 2000 Planned Program:

- 2498 - Study injury mechanisms for exposure conditions inherent to military lasers operating in the visible and near infrared region of the spectrum to refine operational exposure limits.
- 1473 - Validate the application of the Frog Embryo Assay, Xenopus (FETAX) assay as a screening tool to evaluate militarily relevant chemicals: TNT, RDX, HMX, their breakdown products, and select mixtures, for their ability to cause birth defects.
- 3242 - Incorporate data on pathophysiology of combined fire gas exposure into combined gas injury incapacitation predictive models using scaling rules developed to extrapolate data from small and large animals to humans.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology
	PROJECT: A878

FY 2000 Planned Program: (continued)

•	815	- Complete validation of cold water immersion safety limits for Ranger training using data from temperature pills collected in free-ranging Ranger students.
•	1044	- Develop standardized baseline UH-60 simulator, flight performance database for application within spatial disorientation and sustained operations studies.
•	195	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	9267	

FY 2001 Planned Program:

•	2997	- Develop treatment guidance for a field therapy kit for laser-induced retinal injury.
•	3089	- Validate predictive finite element models of blunt trauma, incorporating impact measurement, response model, and injury correlates.
•	1026	- Develop predictive models of head-supported mass and neck injury for aviation applications using manikins and validate performance-based modeling with in-flight testing.
•	2265	- Evaluate the effects of physical fatigue, sleep deprivation, and other operational stressors on the pathophysiological responses to acute or chronic cold exposures.
•	1265	- Assess the impact of fatigue countermeasures and training on prevention of spatial disorientation accidents.
Total	10642	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology
	PROJECT A879

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A879 Medical Factors Enhancing Soldier Effectiveness	7759	8019	8438	8725	9015	10214	10739	Continuing	Continuing

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 1999 Accomplishments:

•	1294	- Demonstrated that low aerobic fitness was a significant risk factor for serious injury in both men and women upon entry into basic combat training.
•	1246	- Developed initial computer models for the assessment of the effects of grayscale levels and letter legibility on performance. Developed an image-capture system and software analysis program to determine image characteristics with respect to spatial frequency and contrast levels. Completed initial tests to determine optimal time over target of laser projection system for head-mounted display.
•	833	- Determined that the thermoregulatory system "fatigues" as indicated by blunting of metabolic heat production when multiple cold exposures are repeated within a day.
•	2650	- Discovered problem side effect with Modafinil in aviators with multiple high doses.
•	1736	- Developed and refined integration of SCENARIO model into MERCURY for reliable prediction of physiological responses to heat and cold stress application in training and operations for both mounted and dismounted soldiers.
Total	7759	

FY 2000 Planned Program:

•	1346	- Quantify effects of current and developmental load-carrying gear, clothing, and individual equipment configured for specific squad positions on the biomechanics and physical performance of warfighters.
•	1824	- Study the effects of high OPTEMPO/PERSTEMPO on soldier and unit readiness for a wide range of military outcomes including marksmanship, soldier retention, and soldier physical and psychological health.
•	2616	- Validate models for predicting the water and metabolic requirements of warfighters operating in mountain environments.
•	967	- Develop interim Health Hazards Assessment method and standard for repeated jolt.
•	1139	- Transition caffeine research, including data on formulations, optimal dosing, and effects in habituated and nonhabituated users, to a caffeine product and/or guidance for caffeine use in the field.
•	127	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	8019	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology
	PROJECT A879

FY 2001 Planned Program:

•	1297	- Demonstrate efficacy of local vasodilators to maximize regional dry heat loss in combination with current microclimate cooling techniques.
•	1580	- Simulate cardiovascular parameters and body fluid shifts to better predict initial stages of heat injury and to model effects of dehydration.
•	1618	- Demonstrate modafinil efficacy for militarily relevant performance sustainment in flight and in field environments.
•	1354	- Identify application of objective physiological test such as voice stress analysis and pupillometry to assess military performance including study of a company-size unit during a real-world mission employing biostatus monitors.
•	2589	- Determine how characteristics of carried loads affect the biomechanical and performance parameters and extend the gait model to accommodate varying terrain conditions.
Total	8438	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A921

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A921 Ovarian Cancer Research	0	11771	0	0	0	0	0	0	11771

Mission Description and Justification: By Congressional direction, the purpose of this appropriation is only for ovarian cancer research.

FY 1999 Accomplishments: Funded within the Defense Health Program in FY 1999.

FY 2000 Planned Program:

- 11454 - Determine FY 2000 vision in a meeting in February 2000. Receive and evaluate proposals.
- 317 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 11771

FY 2001 Planned Program: Project not funded in FY 2001. Award proposals from the FY 2000 program.

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A948

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A948 Portable Cardiopulmonary Bypass Pump and Oxygenator	1925	0	0	0	0	0	0	0	1925

Mission Description and Justification: By Congressional direction, conduct research to advance cardiopulmonary bypass pump and oxygenator technology.

FY 1999 Accomplishments:

•	1925	- Completed review of proposals and conducted peer reviews. - Developed a re-usable but ultimately disposable driver for the pump of the cardiopulmonary bypass fund system.
Total	1925	

FY 2000 Planned Program: Project not funded in FY 2000. Award contract for FY 1999 research grant.

FY 2001 Planned Program: Project not funded in FY 2001.

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A949

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A949 Advanced Cancer Detection	3374	0	0	0	0	0	0	0	3374

Mission Description and Justification: By Congressional direction, the purpose of this appropriation is only for Advanced Cancer Detection.

FY 1999 Accomplishments:

•	3374	- Received 2-year funds in January 1999. Published a program announcement in March 1999. - Completed scientific peer review and programmatic review in July 1999. Funded one proposal in full and working with the University of South Florida on a scientifically meritorious proposal for the balance of the appropriation.
Total	3374	

FY 2000 Planned Program: Project funded under program element 0603002, project 818 in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology		PROJECT: A950

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A950 Teleradiology	2890	0	0	0	0	0	0	0	2890

Mission Description and Justification: By Congressional direction, this program funds continuation of efforts to develop 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 1999 Accomplishments:

•	2890	- Grant awarded and cooperative research and development efforts conducted between the Uniformed Services University of the Health Sciences and the University of South Florida.
Total	2890	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A951

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A951 Diagnostic and Surgical Breast Imaging	1926	0	0	0	0	0	0	0	1926

Mission Description and Justification: By Congressional direction, the purpose of this appropriation is only for Diagnostic and Surgical Breast Imaging.

FY 1999 Accomplishments:

•	1926	- Received 2-year funds in January 1999. Published a program announcement in March 1999. Received and peer reviewed two proposals. Neither proposal was recommended for funding at programmatic review. The Commanding General of the United States Army Medical Research and Materiel Command, directed re-competition. - Re-advertised the project on August 26, 1999 and received 23 proposals by October 1999.
Total	1926	

FY 2000 Planned Program: Project not funded in FY 2000. Conduct scientific peer review and programmatic review by early March 2000 and make initial awards by May 2000 for FY 1999 awards.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A952

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A952 Musculoskeletal Injuries	1926	5885	0	0	0	0	0	0	7811

Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for musculoskeletal injuries.

FY 1999 Accomplishments:

•	1926	- Evaluated competitive contracts/grants to initiate research on musculoskeletal injuries. Awarded research grants.
Total	1926	

FY 2000 Planned Program:

•	5727	- A solicitation for research proposals will be developed and competed.
•	158	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	5885	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology		PROJECT: A953

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A953 Disaster Relief and Emergency Medical Services	9630	9809	0	0	0	0	0	0	19439

Mission Description and Justification: By Congressional direction, this program funds efforts to improve the delivery of emergency medical services through basic physiologic research and advances in the application of information and advanced medical technologies.

FY 1999 Accomplishments:

- 9630 - Continued development of disaster relief and emergency and biological medical response capability at the University of Texas – Houston and Texas A&M.

Total 9630

FY 2000 Planned Program:

- 9545 - Continue development of disaster relief and emergency and biological medical response capability at the University of Texas – Houston and Texas A&M.
- 264 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 9809

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A962

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A962 Polynitroxylated Hemoglobin	0	1962	0	0	0	0	0	0	1962

Mission Description and Justification: By Congressional direction, the purpose of this program is to establish a process to select medical research projects of clear scientific merit and direct relevance to military health including polynitroxylated hemoglobin.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 1909 - Awaiting proposal submission for evaluation to be followed by contract award.
- 53 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 1962

FY 2001 Planned Program: Project not funded in FY 2000.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology		PROJECT: A963

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A963 National Medical Testbed	0	14714	0	0	0	0	0	0	14714

Mission Description and Justification: By Congressional direction, the purpose of this program is to conduct wide-ranging research that will explore, demonstrate, and evaluate technologies and systems that facilitate delivery of health care to distributed, underserved populations, including deployed active duty service members and the general civilian population.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	14318	- Award cooperative (research) agreement to the Loma Linda University Medical Center to conduct exploratory research and development of various advanced medical (and supporting nonmedical) technologies, and clinical and epidemiological studies that support optimal provision of surgical, trauma, and emergency health care in a (military/civilian) community setting.
•	396	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	14714	

FY 2001 Planned Program: Project not funded in FY 2000.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology		PROJECT: A964

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A964 Infomatics-based Medical Emergency Tools	0	4414	0	0	0	0	0	0	4414

Mission Description and Justification: By Congressional direction, the purpose of this program is to conduct research that will explore, demonstrate, and evaluate various (medical and nonmedical) informatics tools and systems that will enhance emergency medical diagnosis, treatment, and patient regulation when time is a critical variable that will determine mortality and morbidity.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	4295	- Award cooperative research agreement to conduct exploratory development and demonstration of clinical decision support module, device, and architecture that will enhance diagnosis, treatment, and patient management (e.g., traumatic and chemical/biological mass casualties.
•	119	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	4414	

FY 2001 Planned Program: Project not funded in FY 2000.

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A965

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A965 Eye Research	0	1962	0	0	0	0	0	0	1962

Mission Description and Justification: By Congressional direction, the purpose of this program is to support collaborative efforts in exploratory low vision eye research.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	1909	- Award cooperative research agreement to conduct exploratory research and development and demonstrate devices (e.g., instrumentation research) and techniques that prevent, facilitate treatment of, and minimize the effects (on human behavior) of low vision.
•	53	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	1962	

FY 2001 Planned Program: Project not funded in FY 2000.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A Medical Technology		PROJECT A966

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A966 Blood Research	0	5395	0	0	0	0	0	0	5395

Mission Description and Justification: By Congressional direction, the purpose of this program is for research into improved blood products and safety in systems compatible with military field use.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 5250 - Awaiting proposal submission for evaluation to be followed by contract award.
- 145 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 5395

FY 2001 Planned Program: Project not funded in FY 2000.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602787A Medical Technology		PROJECT: A967

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A967 Dye Targeted Laser Fusion	0	2943	0	0	0	0	0	0	2943

Mission Description and Justification: By Congressional direction, the purpose of this program is for research into tissue repair systems.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 2864 - Awaiting proposal submission for evaluation to be followed by contract award.
- 79 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 2943

FY 2001 Planned Program: Project not funded in FY 2000.

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A968

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A968 Synchrotron-based High Energy Radiation Beam	0	4905	0	0	0	0	0	0	4905

Mission Description and Justification: By Congressional direction, the purpose of this program is to conduct research that will explore, demonstrate, and evaluate the application of proton beam radiation therapy (supported by three-dimensional imaging and planning applications) to the treatment of various types of cancer.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	4773	- Award cooperative research agreement to Loma Linda University Medical Center to conduct exploratory development, integration, and demonstration of an accelerator and switchyard that will enable precise, extended delivery of proton beam radiation therapy in a treatment room/facility. Funds are currently awaiting release by OSD for FY 2000.
•	132	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	4905	

FY 2001 Planned Program: Project not funded in FY 2000.

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

DATE: February 2000

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602787A Medical Technology

PROJECT: A977

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A977 Emerging Infectious Diseases	0	0	6957	0	0	0	0	0	6957

Mission Description and Justification: The scientific and technical objectives for this project focus on accelerating development of infectious disease threat countermeasures necessary to support operations in nonindustrialized countries and those in which infrastructure has been damaged or destroyed. It will also fund the necessary research to counter the military operational impact of emerging infectious diseases.

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

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program:

- 6957 - Complete applied research to characterize possible tools and components of protective measures against emerging infectious diseases.

Total 6957

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602789A Army Artificial Intelligence Technology PROJECT 880

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
880 ARMY AI TECH	1119	1267	1338	1370	1407	1519	1591	0	0

A. **Mission Description and Budget Item Justification:** The goal of the Intelligent Technology (IT) exploratory development program is to mature emerging intelligent 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 emerging intelligent technology to solve large scale, highly complex management problems; (2) apply emerging intelligent 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 intelligent 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 Intranet tools focusing on the integration and application of intelligent 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. 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 Knowledge Online (AKO) General Officer Steering Committee (GOSC) and is managed solely by the US Army Strategic and Advanced Computing Center, Pentagon.

FY 1999 Planned Program:

•	1119	- Demonstrated use of knowledge management and emerging intelligent technologies to develop a secure Intranet Knowledge Centers for Officers, soldiers, and DA Civilians across the Army. - Developed the Officer Personnel Management System (OPMS) XXI Knowledge Center, which provides officers across the Army access to latest career field and professional development information; it also allows officers to submit knowledge-based career field designation (CFD) forms.
Total	1119	

FY 2000 Planned Program:

•	1233	- Develop and apply an architecture implementation plan that will allow the current AKO project to scale up to support the entire Army. - Continue to incorporate the latest and best Knowledge Management (KM) and Intranet technologies to support the Army. - Develop a secure 'Army Portal', which offers user-tailorable knowledge channels, a "message of the day" and knowledge search capabilities. - Expand development of the OPMS XXI Knowledge Center to include additional officer year groups and three additional knowledge-based career forms.
•	34	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs.
Total	1267	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602789A Army Artificial Intelligence Technology — PROJECT: 880

FY 2001 Planned Program:

- 1338 - Implement an architecture that allows the current AKO project to scale up to support the entire Army.
  - Continue to review, evaluate an incorporate the latest and best KM, Intranet, or other evolving technologies to support the Army.
  - Evolve and improve the capabilities of the Army Portal.
  - Expand the functionality and usefulness of the OPMS XXI Knowledge Center and other knowledge centers associated with AKO.

Total 1338

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	1156	1276	1346
Appropriated Value	1164	1276	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-8		
b. SBIR / STTR	-31		
c. Omnibus or Other Above Threshold Reductions		-5	
d. Below Threshold Reprogramming			
e. Rescissions	-6	-4	
Adjustments to Budget Years Since FY 2000/2001 PB			-8
Current Budget Submit (FY 2001 PB)	1119	1267	1338

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602805A Dual Use Science & Technology (DUST) Program PROJECT A105

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A105 Dual Use Science & Technology (DUST) Program	9388	9924	10154	10447	10889	11846	12906	Continuing	Continuing

A. Mission Description and Justification: The goal of the Dual-Use Science & Technology (DUST) Program 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 (i.e., 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 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 of the Army for Research and Technology. Beginning with FY2000 and continuing into FY2001 and beyond , the Army examines new proposals' relationships to the Army's warfighter-approved Science and Technology Objectives (STOs) to ensure warfighter buy-in and eventual transition to fielded programs. Proposals supporting STOs receive a higher priority for selection.

FY 1999 Accomplishments:

- 9388 - Provided up to 25% of funding for dual-use technology projects proposed by industry to meet Congressionally mandated goal of 7% of Army 6.2 funding being allocated to support dual use technology development. The FY99 solicitation yielded 51 proposals, from which 27 were selected in the Focus areas of AFFORDABLE SENSOR TECHNOLOGY - IR Helmet Sights, Lockheed Martin; Infrared Autonomous Remote Micro Sensors, Boeing; Low Cost Microsensors and Applications, Raytheon Systems Company; AIRCRAFT SUSTAINMENT - Integrated Platform Electronics for Manned/Unmanned Rotorcraft, McDonnell Douglas Helicopter; Advanced Tonal Noise Control Technology Development, Rotorcraft Industry Technology Associates (RITA); Advanced Geometric Modeling (Integrated Helicopter Design Tools, IHDT), RITA; Magnetic Damper for Bearingless Rotor Systems, Bell Helicopter Textron; Advanced Electric Wheel Drive Technology, General Dynamics Land Systems; Low-Cost Manufacture of a Composite Bearingless Tail Rotor, RITA; Advanced Skin Concepts for Rotorcraft Structure, RITA; Smart Antenna Applications for Army Airborne Reconnaissance Systems (SAARS), Lockheed Martin; Smart & Multifunction Rotorcraft Antennas, Boeing; Smart Starting, Lighting and Ignition (SLI) Battery, PowerSmart, Inc.; Advanced Vibration Reduction Concepts, RITA; Next Generation Electrical Architecture (NGEA),

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602805A Dual Use Science & Technology (DUST) Program PROJECT A105

Oakland University; Asian-Pacific Rim Portable Translator, Systran Software Inc.; FUEL EFFICIENCY AND ADVANCED PROPULSION TECHNOLOGY - Variable Geometry Advanced Rotor Technology (VGART) – 1, Boeing; Variable Geometry Advanced Rotor Technology (VGART) -2, Sikorsky Aircraft Corporation; Variable Geometry Advanced Rotor Technology (VGART) – 3, Bell Helicopter Textron, Inc.; Improved

FY 1999 Accomplishments: (continued)

Materials and Powertrain Architectures for 21st Century Trucks (IMPACT), Ford Motor Company;; INFORMATION SYSTEMS AND TECHNOLOGY - Commercial-Quality Machine Translation for Arabic and/or Persian, Applications Technology, Inc; Enhanced Wireless LAN (WLAN) Technology for Mobile Applications, Rockwell Collins, Inc.; Internet Attack Simulator, GTE Government Systems; Bandwidth Brokers for Quality of Service (QoS) Support in IP-Based Networks for Integrated Desktop, Telecordia Technologies, Inc.; MEDICAL TECHNOLOGIES - Simulation Technologies for Advanced Trauma Care, Research Triangle Institute (RTI); Advanced Nonthermal Ration Technologies, Ohio State University; Low-Power High-Resolution Portable UltraSound with Color-Flow Imaging, Teratech Corporation.

Total 9388

FY 2000 Planned Program:

- 9657 - Provide up to 25% of funding proposed by industry to support dual use technology development. The FY00 solicitation yielded 87 proposals, from which 11 proposals were selected in the following Focus areas: AFFORDABLE SENSOR TECHNOLOGY – Miniature Electron Bombarded Active Pixel Sensor, Low Light Level Camera , and Long Range Eyesafe Laser Imaging; WEAPONS SUSTAINMENT – High Pressure Food Processing Low Acid Foods; Increased Situational Awareness; ADVANCED MATERIALS AND MANUFACTURING – Manufacture of Single Crystal Tungsten Alloys; Electrokinetic Phytoreclamation; INFORMATION AND COMMUNICATIONS – Enhanced Terrestial Personal Computers Technology for Tactical Applications; DISTRIBUTED MISSION TRAINING - Rapid Command and Control Data Visualization and Decision Making via War Gaming Technology; ADVANCED PROPULSION, POWER, AND FUEL – Fuel Cell Hybrid Electric Vehicle; MEDICAL AND BIOENGINEERING – A Portable High-Throughput System for Biological Sample Preparation; An Intra-Operative Acoustic Hemostasis Device for Trauma Care; Development of Arrayable Electronic System for Identification of Biological Warfare and Infectious Disease.
- 267 Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Reauthorization Act of 1992.

Total 9924

FY 2001 Planned Program:

- 10154 - Provide up to 25% of funding for dual-use technology projects proposed by industry. Focus areas for Army topics in FY01 are: Affordable Sensors; Weapons System Sustainment; Advanced Propulsion, Power & Fuel Efficiency; Information & Communications Systems; Medical & Bioengineering Technologies; Distributed Mission Training; Advanced Materials & Manufacturing; and Environmental Technologies.

Total 10154

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602805A Dual Use Science & Technology (DUST) Program — PROJECT: A105

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	9935	18222	18217
Appropriated Value	10000	10000	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-65		
b. SBIR / STTR	-263		
c. Omnibus or Other Above Threshold Reduction		-41	
d. Below Threshold Reprogramming	-246		
e. Rescissions	-38	-35	
Adjustments to Budget Years Since FY 2000/2001 PB			-63
New Army Transformation Adjustment			-8000
Current Budget Submit (FY 2001 PB)	9388	9924	10154

Change Summary Explanation: Funding – FY 2001: 8000 decrease in support of the New Army Transformation.

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	30322	44831	15469	17268	17232	22973	23999	Continuing	Continuing
DC07 Joint Service Combat Feeding Technology Demonstration	1925	2064	2167	2212	2274	2283	2396	Continuing	Continuing
DJ50 Future Warrior Technnology Integration	6587	6266	6308	7483	7772	12954	13056	Continuing	Continuing
D242 Airdrop Equipment	1212	1875	2330	2916	3547	3793	3976	Continuing	Continuing
D393 Military Operations in Urban Terrain	19853	20087	3874	3857	0	0	0	0	66969
D543 Ammunition Logistics	745	778	790	800	811	969	1598	Continuing	Continuing
D594 Metrology and Calibration	0	981	0	0	0	0	0	0	0
D557 Biosystems Technology	0	5885	0	0	0	0	0	0	0
DJ51 Combat ID for Dismounted Soldiers	0	6895	0	0	0	0	0	0	0
D545 Force Projection Logistics	0	0	0	0	2828	2974	2973	Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u>: This program element demonstrates technology for the individual soldier that is essential to support and sustain wartime operations and peacetime readiness. The 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 sustainment (O&S) costs, and improve ammunition logistics system performance. The Joint Service Combat Feeding Technology project demonstrates technologies for food service systems and food products to include processing, preservation, packaging and equipment and energy technologies that improve field feeding, ration quality, and warfighter combat effectiveness. The Future Warrior Technology Integration project 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. The Airdrop Equipment project provides enhancements for rapid deployment required for dropping cargo to precise locations from higher altitudes, greater offset distances and higher speeds, resulting in increased survivability of aircraft and crews, and increased probability that materials delivered will land in a usable condition. The Military Operations in Urban Terrain (MOUT) Advanced Concept Technology Demonstration (ACTD) will identify, integrate, and demonstrate a system of systems approach of existing and emerging technologies to provide improved command, control, communications, computers 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,

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material handling equipment, and ammunition throughput/management for improved munitions availability and survivability. Contractors performing the work for this PE include Tecogen, United Technologies, 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 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 and by the DoD Technology Area Review and Assessment (TARA) Review process. Work in this program element is related to and fully coordinated with efforts in PE 0602786A (Warfighter Technology), and Defense Advanced Research Projects Agency (DARPA) Small Unit Operations projects. 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. The reduction from FY 2000 to FY2001 is due to the conclusion of the MOUT ACTD culminating demonstration.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	30430	31287	16337
Appropriated Value	30669	45287	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-239		
b. SBIR / STTR	-223		
c. Omnibus or Other Above Threshold Reductions		-146	
d. Below Threshold Reprogramming	+161		
e. Rescissions	-46	-310	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-868
Current Budget Submit (FY 2001 PB)	30322	44831	15469

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology		PROJECT DC07

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DC07 Joint Service Combat Feeding Technology Demonstration	1925	2064	2167	2212	2274	2283	2396	Continuing	Continuing

Mission Description and Justification: The goal of the Joint Service Combat Feeding Technology Demonstration project is to develop and demonstrate nutritionally advanced rations, biosensor technologies, and logistically streamlined combat feeding systems with enhanced fuel efficiencies to decrease the combat feeding logistics tail. The project focuses on demonstrations of advances in combat rations technology, materials, energy utilization, and heating technologies to provide efficient and effective 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 a DoD program for which the Army has Executive Agent responsibility and is managed by the U.S. Army Natick Soldier Center, Natick, MA.

FY 1999 Accomplishments:

- 1159 - Completed design and fabricated Central Heat Unit Cogeneration Kitchen (CHUCK wagon) featuring thermal fluid heat transfer and integral cogenerator; demonstrated CHUCK wagon's potential as a revolutionary technology concept for future Army field feeding systems; demonstrated increased mobility (High Mobility Multi-Purpose Wheeled Vehicle vs. 2 ½ ton truck), 50% decrease in fuel consumption, ease of use, and ability to prepare higher quality meals faster and cheaper than current kitchens; transitioned CHUCK wagon technology to Program Definition and Risk Reduction.
- 766 - Developed and demonstrated producibility of interactive packaging technologies and quantified the effects of interactive packaging on improving ration acceptance, while decreasing weight/volume of packaged rations.
  - Modeled the positive effects of incremental differences in carbohydrate sources on mission effectiveness and completion.
  - Demonstrated, in collaboration with the United States Department of Agriculture (USDA), revolutionary shock wave technologies, for processing meat items for combat rations with improved sensory qualities.
  - Identified commercial and developmental items and initiated acceptance and storage testing to support an expanded family of novel, shelf-stable breakfast items for on-demand combat field feeding.

Total 1925

FY 2000 Planned Program:

- 812 - Conduct studies to evaluate different classes of ethylene inhibiting and blocking products to extend the shelf-life of fresh fruits and vegetables for military feeding systems.
  - Complete product acceptance and shelf-life studies on family of novel, shelf-stable breakfast items for combat rations; complete menu design.
  - Develop and demonstrate formulas and evaluate packaging alternatives for improved shelf-stable pouch bread.
  - Complete demonstration of interactive packaging technologies which maintain initial ration component quality while extending shelf-life, and transition to fielded ration systems.

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology PROJECT DC07

FY 2000 Planned Program: (continued)

•	687	- Complete interactive studies of potential packaging films for irradiated foods and support development of additional American Society of Testing and Materials (ASTM) standards. - Develop and complete field demonstration of revolutionary radio frequency processed group ration components which significantly reduce degradative effects of conventional thermal processing, and coordinate with FDA and USDA for regulatory process approval. - Demonstrate the effects of acoustical matching with product type, packaging material, and hydrodynamic shock waves to improve meat component texture for combat ration optimization.
•	537	- Develop rudimentary modeling capability within the Integrated Unit Simulation System (IUSS - individual/small unit force-on-force model) to baseline an individual's "available energy" to perform select military tasks. - Conduct small-scale tech demo to downselect miniaturized biosensor probe to ensure microbiological/chemical safety of both fresh prepared and packaged rations, and prepare for user/field testing of the system.
•	28	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).
Total	2064	

FY 2001 Planned Program:

•	720	- Develop and integrate fuel reformer, fuel cell, and thermal fluid heat exchanger in field kitchens, and conduct technology demonstration to validate reduced fuel consumption, increased combustion efficiency, user safety and maximize equipment capabilities. - Develop and fabricate conceptual Self Heated Meals for Remote Site Feeding (reducing weight and cube by 80% over conventional system) and demonstrate to obtain user feedback/acceptance on ease-of-use, heat transfer and safety.
•	1447	- Demonstrate portable combat ration biosensor system for validating the wholesomeness and safety of combat rations, and transition to Veterinary Command. - Develop and evaluate prototype delivery systems to extend the shelf-life of fresh fruit and vegetables for military feeding systems reducing demand for replenishment supplies. - Extend the IUSS to dynamically track an individual's "level of fatigue" based on "available energy" minus energy expenditures (task performance) to optimize combat ration consumption. - Conduct testing for improved USAF tube foods for high altitude reconnaissance to maintain high levels of pilot cognitive skills. - Complete assessment of irradiated foods with enhanced safety to extend shelf-life, increase variety, and reduce weight and cube of combat rations. - Demonstrate improved pouch bread with warriors and transition to DLA.
Total	2167	

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BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology — PROJECT: DJ50

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DJ50 Future Warrior Technnology Integration	6587	6266	6308	7483	7772	12954	13056	Continuing	Continuing

Mission Description and Justification: The expanding mission of today's soldier requires that superior advanced technologies be integrated onto the soldier platform so that individuals and small units can be effective against all anticipated threats. The Land Warrior (LW) system will be the first ever fully integrated warrior system. This new system requires technology upgrades to maintain combat overmatch and to keep pace with the quickly moving electronics and computer industries. The Future Warrior Technology Integration project addresses the critical areas of weight, power requirements, fightability and cost of the Land Warrior system. In the near term, the Future Warrior Technology Integration project focuses on completing the maturation of integrated navigation, system voice control and LW combat identification into the LW system and on developing tethered hardware and software interfaces among LW, the Objective Individual Combat Weapon (OICW) and Javelin weapon systems. The Future Warrior Technology Integration project will utilize baseline LW systems to develop and demonstrate the following technology upgrades for transition as Pre-Planned Product Improvements: OICW and Javelin interfaces with less than three frame latency, an integrated medical monitoring system, and emerging commercial electronics and software that require 10% less power than the baseline LW. The project also will participate in Defense Advanced Research Projects Agency (DARPA) Small Unit Operations/Situation Awareness Systems (SUO/SAS) and Global Mobile Operations (GloMo) evaluations to measure SUO/SAS and GloMo technologies performance within the LW platform, transition the most viable technologies, and will demonstrate the viability of an advanced combat uniform system to include an integrated personal area network. This project is managed by the US Army Natick Soldier Center, Natick, MA.

FY 1999 Accomplishments:

- 3294 - Assessed and developed future technology insertions into the Land Warrior system.
  - Built system voice control, integrated navigation, combat ID, enhanced soldier radio, and integrated sight components for the ITD, with some functionality limitations due to use of surrogate systems.
  - Completed Integrated Technology Demonstrations (ITDs) using surrogate Land Warrior Systems.
- 1976 - Performed ITD of upgraded Land Warrior (surrogate) systems.
  - Prepared transition documents for other successful technologies.
  - Demonstrated future component integration onto the Land Warrior (surrogate) platform.
- 1317 - Completed Future Warrior Architecture 2010 Analysis.
  - Defined warrior system concepts to reduce weight, power, cost and increase fightability.

Total 6587

FY 2000 Planned Program:

- 3955 - Complete transition of system voice control, integrated navigation, and Land Warrior combat identification to the Land Warrior Engineering and Manufacturing Development (EMD) program.
  - Prepare transition documentation and complete planning and budgeting with appropriate PMs.

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology PROJECT DJ50

FY 2000 Planned Program: (continued)

- Integrate new technology into Land Warrior platform and conduct demonstrations and user evaluations.
- Identify DARPA Small Unit Operations (SUO) technologies for potential Land Warrior upgrades.

•	2172	- Develop tethered Land Warrior interfaces with the Objective Individual Combat Weapon (OICW) and Javelin weapon systems.
•	139	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).
Total	6266	

FY 2001 Planned Program:

•	3221	- Develop and integrate advanced technology upgrades (e.g., OICW and Javelin integration, medical monitoring, low power electronics and software, and advanced antennae), for Land Warrior systems. - Demonstrate and assess upgraded Land Warrior systems. - Perform user evaluations of upgraded systems.
•	3087	- Perform experiments with emerging technologies from the 6.2 Lightweight Soldier program and related efforts to validate performance on Land Warrior systems. - Baseline performance of production quality Land Warrior systems to aid in technology investment decisions. - Begin development of advanced combat uniform (ACU) system.
Total	6308	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology — PROJECT: D242

COST (In Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D242 Airdrop Equipment	1212	1875	2330	2916	3547	3793	3976	Continuing	Continuing

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 and global precision delivery, particularly into hostile areas as envisioned in Joint Vision 2010. 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 useable/desirable payload weights, a glide ratio of at least 6:1, and an optional glide augmentation system with a range of 75-300 km.

FY 1999 Accomplishments:

•	1212	- Conducted flight testing of High Glide Air Delivery System for use in Air Delivery of cargo from an offset range of 75-300 km using an advanced guidance package and powered glide augmentation. - Conducted demonstration of precision high glide of a 2,000 lb. payload, with a goal of a 5,000 lb. payload, high glide wing.
Total	1212	

FY 2000 Planned Program:

•	1834	- Identify and analyze candidate systems for an efficient long range, 10,000 lb. payload autonomous airdrop resupply capability.
•	41	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).
Total	1875	

FY 2001 Planned Program:

•	2330	- Fabricate components and conduct scale model testing for the long-range autonomous "just in time" resupply airdrop system. - Analyze and design candidate integrated concepts for a pneumatic muscle/airbag landing system to provide a roll-on/roll-off quick airdrop capability for a 20,000 lb. payload.
Total	2330	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Warfighter Advanced Technology PROJECT D393

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D393 Military Operations in Urban Terrain	19853	20087	3874	3857	0	0	0	0	66969

Mission Description and Justification: This project conducts the integration of technology products into a "System of Systems", develops operational concepts and tactics/techniques/procedures (TTPs), and executes live experiments and simulations to determine the military utility of various technologies in enhancing military 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 FY2000. 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 Soldier Center, Natick, MA.

FY 1999 Accomplishments:

- 9453 - Implemented integration, interoperability assessments, and diagnoses of technology candidate products for the MOUT systems of systems.
  - Conducted modeling and simulation to quantify military utility of advanced technology hardware and software.
  - Assessed MOUT operational concepts and Tactics, Techniques and Procedures to determine effectiveness of new capability employment.
- 10400 - Managed, coordinated, and executed the FY99 MOUT ACTD program.
  - Procured additional prototype hardware and software for use in MOUT ACTD experiments.
  - Conducted transition assessments of successful technologies; transitioned rifle launched entry munition capability to PM Small Arms.
  - Completed follow-on squad/platoon level MOUT experiments with prototype hardware.
  - Conducted joint MOUT company level experiments to ensure integration and interoperability of MOUT ACTD hardware and software.

Total 19853

FY 2000 Planned Program:

- 7000 - Manage, coordinate and execute FY00 MOUT ACTD program.
  - Complete integration/modifications resulting from joint company experiments.
  - Conduct force effectiveness analyses to determine higher echelon impacts of individual soldier/small unit MOUT improvements.
- 12546 - Complete New Equipment Training (NET), conduct NET, and support associated field training exercises using new MOUT ACTD technologies.
  - Deliver culminating demo hardware.
  - Conducted Advanced Concept Excursion to identify MOUT potential of emerging technologies (1Q FY00).

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BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology — PROJECT: D393

FY 2000 Planned Program: (continued)

		- Conduct MOUT ACTD culminating demonstration at Joint Readiness Training Center.
		- Finalize technology transition assessments.
•	541	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).
Total	20087	

FY 2001 Planned Program:

•	1733	- Complete transitions of successful MOUT ACTD technologies to Army acquisition programs.
		- Refurbish ACTD residual hardware.
		- Transition residual hardware to Army and USMC experimental forces units.
		- Conduct extended military utility and technical analyses and assessments of residual hardware.
•	2141	- Provide technical/engineering operations for residual hardware during extended evaluation phase.
Total	3874	

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DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology

PROJECT: D543

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D543 Ammunition Logistics	745	778	790	800	811	969	1598	Continuing	Continuing

Mission Description and Justification: This project develops technology that provides rapid munitions deployability, resupply, and rearm for the force projection Army. It enhances force readiness and reduces the logistics footprint through improvements in explosive safety, Materiel Handling Equipment (MHE), ammunition and missile packaging/palletization, and asset throughput/management. It also improves weapon system rearm for artillery, armor, air defense, aviation, and infantry. 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. Technology will transition to weapons and munitions development programs for weapons, munitions, MHE, and tactical vehicles.

FY 1999 Accomplishments:

•	745	- Conducted full scale testing of a prototype rapidly deployable barrier and fire blocking system that improves the survivability of munitions storage areas and personnel. - Prepared data package for the rapidly deployable barrier and fire blocking systems.
Total	745	

FY 2000 Planned Program:

•	757	- Design and fabricate a prototype sensor and passive (battery-free) transceiver unit that will be embedded in advanced munitions for the Future Combat Systems armament system to provide asset visibility and expenditure rates for anticipatory resupply as well as internal temperature data used by the fire control system to improve armament system accuracy. Also, evaluate the ability to obtain the munition's temperature profile while sitting in chamber. - Develop a modular munitions packaging/logistics system concept for autonomous resupply/rearm of the Future Combat Systems in the field to reduce the logistics tail, greatly decrease rearm burden, and allow the Future Combat Systems more time on station. - Design a prototype battery powered micro-sensor based environmental sensor suite to provide remote munitions readiness prognostics and diagnostics for improved stockpile management/readiness and Total Asset Visibility.
	21	Small Business Innovation Research/Small Business Technology Transfer Program
Total	778	

FY 2001 Planned Program:

•	790	- Integrate discrete components and conduct full scale testing and demonstration of the embedded passive sensor for Future Combat Systems munitions. - Design conceptual munitions resupply module for the Future Combat Systems armament system.
Total	790	

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BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology		PROJECT: D594

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D594 Metrology and Calibration	0	981	0	0	0	0	0	0	0

Mission Description and Justification: This one year Congressional special interest project enables the Army to develop and test new measurement technologies, which ensure the accuracy of essential Army measurement systems. This work supports key technology projects required to establish national calibration support and traceability for Army gas mask testers, microwave power calibrations and related instrumentation. This is a Joint Service program coordinated through the Joint Logistics Commanders. This project is managed by the U.S. Army Test Measurement and Diagnostic Equipment Activity, Redstone Arsenal, AL.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	955	Develop calibration systems for gas mask testers, microwave power calibrations and related instrumentation.
•	26	Small Business Innovation Research/Small Business Technology Transfer.
Total	981	

FY 2001 Planned Program: Project not funded in FY 2001.

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BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology		PROJECT: D557

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D557 Biosystems Technology	0	5885	0	0	0	0	0	0	0

Mission Description and Justification: This Congressionally-mandated project has been previously funded in FY93 under project number A830 and in FY98 under project number A823. This project pursues science and technology biological systems research in conjunction with the United States Department of Agriculture Sustainable Economic Activity program. It supports the development of environmentally sensitive products and services essential for the efficient operation of all branches of the military and the civilian sector.

FY 1999 Accomplishments: Project not funded in FY 1999

FY 2000 Planned Program:

•	5727	Develop products for both the military and civilian sectors, utilizing the unique resources of tropical and sub-tropical regions.
•	158	Small Business Innovation Research/Small Business Technology Transfer.
Total	5885	

FY 2001 Planned Program: Project not funded in FY 2001

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BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Warfighter Advanced Technology — PROJECT: DJ51

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DJ51 Combat ID for Dismounted Soldiers	0	6895	0	0	0	0	0	0	0

Mission Description and Justification: The Combat Identification for Dismounted Soldiers (CIDDS) program requested the funding transfer of OPA funds to RDTE Engineering and Manufacturing Development for non-recurring engineering efforts required to reduce the system weight, analyze integration issues, and optimize the design to meet the full-spectrum of Army missions. The funding was placed in PE 63001 in error and the necessary reprogramming efforts are underway to transfer the funds to PE 0604817A.

FY 1999 Accomplishments: Program not funded in FY 1999

FY 2000 Planned Program:

- 6895 Funding will be reprogrammed to Program Element 6.4817 in Engineering and Manufacturing Development (EMD). EMD will reduce the system weight, integrate the system, and optimize the overall design of the combat system for the various missions which dismounted soldiers perform.

Total 6895

FY 2001 Planned Program: Program not funded in FY 2001.

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DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	223999	73252	16512	13491	16000	19380	21036	Continuing	Continuing
D800 Telemedicine Testbed	0	0	1855	1657	1984	2922	3402	Continuing	Continuing
D804 Prostate Cancer Research	48155	2943	0	0	0	0	0	0	51098
D806 Breast Cancer Research	130019	0	0	0	0	0	0	0	130019
D810 Industrial Base/Infectious Disease Vaccines and Drugs	8148	7887	8069	8636	9071	9584	10050	Continuing	Continuing
D815 National Medical Testbed	7704	0	0	0	0	0	0	0	7704
D818 Advanced Cancer Detection	0	3433	0	0	0	0	0	0	3433
D819 Field Medical Protection and Human Performance Enhancement Non-Systems - Advanced Development	0	198	192	553	571	1477	1649	Continuing	Continuing
D840 Combat Injury Management	2335	5823	2421	2645	4374	5397	5935	Continuing	Continuing
D923 Prostate Diagnostic Imaging	7223	7356	0	0	0	0	0	0	14579
D929 Artificial Lung Technology	821	981	0	0	0	0	0	0	1802
D934 Volume Angiocat	3853	5885	0	0	0	0	0	0	9738
D940 Epidermolysis Bullosa	0	981	0	0	0	0	0	0	981
D941 Diabetes Research	4333	13733	0	0	0	0	0	0	18066
D945 Breast Cancer Stamps	1778	0	0	0	0	0	0	0	1778
D954 Digital X-Ray	3852	0	0	0	0	0	0	0	3852

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D955 Assistive Technology	5778	0	0	0	0	0	0	0	5778
D969 Alcoholism Research	0	6866	0	0	0	0	0	0	6866
D970 Enzymatic Wound Disinfectant	0	1962	0	0	0	0	0	0	1962
D971 HIV Research	0	9809	0	0	0	0	0	0	9809
D972 Laser Vision Correction	0	1962	0	0	0	0	0	0	1962
D973 Recombinant Vaccine Research	0	1962	0	0	0	0	0	0	1962
D974 Smart Aortic Research	0	1471	0	0	0	0	0	0	1471
D975 Emerging Infectious Diseases	0	0	3975	0	0	0	0	0	3975

A. **Mission Description and Budget Item Justification**: 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 element is managed primarily by the U.S. Army Medical Research and Materiel Command. This program element also serves to track funds for Congressionally directed medical research in projects 804, 806, 815, 818, 923, 929, 934, 940, 941, 945, 954, 955, 969, 970, 971, 972, 973, and 974. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	229325	10539	12591
Appropriated Value	230862	74539	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-1537		
b. SBIR / STTR	-6021		
c. Omnibus or Other Above Threshold Adjustments	1778	-295	
d. Below Threshold Reprogramming	-167		
e. Rescissions	-916	-992	
Adjustments to Budget Years Since FY 2000/2001 PB			+3921
Current Budget Submit (FY 2001 PB)	223999	73252	16512

Change Summary Explanation: Funding - Adjustment in FY 2001 is a one time adjustment in support of D975- Emerging Infectious Diseases.

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D800

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D800 Telemedicine Testbed	0	0	1855	1657	1984	2922	3402	Continuing	Continuing

Mission Description and Justification: Primary goals are to demonstrate capabilities for real-time monitoring and assessment of soldiers, remote identification of injured personnel, simulations for training of medical personnel, and decision support and remote intervention for medical personnel. This program element funds development, evaluation, and demonstration of prototypes of advanced technologies that will incorporate health awareness into battlespace awareness, provide force protection, reduce time to critical intervention for injured personnel, improve the skills and proficiency of medical personnel, and improve the quality of emergency and surgical care throughout the battlespace.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program:

- 1855 - Develop and test a seamless telemedicine network that connects health care providers in the front lines with tertiary medical treatment centers under the Joint Medical Operations - Telemedicine Advanced Concept Technology Demonstration Project. This program element is a new start.

Total 1855

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D804

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D804 Prostate Cancer Research	48155	2943	0	0	0	0	0	0	51098

Mission Description and Justification: By Congressional direction, the purpose of this appropriation is to continue the peer-reviewed Prostate Cancer Research Program in FY 1999 and to provide 1-year of funding for research at the Gallo Cancer Center in FY 2000.

FY 1999 Accomplishments:

•	48155	- Received 2-year funds in November 1998. Published a program announcement in December 1998. - Conducted scientific peer review and programmatic review for training grants and made initial awards by May 1999. - Conducted scientific peer review and programmatic review for idea and new investigator grants by August 1999 and began award negotiations in September 1999. - Conducted peer review for prostate cancer center grants in September 1999 and programmatic review in October 1999. Recommended a total of 107 awards for funding in all categories.
Total	48155	

FY 2000 Planned Program:

•	2864	- Solicit a proposal for the FY 2000 Gallo Cancer Center project when funding arrives. Scientifically peer review and award the grant by September 2000. Make initial awards in January 2000 for the FY 1999 cancer center grants. - Complete the program for the 107 FY 1999 awards recommended for funding in all categories and make final awards by September 2000. Received funds in January 2000 and released a program announcement for the FY 2000 Prostate Cancer Research Program. Receive training proposals in March 2000 and all other proposals in April 2000. - Complete peer and programmatic review by September 2000. Peer-reviewed prostate cancer research funded within the Defense Health Program in FY 2000.
•	79	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	2943	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology		PROJECT: D806

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D806 Breast Cancer Research	130019	0	0	0	0	0	0	0	130019

Mission Description and Justification: By Congressional direction, the purpose of this appropriation is to continue the peer-reviewed Breast Cancer Research Program.

FY 1999 Accomplishments:

- 130019 - Received 2-year funds in January 1999 for the FY 1999 program. Held vision setting meeting in January 1999. Published a program announcement in March 1999.
  - Received 1,281 proposals by June 1999.
  - Conducted scientific peer review in September 1999 and programmatic review in November 1999. Complete the awards for the 397 FY 1999 proposals recommended for funding by September 2000.

Total 130019

FY 2000 Planned Program: Program funded with Defense Health Program dollars in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D810

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D810 Industrial Base/Infectious Disease Vaccines and Drugs	8148	7887	8069	8636	9071	9584	10050	Continuing	Continuing

Mission Description and Justification: The primary goal of this program is the 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; and Research Triangle Associates, Research Triangle Park, NC.

FY 1999 Accomplishments:

- 1631 - Conducted the first human evaluation of a vaccine for the prevention of hepatitis E disease and showed safety and immunogenicity.
  - Conducted field testing and evaluation of a scrub typhus rapid diagnostic device, necessary for its future licensure.
  - Completed a Phase 1 safety and immunogenicity study comparing three candidate vaccine formulations for prevention of bacterial meningitis due to Group B *Neisseria meningitidis.*
  - Completed multisite field testing of malaria diagnostic test, necessary for advancing this device to advanced development.
  - Conducted multisite field testing of device to detect *Plasmodium falciparum* and *Plasmodium vivax* malaria in mosquitoes and determined that this device shows promise but requires further development to be a valuable tool for preventive medicine personnel; conducted limited field trials of a *Shigella* diagnostic test for cases of diarrhea.
- 786 - Completed preclinical testing demonstrating that a candidate DNA vaccine protected hamsters against infection by hantaviruses.
  - Completed comparative evaluation of rapid dengue antibody tests and determined the best test for clinical use in future vaccine field trials, necessary to support studies of vaccine effectiveness.
  - Completed immunogenicity trials of modified dengue DNA-vaccine candidates against all four dengue serotypes in mice, demonstrating an increased immune response resulting from the modifications; demonstrated that the dengue serotype 1 DNA vaccine candidate protected monkeys from experimental challenge.
- 1337 - Conducted concept exploration on vaccines for common causes of bacterial diarrhea.
  - Conducted a Phase 1 trial of a candidate *Shigella sonnei* vaccine, demonstrating that this vaccine is safe and immunogenic in humans.
  - Assessed safety, immunogenicity, and protection against diarrhea of candidate *Campylobacter* vaccines in animal models, necessary preclinical studies before these vaccines can progress to human clinical studies.
  - Completed preclinical testing, including characterization and safety testing in mice of four candidate vaccines against enterotoxigenic *Escherichia coli* (ETEC); manufacturing conditions were determined so that sufficient quantities of these vaccines can be produced with quality acceptable for use in human testing.
- 4394 - Conducted concept exploration on vaccines and drugs to prevent or treat malaria.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology
	PROJECT D810

FY 1999 Accomplishments: (continued)

- Completed good manufacturing practices (GMP) manufacturing of a five-gene DNA vaccine. Completed the preclinical safety and performed immunogenicity tests for submission of an Investigational New Drug (IND) application to the Food and Drug Administration (FDA), necessary to proceed to human clinical evaluation.
- Analyzed surveillance data and drafted a report for Commanders in Chief on the threat of drug-resistant malaria to military operations worldwide, including recommendations for prophylaxis against malaria, treatment of soldiers with malaria, and monitoring treated soldiers to assure they have been cured, important for effecting efficacious use of available anti-malarial drugs.
- Completed preclinical studies necessary for application to the FDA for IND status for a new drug (artelinic acid) to treat severe and complicated malaria.

Total 8148

FY 2000 Planned Program:

• 4494
- Conduct concept exploration on vaccines and drugs to prevent or treat malaria.
- Analyze clinical samples from malaria vaccine trials for specific immune responses to component antigens, necessary for defining measures of vaccine effectiveness; develop a method for inpatient P. vivax sporozoite challenge for clinical vaccine studies.
- Produce *P. falciparum* sporozoites and other reagents, necessary for preclinical evaluation of potential vaccine candidates and conduct preclinical studies of candidate vaccines to support an IND application; perform preclinical toxicology, pharmacokinetic, absorption, disposition, biotransformation, and excretion studies of new drugs, necessary clinical studies before proceeding to clinical studies of safety and efficacy.
- Prepare gram and kilogram quantities of drug candidates and prepare drug delivery systems under Good Laboratory Practices (GLP)/GMP, necessary for clinical study of candidate antimalarial drugs.
- Conduct a surveillance program for drug-sensitivity patterns of malaria from diverse geographic regions, necessary for defining focus and direction of new drug discovery and development and for advising U.S. forces regarding best effective strategies for drug prevention and treatment of malaria.

• 1364
- Conduct concept exploration on vaccines for common causes of bacterial diarrhea.
- Evaluate immune responses generated by candidate *Shigella* vaccines, necessary for defining standards and measures of vaccine efficacy in clinical efficacy trials; develop, manufacture, and evaluate candidate *Shigella* vaccines and diagnostic techniques.
- Characterize parameters of ETEC protection in humans, necessary for evaluating vaccine efficacy and test candidate ETEC vaccines in a human challenge model to select vaccine candidate for advanced development.
- Study the relative roles of cellular, humoral, and mucosal immunity in recovery from acute *Campylobacter jejuni* disease and in long-term protective immunity, necessary for design and evaluation of vaccine candidates.

• 1063
- Conduct concept exploration on vaccines to prevent hepatitis E, scrub typhus, and Group B meningococcus; on new diagnostic tests for diseases of military interest for incorporation into the common diagnostic platform for biological and infectious threats; and on insect vector control systems.
- Seek and test new repellent candidates that will outperform the current repellent (DEET) in durability, effectiveness, and user-acceptability.
- Perform advanced technology development of a dengue Vector Control System, an integrated system of tools and information that can be physically packaged for a Preventive Medicine Detachment (or service equivalent).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology
	PROJECT D810

FY 2000 Planned Program: (continued)

•	807	- Conduct concept exploration on vaccines for viral diseases that may interrupt military operations: dengue, hemorrhagic fevers, hantavirus infections. - Develop test beds for efficacy evaluations of candidate hemorrhage fever vaccines and protective strategies in human, at-risk populations. Improve capability to rapidly identify, assess risk, and formulate control strategies for hantaviruses, including conduct of serosurveys of rodents or humans to detect hantaviruses.
•	159	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	7887	

FY 2001 Planned Program:

•	5235	- Conduct concept exploration on vaccines and drugs to prevent or treat malaria. - Conduct preclinical studies of a *P. vivax* malaria vaccine, necessary for advancing to human clinical study. - Validate the *P. vivax* experimental challenge model, necessary for Phase 1/2 clinical efficacy studies of candidate malaria vaccines to prevent *P. vivax* infection. - Transition to advanced development at least one new drug for oral treatment of multidrug-resistant malaria. - Complete evaluation of prototype kits and other methodologies for determining with greater than 90 percent accuracy the degree of malaria parasites' resistance to therapeutic agents, necessary to assure the veracity of resistance surveillance data and decision making with regard to the use of available drugs. - Submit IND to FDA for a drug that will effect radical cure of malaria.
•	1377	- Conduct concept exploration on vaccines for common causes of bacterial diarrhea. - Transition to advanced development a *Shigella dysenteriae* candidate vaccine with potential to protect 80 percent of immunized personnel. - Transition to advanced development an oral microencapsulated ETEC vaccine with potential to protect 80 percent of immunized personnel from traveler's diarrhea. - Conduct animal studies to determine safety and immunogenicity of combined enteric (*Campylobacter*, *Shigella,* and ETEC) vaccine formulations, necessary preclinical studies for advancing candidate vaccines to human clinical studies.
•	836	- Conduct concept exploration on vaccines to prevent hepatitis E, scrub typhus, and Group B meningococcus; on new diagnostic tests for diseases of military interest for incorporation into the common diagnostic platform for biological and infectious threats; and on insect vector control systems. - Evaluate the nucleic acid analysis system platform performance characteristics before transitioning to advanced development and clinical evaluation. - Conduct Milestone I's for a monovalent Group B meningococcal vaccine and an insect repellent to replace DEET - Conduct Phase 1 studies of multivalent vaccine candidates for prevention of bacterial meningitis due to Group B *N. meningitidis*, necessary for advancing candidate vaccine to Milestone I and advanced development.
•	621	- Conduct concept exploration on vaccines for viral diseases capable of interrupting military operations. - Conduct advanced technology development on a DNA vaccine to prevent dengue.
Total	8069	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D815

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D815 National Medical Testbed	7704	0	0	0	0	0	0	0	7704

Mission Description and Justification: By Congressional direction, the purpose of this project is to develop initial research models for a national medical testbed that display measurable improvements in cost and effectiveness in many areas of health care delivery.

FY 1999 Accomplishments:

•	7704	- Completed proposal review panel in September 1999 for supported studies by the Loma Linda Medical Center. Fields of interest included management of trauma and shock; modalities that may improve the rate of tissue and bone healing as well as the regulation of growth, healing, and bone restructuring; and development and testing of new medical instrumentation.
Total	7704	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology		PROJECT D818

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D818 Advanced Cancer Detection	0	3433	0	0	0	0	0	0	3433

Mission Description and Justification: By Congressional direction, the purpose of this appropriation is only for Advanced Cancer Detection.

FY 1999 Accomplishments: Project funded under program element 0602787, project 949 in FY 1999.

FY 2000 Planned Program:

- 3341 - Develop with the University of South Florida a scientifically meritorious proposal for the appropriation for the FY 1999 and FY 2000 programs.
- 92 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 3433

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology — PROJECT: D819

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D819 Field Medical Protection and Human Performance Enhancement Non-Systems - Advanced Development	0	198	192	553	571	1477	1649	Continuing	Continuing

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 development of laser eye protection technologies and laser bioeffects treatment, 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 and rapid test kits for toxic industrial and agricultural chemicals.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	193	- Conduct selection of the best technology to detect unhealthy concentrations of coliform bacteria and toxic agricultural pesticides as defined by Department of Defense standard samples within 4 hours.
•	5	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	198	

FY 2001 Planned Program:

•	192	- Continue downselection of best rapid water microbiological test kit technologies.
Total	192	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology		PROJECT D840

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D840 Combat Injury Management	2335	5823	2421	2645	4374	5397	5935	Continuing	Continuing

Mission Description and Justification: This project funds prototypes of nonsystem-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 1999 Accomplishments:

- 757 - Completed a study of blood loss and hemodynamic changes after treatment of severe liver injury with fibrin foam to assess hemostatic capability of foam formulation.
  - Continued a study to assess arterial pressure at which rebleeding occurs to develop guidelines for optimal resuscitation pressure endpoint. Developed novel methods to evaluate platelet membrane fluidity during storage.
- 711 - Completed a study of freeze-dried vascular allografts in an animal model to determine efficacy of these allografts as vascular grafts. Investigated dermal replacement materials in skin graft models and determined that they appear to be incorporated in host tissue and to enhance wound healing.
  - Completed study of biomechanical characteristics of self-drilling/tapping external fixator half pins for bone fracture repair. Completed an analysis of in vivo strength and healing characteristics of metallic and bioabsorbable suture anchors in an animal model.
- 217 - Developed an experimental model that combines traumatic brain injury with hypoxia that will be used as a sensitive test for potential therapeutics.
- 650 - Funded development of LSTAT (Life Support for Trauma and Transport).
  - Developed a prototype field dental unit with significantly reduced weight and cube, and undertook limited field testing.
  - Developed a warzone expedient electric dental handpiece for clinical use.

Total 2335

FY 2000 Planned Program:

- 3408 - Continue development of LSTAT.
  - Develop and evaluate a tourniquet that can be applied one-handed.
  - Document the adequacy of inhaled anesthetic output from a draw-over anesthesia machine when used in combination with a transport ventilator.
- 1293 - Continue clinical testing of 10-week red blood cell storage solution to assess safety and efficacy.
  - Continue preclinical testing of fibrin foam formulations in animal models of hemorrhage to assess hemostatic efficacy.
  - Start Phase 1 clinical testing of polynitroxylated albumin to assess safety.
- 971 - Establish a cytofluorometric method to evaluate combined therapies to inhibit cellular inflammation after hemorrhage and reperfusion. Begin testing of methods for the early diagnosis of limb ischemia in patients with burns to the extremities.
  - Continue testing neuroprotective drugs in animal models to assess efficacy; continue to evaluate wound repair biologics.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D840

FY 2000 Planned Program: (continued)

- Evaluate modes of failure of bioabsorbable versus metallic soft tissue anchors in knee joints. Investigate microencapsulated anti-inflammatory dental pulp-capping agents to enhance return to duty in far-forward locations.

•	151	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	5823	

FY 2001 Planned Program:

•	2421	- Test commercial off-the-shelf oxygen carrier solutions in austere environments to assess suitability for military use.
		- Conduct Milestone I to transition 10-week red blood cell storage solution to advanced development.
		- Develop advanced field dressing incorporating ease of use, air tight seal, and advanced materials.
		- Transition fibrin foam hemostatic agent to Phase 1 clinical trials.
		- Transition anticaries and antiplaque peptides to Phase 1 clinical trials.
		- Perform preclinical trials of antisense DNA as a therapy against excess mucus secretion after smoke inhalation.
		- Conduct preclinical trials of lead neuroprotective and cardiovascular protective antioxidant compounds.
Total	2421	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology		PROJECT D923

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D923 Prostate Diagnostic Imaging	7223	7356	0	0	0	0	0	0	14579

Mission Description and Justification: By Congressional direction, continue funding the Center for Prostate Disease Research at the Walter Reed Army Medical Center.

FY 1999 Accomplishments:

•	7223	- Continued clinical research efforts at Walter Reed Army Medical Center for Prostate Disease Research comparing efficacy of treatment options for patients. Identified screening guidelines for high-risk populations. - Evaluated molecular biomarkers to monitor patient progress. - Developed a comprehensive clinical research database. - Developed an extensive library of prostate cancer specimens for genetic studies. Discovered a novel gene involved in prostate cancer.
Total	7223	

FY 2000 Planned Program:

•	7158	- Receive funds in January 2000. Ensure scientific peer review of research conducted at Walter Reed Army Medical Center for Prostate Disease Research and transfer funding to continue efforts. - Study epidemiology of prostate cancer patients to determine possible racial and socioeconomic impacts on prostate cancer's presentation, progression, and response to therapy. - Study hormonal therapy and chemotherapy of prostate cancer inpatients who do not respond well to usual treatments of surgery and radiation.
•	198	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	7356	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology		PROJECT: D929

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D929 Artificial Lung Technology	821	981	0	0	0	0	0	0	1802

Mission Description and Justification: By Congressional direction, the purpose of this annual program is to develop an intravenous membrane-based oxygenator to enable oxygen delivery to patients with pulmonary insufficiency.

FY 1999 Accomplishments:

•	821	- Completed initial acute and long-term (21 days) testing of intravenous membrane oxygenator patency and function in an animal model of pulmonary insufficiency.
Total	821	

FY 2000 Planned Program:

•	955	- Awaiting proposal submission for evaluation to be followed by contract award.
•	26	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	981	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D934

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D934 Volume Angiocat	3853	5885	0	0	0	0	0	0	9738

Mission Description and 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 1999 Accomplishments:

•	3853	- Developed sequential rapid slice or high speed computer tomography (HSCT) scanning to provide true real-time and true volume 4D imaging. - Developed state-of-the-art CT spatial resolution, superior tissue contrast resolution, and improved signal-to-noise ratio with a photon flux rate 10X that of electron beam computer tomography (EBCT) or HSCT. - Provided markedly superior temporal resolution with routine exposure times of 50-100 ms compared to about 1 sec in current state-of-the-art HSCT. - Created a single rapid diagnostic examination that will replace 2-4 examinations that are currently being performed. - Integrated stereo fluorography and high resolution digital radiography into the 3D/4D volume imaging for combined digital angiography, mammography, or 3D fluoroscopic guidance of instrumentation.
Total	3853	

FY 2000 Planned Program:

•	5727	- Awaiting proposal submission for evaluation to be followed by contract award.
•	158	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	5885	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology		PROJECT D940

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D940 Epidermolysis Bullosa	0	981	0	0	0	0	0	0	981

Mission Description and Justification: By Congressional direction, the purpose of this Congressional Special Interest Research Program (CSIRP) is to develop a research effort utilizing the inheritable disease Epidermolysis Bullosa (EB) as a model for vesicant-induced skin injury.

FY 1999 Accomplishments: Received one million dollars in both FY 1998 and FY 1999 to initiate the EB research effort. Received proposals in response to a request for proposals, reviewed proposals for scientific merit by an extramural peer review panel, and ranked proposals by scientific and program relevance. Awarded FY 1998 funds to Dr. John F. Klement, Thomas Johnson University (Cooperative Agreement) and awarded FY 1999 Defense Health Program funds to Dr. Angela Christiano, Columbia University (Grant).

FY 2000 Planned Program:

•	955	- Award the FY 2000 appropriation based on the outcome of evaluation of proposals received in response to a new RFP. The principal objectives of this research program are to identify common molecular blistering mechanisms between EB and HD-induced blistering and to develop potential therapeutic targets to accelerate wound healing.
•	26	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	981	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology		PROJECT D941

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D941 Diabetes Research	4333	13733	0	0	0	0	0	0	18066

Mission Description and Justification: By Congressional direction, the purpose of this project is to conduct diabetes research.

FY 1999 Accomplishments:

- 555 - Awarded funds to the Children's Hospital in Pittsburgh for exploring the potential link between the Coxsackievirus B (or CVB) causing the body to react and potentially trigger the onset of juvenile diabetes.
- 3778 - Implemented Phase 2 program at Joslin Diabetes Center:
  - Developed retinal imaging technology that accurately diagnoses the clinical level of retinal damage due to diabetes, which correlates with systemic diabetes. This will allow physicians to monitor a patient remotely by sending the image of the patient's retina to the physician, thereby eliminating patient travel and logistics expenses.
  - Introduced Diabetes Outpatient Intensive Treatment Program to educate the diabetic population on lifestyle adjustments to prevent debilitating secondary complications.

Total 4333

FY 2000 Planned Program:

- 13363 - Awaiting proposal submission for evaluation to be followed by contract award. Complete research funded in FY 1999.
- 370 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 13733

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology		PROJECT D945

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D945 Breast Cancer Stamps	1778	0	0	0	0	0	0	0	1778

Mission Description and Justification: By Congressional direction from the Stamp Out Breast Cancer Act, funds are provided for the Department of Defense (DOD) Breast Cancer Research Program.

FY 1999 Accomplishments:

- 1778 - Published a program announcement in March 1999. Conducted scientific peer review.

Total 1778

FY 2000 Planned Program: Complete all FY 1999 awards by September 2000. Based on sales of the breast cancer stamp and the legislation that authorized the stamp, DOD expects two payments of an unknown amount from the U.S. Postal Service in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology		PROJECT: D954

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D954 Digital X-Ray	3852	0	0	0	0	0	0	0	3852

Mission Description and Justification: By Congressional direction, this program funds development of a prototype portable digital x-ray for field and fixed facility applications.

FY 1999 Accomplishments:

- 3852 - Awarded contract in January 2000 to adapt Apollo clinical x-ray technology for immediate military use, including providing a feasibility prototype for military evaluation. This advanced technology will provide ability to generate x-ray images closer to the site of injury, the ability to transmit data for remote interpretation, the elimination of chemicals or auxiliary equipment for image generation, superior image quality, and the possibility of storing image in a digital dog tag.

Total 3852

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D955

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D955 Assistive Technology	5778	0	0	0	0	0	0	0	5778

Mission Description and Justification: By Congressional direction, this program funds the research, development, and evaluation of technologies (initially developed for military and space purposes) that can be used to improve the lives of Americans with disabilities.

FY 1999 Accomplishments:

•	5778	- Committed funds to National Rehabilitation Hospital Assistive Technology Center. - Peer-reviewed projects are in the final stages of being awarded. This contract will help expand efforts to transfer technology from both military and space programs to civilian healthcare, targeting disabled Americans so that treatment and care of these individuals can be maintained and improved.
Total	5778	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology		PROJECT D969

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D969 Alcoholism Research	0	6866	0	0	0	0	0	0	6866

Mission Description and Justification: By Congressional direction, the purpose of this project is to research alcohol abuse and alcohol-related behaviors in military personnel.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	6682	- Determine the environmental contexts, psychological dispositions, and organic factors that lead to alcohol abuse.
		- Develop intervention programs to promote behaviors that reduce alcohol abuse.
•	184	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	6866	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology		PROJECT D970

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D970 Enzymatic Wound Disinfectant	0	1962	0	0	0	0	0	0	1962

Mission Description and Justification: By Congressional direction, the purpose of this program is to establish a process to select medical research projects of clear scientific merit and direct relevance to military health including enzymatic wound disinfectants.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 1909 - Awaiting proposal submission for evaluation to be followed by contract award.
- 53 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 1962

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D971

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D971 HIV Research	0	9809	0	0	0	0	0	0	9809

Mission Description and Justification: By Congressional direction, the purpose of this program is to perform human immunodeficiency virus (HIV) Research.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 9545 - Conduct Phase 1/2 clinical trials of candidate vaccines, including a DNA vaccine (carried by the canary pox virus) combined with a booster immunization with a new candidate protein vaccine, a DNA vaccine (carried by canary pox virus) in combination with booster immunizations with three different candidate protein vaccines to test the best immune response, the Therapore HIV vaccine, and a Venezuelan Equine Encephalitis (VEE) –HIV virus replicon particle. Conduct studies of the natural history of HIV infection among U.S. military personnel, including newly infected personnel.
- - Conduct cohort development studies for future overseas vaccine studies. Develop field sites for vaccine testing in the United States, Thailand and Uganda; and produce candidate vaccines under good manufacturing practices for vaccine trials.
- - Conduct pre-clinical studies of new complex proteins, new recombinant protein vaccines, new vaccines carried by other viruses, and new vaccine delivery systems.
- - Conduct national and international surveillance of HIV subtypes; conduct surveillance of HIV subtypes among newly serconverting service members to determine the relevant subtypes and immune responses for vaccine design.
- - Conduct studies of HIV drug resistance among infected U.S. military personnel, especially those with non-subtype B infection.
- 264 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 9809

FY 2001 Planned Program: Project not funded in FY 2001.

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D972

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D972 Laser Vision Correction	0	1962	0	0	0	0	0	0	1962

Mission Description and Justification: By Congressional direction, the purpose of this project is to research Photorefractive Keretectomy (PRK) as a surgical procedure for the correction of myopia and astigmatism for military personnel.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	1909	- Leverage the current joint Air Force and Navy human PRK study and examine the effect of PRK on mesopic and scotopic visual function and military performance.
•		- Explore corneal wound healing to improve visual outcome by reducing haze, glare, and refractive regression effects subsequent to PRK surgery.
•	53	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	1962	

FY 2001 Planned Program: Project not funded in FY 2001.

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D973

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D973 Recombinant Vaccine Research	0	1962	0	0	0	0	0	0	1962

Mission Description and Justification: By Congressional direction, the purpose of this project is to exploit the unique capabilities of the University of Nebraska, Lincoln, for the production of vaccine candidate materiel.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	1909	- Support the full utilization and retention of a highly skilled Principal Investigator and his team of researchers who produce large quantities of vaccine candidate materiel by the fermentation, recovery and purification of the HC fragment of the Botulinum Neurotoxin from Pichia Pastoris.
•	53	- Small Business Innovative Research/Small Business Technology Transfer Research Programs.
Total	1962	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology		PROJECT: D974

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D974 Smart Aortic Research	0	1471	0	0	0	0	0	0	1471

Mission Description and Justification: By Congressional direction, the purpose of this program is to perform research into a smart aortic arch catheter.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 1432 - Awaiting proposal submission for evaluation, to be followed by contract award.
- 39 - Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 1471

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology — PROJECT: D975

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D975 Emerging Infectious Diseases	0	0	3975	0	0	0	0	0	3975

Mission Description and Justification: The scientific and technical objectives for this project focus on accelerating development of infectious disease threat countermeasures necessary to support operations in nonindustrialized countries and those in which infrastructure has been damaged or destroyed. It will also fund the necessary research to counter the military operational impact of emerging infectious diseases.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program:

•	3975	- Conduct concept exploration of candidate products that could provide protection of warfighters against emerging infectious diseases.
Total	3975	

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	43509	33921	28810	41666	44869	74376	83074	Continuing	Continuing
D313 Advanced Rotary Wing Vehicle Technology	16167	23466	14635	27984	31054	61227	52137	Continuing	Continuing
D391 D391	914	0	0	0	0	0	0	0	7682
D435 Aircraft Weapons	0	1427	3677	1787	1290	0	11574	Continuing	Continuing
D436 Rotary-Wing Mission Equipment Package Integration	4909	2088	3599	5098	5759	6109	12001	Continuing	Continuing
D447 Aircraft Demonstration Engines	6291	6940	6899	6797	6766	7040	7362	Continuing	Continuing
DA38 Starstreak	15000	0	0	0	0	0	0	0	18185
DB97 Aircraft Avionics Equipment	228	0	0	0	0	0	0	0	1086

A. Mission Description and 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 2010. 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 at or 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 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 demonstrated for applications that will improve and correct deficiencies in current DoD / Army RWV systems, and to improve the capabilities of future rotorcraft. The PE focuses on demonstrating technologies to enable rotorcraft to operate affordably throughout the military spectrum from peacekeeping to combat missions. 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. Technology demonstrated in this PE will support the future DoD Joint Transport Rotorcraft (JTR) identified to potentially replace the aging Army CH/MH-47D/E Chinook and Navy CH-53 Super Stallion helicopters. Upgrade activities [as applicable] of Army systems such as the AH-64 Apache, RAH-66 Comanche,

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology

UH-60 Blackhawk, Navy SH-60 Seahawk and USMC AH-1 Cobra are supported as well. Work in this PE is performed by contractors including Georgia Institute of Technology, Atlanta, GA; Boeing Company, Mesa, AZ, St. Louis, MO; and Philadelphia, PA; Loral Western Development Laboratories, San Jose, CA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Lockheed-Martin, Atlanta, GA and Palmdale, CA; General Electric, Lynn, MA; Allied Signal Engines, Phoenix, AZ; Honeywell, Minneapolis, MN; Sikorsky Aircraft Division UTC, 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 Directorate, Army Research Laboratory (ARL), NASA Langley Research Center, Hampton, VA; and Vehicle Technology Directorate, ARL, NASA Lewis Research Center, Cleveland, OH. Related activities are performed by NASA.

This program adheres to DoD Reliance Agreements on Aeropropulsion and Air Vehicles (Rotary Wing). Related applied research is conducted under PE 0602211A (Aviation Technology). Efforts under this PE transition to programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). 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, 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 (TTCP) 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 pursued to allow technology information exchange.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	44834	34167	38388
Appropriated Value	45048	34167	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-214		
b. SBIR / STTR	-687		
c. Omnibus or Other Above Threshold Reductions			
d. Below Threshold Reprogramming	-518	-133	
e. Rescissions		-113	
Adjustments to Budget Years Since FY 2000/2001 PB	-120		
New Army Transformation Adjustments			-9578
Current Budget Submit (FY 2001 PB)	43509	33921	28810

Funding – FY01: Projects 313 and 435 were adjusted to reflect the new Army Transformation

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology		PROJECT D313

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D313 Advanced Rotary Wing Vehicle Technology	16167	23466	14635	27984	31054	61227	52137	Continuing	Continuing

Mission Description and Justification: The objective of this project is to develop and demonstrate advanced technologies that increase strategic / tactical mobility, increase maneuverability / agility; increase reliability through improved maintainability / sustainability, and reduce acquisition and operational cost. RWV technology areas supported by this project are advanced rotors / controls, flight controls, airframes / structures, crew / vehicle survivability, drive-train and subsystems. The Rotary Wing Structures Technology (RWST), Survivable, Affordable, Repairable Airframe Program (SARAP) and Full Spectrum Threat Protection (FSTP) technology demonstrations (TD) will increase the survivability and reduce weight, manufacturing and operational costs of the rotorcraft fuselages and wing subsystems. The Advanced Rotorcraft Transmission Phase II (ART-II) and Rotorcraft Drive Systems for the 21st Century (RDS21) TDs will provide a 35% reduction in weight and 15dB reduction in noise for advanced drivesystems. The Helicopter Active Control Technology (HACT) and Variable Geometry Advanced Rotor Demonstration (VGARD) TDs will contribute to a 2X increase in payload, 4X increase in range and 65% improvement in maneuverability / agility when integrated with the RWV system. These programs will focus on the demonstration and transition of advanced technology to the JTR program to meet the cargo / transport and commuter needs of the military and civilian sectors, as well as technology insertion for other DOD legacy rotorcraft systems. The funding profile supports these technology demonstrations that have been approved in Army 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 1999 Accomplishments:

- 8052 - Completed fabrication of ART II demonstrator hardware.
  - Fabricated diamond-like carbon coated gears, ring gear isolation, low noise bevel pinion, advanced bearing materials, heat exchangers, and seal hardware for reduced weight and increased durability when applied to upgraded UH-60 Blackhawk and AH-64 Apache helicopter transmissions.
- 3267 - Developed baseline helicopter active flight control system designs; evaluated design methodologies; conducted engineering modeling, simulation, analysis, and evaluated candidate active control system designs.
- 4848 - Conducted detailed designs of structural concepts using virtual prototyping which will reduce developmental and manufacturing risk of demonstration fuselage assemblies and reduce detail design cycle time to half the normal time.

Total 16167

FY 2000 Planned Program:

- 7000 - Conduct component testing of ART II positive engagement overrunning clutch.
  - Complete initial assembly of ART II demonstrator hardware
  - Conduct development testing of ART II Demonstrator 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.
  - Conduct ART II endurance testing for demonstration of 25 % increase in power-to-weight and 2X increase in transmission durability.

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology
	PROJECT D313

FY 2000 Planned Program: (continued)

- Conduct ART II noise testing to demonstrate a -10dB reduction in transmission noise.
- Perform endurance testing of diamond-like carbon coated gears, ring gear isolation, low noise bevel pinion, advanced bearing materials, heat exchangers, and seal hardware for reduced weight and increased durability when applied to upgraded UH-60 Blackhawk and AH-64 Apache helicopter transmissions.

•	8970	- Conduct detailed design of active flight control system for demonstration. - Develop active flight control engineering models, and piloted and hardware in-the-loop simulation to support flight demonstration. - Determine reduction in flight control design and development costs.
•	6326	- Fabricate rotary wing structural demonstrator fuselage sections comprised of advanced structural concepts demonstrating reduced weight and manufacturing cost, and conduct full scale-crash testing of demonstrator fuselage.
•	574	- Conduct review & analysis of JTR scenarios, missions, and performance characteristics - Perform parametric analysis & Preliminary Design (PD) of potential JTR concepts. - Construct computer models which integrate advanced technologies (advanced transmissions, active flight controls, turbine engine, rotors, airframes/structures and signature management) for defining JTR configuration alternatives. Conduct simulation runs to support analysis & PD. - Perform initial cost & technology assessments and down-select to contractor(s) recommended "best" JTR preliminary configuration.
•	596	- Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	23466	

FY 2001 Planned Program:

•	1388	- Conduct RDS21 preliminary design for 35% increase in power-to-weight, -15dB noise reduction, 2X increase in durability and 25% reduction in production cost.
•	7630	- Integrate hardware and software into demonstration rotorcraft. - Conduct flight control subsystems flight tests. - Refine helicopter active flight controls engineering models and simulation.
•	2617	- Conduct full-scale static testing of rotary wing structural demonstrator fuselage sections demonstrating weight, cost and development cycle time reductions.
•	3000	- Analyze & model attributes of selected JTR PD concepts. - Create virtual prototypes (VP) and assess performance & operational impact of JTR on virtual battlefield. - Use VP to analyze development, production and O&S costs considering Cost As Independent Variable (CAIV). - Analyze JTR derivatives and service unique requirements to assess best approach(es) for commonality. - Conduct technology & program risk assessment. Determine JTR System Specification and sizing criteria for critical subsystem technology demonstrations. - Conduct final simulation demonstration of VP(s).
Total	14635	

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology PROJECT D435

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D435 Aircraft Weapons	0	1427	3677	1787	1290	0	11574	Continuing	Continuing

Mission Description and Justification: This project demonstrates rotorcraft weaponization technologies for air-to-ground and air-to-air application. Integration of advanced missiles (Air-to-Air / Air-to-Ground), rockets, guns, fire control and advanced target acquisition are evaluated and demonstrated on rotorcraft platforms to assure compatibility of the weapon system with the rotorcraft. Technology integration issues with on-board systems, vehicle flight characteristics and weapon system are investigated and evaluated. The project will integrate Low Cost Precision Kill (LCPK) rocket system using a 2.75 rocket with a laser seeker sensor and will evaluate other technologies for providing rotorcraft air combat enhancements, including a lightweight, electric turret for a 20% increase in air-to-air accuracy.

FY 1999 Accomplishments: Project not funded in FY99.

FY 2000 Planned Program:

•	1389	- Conduct AH-64 Longbow Apache aircraft preliminary integration design for Low Cost Precision Kill (LCPK) guided rocket system . - Conduct AH-64 Longbow Apache aircraft preliminary design for integration of Multi-Role Aviation Weapon System (MRAWS) lightweight, electric turret.
	38	- Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	1427	

FY 2001 Planned Program:

•	3677	- Complete LCPK aircraft integration design and fabricate flight hardware for Apache Longbow to support airborne evaluation of the LCPK guided rocket.
Total	3677	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology PROJECT D436

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D436 Rotary-Wing Mission Equipment Package Integration	4909	2088	3599	5098	5759	6109	12001	Continuing	Continuing

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. It provides for the demonstration of rotorcraft crew stations utilizing knowledge-based information systems to develop Cognitive Decision Aiding (CDA) for crews. Advanced integration technology in information management, sensors, displays, and controls will be demonstrated to maximize combat helicopter mission effectiveness and survivability for day / night adverse weather operations. The Rotorcraft Pilot's Associate (RPA) program demonstrated significant capabilities in data fusion, battlefield assessment, route, reconnaissance, survivability and sensor planning, and cockpit information management, attack planning and crew intent estimation for dual crew operations. Virtual prototyping capability is used as the foundation for evaluating combined rotorcraft control and crew performance. 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. The manned/unmanned team will be capable of performing scout and reconnaissance assignments and alerting manned rotorcraft of "just ahead" tactical situation awareness. State-of-the-art approaches in artificial intelligence, intelligent agents, sensors, avionics, communications, pilot vehicle interfaces, and autonomous assistants will result in an integrated team that enhances Army aviation battlefield effectiveness.

FY 1999 Accomplishments:

•	4909	- Conducted RPA flight test including operationally relevant scenarios and threats which will be subject to the same tactical environments used in the virtual simulations; performed data reduction, analysis, final report / briefing and transitioned technology and lessons learned to fielded / development systems. - Completed virtual simulation tests which serves as final effort to measure exit criteria.
Total	4909	

FY 2000 Planned Program:

•	2034	- Develop and demonstrate AMUST teaming using a AH-64D with basic payload and rudimentary navigation control of a Hunter Unmanned Aerial Vehicle. - Define advanced AMUST configuration and interfaces for manned (AH-64D and other manned systems) and unmanned (family of military UAVs) teams.
•	54	- Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	2088	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology	PROJECT D436

FY 2001 Planned Program:

•	3599	- Develop AMUST algorithms to support critical operational functions. - Construct engineering simulation to support preliminary development and engineering evaluation of the system. - Conduct knowledge acquisition collection and refinement for scout / attack and Special Operations aviation forces' mission teams composed of manned and unmanned systems.
Total	3599	

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology		PROJECT D447

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D447 Aircraft Demonstration Engines	6291	6940	6899	6797	6766	7040	7362	Continuing	Continuing

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 IHPTET program and industry. IHPTET / JTAGG goals focus on reducing specific fuel consumption (SFC) and increasing the power to weight (P/W) ratio of turboshaft engines while decreasing production and maintenance costs. This provides significantly increased range and payload capabilities for current fleet upgrades and for future new rotorcraft with significant Operation and Support cost savings.

FY 1999 Accomplishments:

•	6291	- Completed JTAGG III components initial detail design including axial rotors and impeller, ceramic matrix composite combustor liners, turbine airfoils, and mechanical components for JTAGG III initial build. - Procured long-lead JTAGG III hardware. - Conducted initial component testing in support of JTAGG III initial gas generator build.
Total	6291	

FY 2000 Planned Program:

•	6757	- Demonstrate in testing, the JTAGG II goals of 80% increase in shaft horsepower to weight ratio, 30% decrease in SFC and 20% reduction in acquisition and maintenance costs. - Fabricate / procure hardware for JTAGG III initial gas generator build. - Continue initial component testing in support of JTAGG III initial gas generator build. - Evaluate JTAGG III component design modifications in support of gas generator build.
•	183	- Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	6940	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology	PROJECT D447

FY 2001 Planned Program:

•	6899	- Complete initial gas generator hardware fabrication and component testing. - Conduct testing of JTAGG III initial gas generator build in support of 120% increase in shaft horsepower to weight, 40% decrease in SFC, and 35% reduction in acquisition and maintenance costs. - Complete design modifications and fabricate / procure hardware for second gas generator build. - Conduct component testing in support of second gas generator build. - Perform JTAGG III component design modifications in support of final gas generator build for goal demonstration.
Total	6899	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology		PROJECT DA38

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DA38 Starstreak	15000	0	0	0	0	0	0	0	18185

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 effort explored the integration of the Air-to-Air Starstreak (ATASK) missile on the AH-64D Apache Longbow helicopter in preparation for a potential follow-on side-by-side comparison with the Air-to-Air Stinger (ATAS) missile. This effort follows a two-phased effort (FY95-FY97) in which the technical feasibility, safety and preliminary worth of the Starstreak (ATASK) was assessed as an air-to-air self defense weapon for the AH-64 Apache helicopter.

Public Law 105-262, dated 17 Oct 99, requires the Secretary of the Army to certify, in writing, that side-by-side, air-to-air tests between the Starstreak and Stinger missiles can be fired safely at AH-64D Apache helicopter air speeds consistent with normal operating limits and survivability of the aircraft and missile performance standards. Due to Starstreak missile blast overpressure and launch debris damage during earlier congressionally directed ATASK testing, no certification has been possible. FY99 accomplishments for this congressionally directed program, therefore, are pending resolution of these technical and safety issues associated with the Starstreak missile design.

FY 1999 Accomplishments:

- 15000 - The FY99 funds are intended to accomplish the following activities:
  - Development of system integration design requirements
  - Missile performance envelope expansion via simulation
  - Initial effort to integrate the Starstreak missile on the AH-64D Longbow Apache
  - Initial fabrication of hardware to support system integration on the AH-64D
  - Initial planning for test activities
  - Program Management

  - No FY99 funds have been obligated or expended as of Dec 99, but are intended for execution in FY00.

Total 15000

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology		PROJECT: DB97

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DB97 Aircraft Avionics Equipment	228	0	0	0	0	0	0	0	1086

Mission Description and 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 1999 Accomplishments:

•	228	- Completed RPA mission equipment integration support in the areas of communication, navigation, Advanced Helicopter Pilotage (AHP), voice recognition, controls and displays, and artificial intelligence, during the flight test program.
Total	228	

FY 2000 Planned Program: Project not funded in FY00.

FY 2001 Planned Program: Project not funded in FY01.

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	24049	58042	29738	12201	18369	16871	36546	Continuing	Continuing
DL94 Electric Gun Systems Demonstration	0	0	0	0	0	0	0	Continuing	Continuing
D43A Advanced Weaponry Technology Demonstration	12966	37054	16029	6304	8525	11058	20152	Continuing	Continuing
D232 Advanced Munitions Demonstration	11083	16083	13709	5897	9844	5813	16394	Continuing	Continuing
D244 Warheads and Energetics Center of Excellence	0	4905	0	0	0	0	0	4905	4905

A. **Mission Description and Budget Item Justification:** The objective of this Program Element (PE) is to demonstrate affordable, smaller and/or lighter advanced weapons and munitions technologies that will increase battlefield lethality and survivability. This PE funds several direct and indirect fire weapon demonstrations that include the Direct Fire Lethality (DFL) Program, the Tank Extended Range Munition (TERM), the Precision Guided Mortar Munition (PGMM), the Future Direct Support Weapon System (FDSWS) and Multi-role Direct/Indirect Fire for Future Combat Systems (FCS) Armament. In the area of combat vehicle anti-armor munitions, advanced explosively formed penetrator (EFP) warheads exploit technologies in explosives, liner materials and modeling, and demonstrate increased armor penetration through advanced warhead concepts. Work in this program element is consistent with the Army 2010 and beyond, including enabling technologies for the FCS , 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, 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).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 / 2001 PB)	24858	39893	38686
Appropriated Value	25055	58643	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-197		
b. SBIR/STTR	-453		
c. Omnibus or Other Above Threshold Reductions		-208	
d. Below Threshold Reprogramming	-258		
e. Rescissions	-98	-393	
Adjustments to Budget Years Since (FY 2000 / 2001 PB)			-8948
Current Budget Submit (FY 2001 PB)	24049	58042	29738

Change Summary Explanation: Funding - FY2001: Funds realigned to higher priority requirements

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT D43A

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D43A Advanced Weaponry Technology Demonstration	12966	37054	16029	6304	8525	11058	20152	Continuing	Continuing

Mission Description and Justification: This project includes lethality enhancements for the DFL, TERM, PGMM, FDSWS and the Multi-role Direct/Indirect Fire for FCS Programs. The DFL program will enhance tank lethality of current and future kinetic energy (KE) penetrator munitions, particularly against explosively reactive armor (ERA) appliqué arrays now available on fielded threat systems. The TERM will provide an affordable extended range precision munition for the Abrams tank and enabling technologies of FCS, providing a 700% increase in lethal battlespace, engaging high priority targets in both line-of-sight and beyond line-of-sight. The PGMM demonstration will feature an affordable laser guided mortar munition with an extended range glide capability that will double current 120mm mortar range capabilities and dramatically improve mortar accuracy. The FDSWS will explore technologies to significantly lower the weight of large caliber artillery systems through the application of advanced methods of recoil management, materials and structures. Smart munition sensor technologies capable of locating targets in clutter will also be evaluated, this will include side by side comparative testing with smart submunition sensor suites. These concepts are candidates for technology insertions and provide significant enhancements over existing systems. This effort will support the area denial technology demonstration scheduled for FY 2001. In-house efforts are accomplished by 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; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; PRIMEX-Flinchbaugh, Red Lion, PA; Textron, Inc., Willington, MA; Technical Solutions Incorporated (TSI), Mesina Park, NM; Motorola, Scottsdale, AZ; Lockheed Martin, Orlando, FL; MEI Technology, Lexington, MA; Computing Device International, Minneapolis, MN; Singer Kearfott, Wayne, NJ; Diehl GmbH., Rothenbach, Germany; Design Systems Technologies Inc. (DSTI), Rockville, MD, Alliant Tech Systems, Allegheny Ballistics Laboratory, Rocket City MD, Raytheon/TI Systems, Tucson, AZ.

FY 1999 Accomplishments:

- 5974 - Conducted PGMM fin deployment live fire tests; conducted navigation sensor trade studies; participated in the Military Operations in Urban Terrain (MOUT)) Advanced Concept Technology Demonstration (ACTD) via simulation; selected and tested new gyro.
- 829 - Supported automated towed howitzer extended user evaluation under the Rapid Force Projection Initiative (RFPI) ACTD.
- 2390 - Performed modeling and simulation of 5700 lb. FDSWS weapon including electro-rheological (ER) fluid recoil system; fabricated hardware for ER fluid recoil system testbed.
- 1295 - Continued integrated design of dual novel penetrator system for defeat of future armor targets with less than 5 megajoules of energy on target.
- 2478 - Completed initial system designs for TERM concepts, downselected to two concepts for sensor demonstrations.

Total 12966

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT D43A

FY 2000 Planned Program:

•	10057	- Conduct sensor demonstrations of TERM concepts using simulation and Captive Flight Tests (CFT).
		- Define TERM fire control system and munition concept design.
•	11300	- Conduct PGMM system hi-g tests via parachute round firings; conduct wind tunnel tests; conduct flight integrity live fire tests; complete gyro integration; flight integrity live fire tests.
		- Conduct simulation and modeling effort for area denial; procure and test prototype weapon system and sensor hardware.
•	11361	- Define combined laser detection and ranging (LADAR), millimeter wave radar and infrared sensor suite requirements to detect low observable targets; conduct captive flight test to evaluate W BAND (94 gigahertz) millimeter wave radar and LADAR sensor suite for next generation smart munition applications.
		- Conduct FDSWS live fire demonstration of 6750 lb. weapon; complete fabrication of 5700 lb. weapon; start virtual simulations; perform ER fluid research including fluid characterization, software control methodology; materials and structures modeling, and power supply design
•	2118	- Conduct integrated demonstrations of novel dual penetrator systems to establish enhanced defeat of complex armor with less than 5 megajoules of energy on target.
•	1365	- Procure and evaluate prototype quantities of 120mm, one-tenth range training rounds to verify performance and reusability.
		- Develop and procure a small, lightweight, low energy laser ignition system for 155mm howitzers for a technology demonstration.
•	853	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	37054	

FY 2001 Planned Program:

•	5900	- Conduct subsystem technology demonstrations of TERM concepts including warhead, propulsion and Hi G testing.
		- Demonstrate defeat of advanced threat armors and active protection systems through simulation and/or live fire.
		- Design air bursting warheads for a medium caliber lightweight armament system for future combat vehicles.
		- Refine novel, dual KE penetrator for robust defeat of advanced complex armors with less than 5 megajoules of energy on target at extended ranges.
•	5164	- Conduct hardware in-the-loop simulations and perform PGMM ATD laser round demonstration firings.
		- Build and test area denial hardware and conduct system demonstration.
•	4965	- Perform operational evaluation of 5700 lb. FDSWS weapon and validate virtual simulations.
Total	16029	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT D232

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D232 Advanced Munitions Demonstration	11083	16083	13709	5897	9844	5813	16394	Continuing	Continuing

Mission Description and Justification: This project includes the DFL program which will enhance tank KE penetrator lethality, particularly against ERA appliqué arrays now available on fielded threat systems, through use of a precursor defeat mechanism. Additionally it will demonstrate range and lethality enhancements for tank munitions and emerging technologies needed to defeat active protection systems (APS). This project demonstrates advanced warhead and cartridge concepts, utilizing novel EFP and shaped charged (SC) designs, that can be applied to product improvements to fielded and developmental anti-armor munitions, (e.g., wide area munitions (WAM), and 120mm chemical energy (CE) cartridge.) 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. In-house efforts are accomplished by ARDEC, Picatinny Arsenal, NJ and the ARL, Aberdeen Proving Ground, MD. Major contractors include: Alliant Tech Systems, Minneapolis, MN; SAIC, McLean, VA; LTV Aerospace, Dallas, TX; Textron Defense Systems, Wilmington, MA; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; PRIMEX-Flinchbaugh, Red Lion, PA; Alliant Tech Systems-Allegheny Ballistics Laboratory, Rocket City MD and Raytheon/TI Systems, Tucson, AZ.

FY 1999 Accomplishments:

•	4996	- Completed DFL ATD precursor penetrator integrated cartridge design.
		- Conducted technology maturation demonstrations for optimum novel penetrator function and armor penetration utilizing tactical composite sabot and propulsion system.
•	3572	- Demonstrated via modeling and simulation TERM technical feasibility and operational force effectiveness.
		- Completed TERM concept designs and downselect.
•	2515	- Conducted tests of long stand-off warheads (downselected in FY1998) and matured candidates for counter active protection systems.
Total	11083	

FY 2000 Planned Program:

•	7210	- Demonstrate novel penetrator to achieve up to 70% increase in armor penetration over the M829A2 munition at extended ranges.
		- Complete design of advanced KE munition for defeat of explosive reactive armor.
•	8513	- Develop TERM multi-sensor technologies to achieve sufficient footprint for long range engagement.
		- Complete CFT verification of sensor technology.
	360	- Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	16083	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT D232

FY 2001 Planned Program:

•	6243	- Fabricate test hardware for final design of advanced KE munition.
		- Demonstrate advanced KE munition against ERA; complete the DFL ATD.
•	7466	- Complete TERM sensor development and final CFT.
		- Conduct risk reduction activities of TERM concepts including warhead, propulsion and Hi-G testing.
Total	13709	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology	PROJECT: D244

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D244 Warheads and Energetics Center of Excellence	0	4905	0	0	0	0	0	4905	4905

Mission Description and Justification: This one-year Congressional plus-up will design and demonstrate SC and EFP warheads that are more lethal, lighter and smaller with multiple effects for high performance against armor, masonry, wall and bunker targets. It develops explosives for future warheads with increased energy and reduced sensitivity which are affordable and easy to demilitarize. This project will develop propulsion systems providing increased performance with Insensitive Munitions (IM) compliance and reduced gun tube wear. This effort will augment current efforts and support FCS requirements. Efforts will be performed by members of the National Warheads and Energetics Consortium under the Warheads and Energetics Center, Picatinny Arsenal, NJ and the ARL, Aberdeen Proving Ground, MD. Major contractors include Alliant Tech Systems, MN; SAIC, McLean, VA; Textron Defense Systems, Wilmington, MA; Aerojet, Sacramento, CA; Geocenters, Wharton, NJ; Hunting Engineering, London, U.K.; Dynamit Nobel, Nurenburg, GE.

FY 1999 Accomplishments: Project not funded in FY 1999

FY 2000 Planned Program:

- 1068 - Synthesize, scale-up and develop processes to manufacture new explosives, i.e.: TNAZ, CL-20, PAX 2A and polynitrcubanes.
- 925 - Develop high performance/ low flame temperature gun propellant to reduce tube wear and erosion.
- 1130 - Design, fabricate and test EFP warheads for active protection system.
- 1650 - Complete designs, fabricate and test SC and EFP warheads with novel liner materials, configurations, and explosives.
- 132 - Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 4905

FY 2001 Planned Program: Program completed in FY00.

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	58706	130525	148114	117403	189498	199930	166801	Continuing	Continuing
DC62 DC62	16198	0	0	0	0	0	0	0	16198
DC66 DC66	0	960	2835	4723	2631	999	1028	Continuing	Continuing
D221 Combat Vehicle Survivability	681	20440	28322	25726	19293	21535	9890	Continuing	Continuing
D440 Advanced Combat Vehicle Technology	23134	60956	104719	72380	146540	161052	150929	Continuing	Continuing
D441 Combat Vehicle Mobility Technology	4655	8091	7479	4699	5949	2951	0	0	33824
D497 Combat Vehicle Electronics	7006	5747	2997	5594	6225	5871	0	0	33440
D502 HAECO II	772	5885	0	0	0	0	0	0	6657
D506 Aluminum Metal Matrix Composite (NAC)	3853	6866	0	0	0	0	0	0	10719
D507 PLS Commercial Engine (NAC)	2407	0	0	0	0	0	0	0	2407
D515 Robotic Ground Systems	0	0	1762	4281	8860	7522	4954	Continuing	Continuing
D532 Abrams Engine	0	4905	0	0	0	0	0	0	4905
D533 Technology Transfer Center	0	7847	0	0	0	0	0	0	7847
D539 Mobile Parts Hospital	0	2943	0	0	0	0	0	0	2943
D540 Improved HMMWV Research	0	5885	0	0	0	0	0	0	5885

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology

A. Mission Description and Budget Item Justification: The Army's new vision calls for strategic dominance across the entire spectrum of operations. This spectrum of likely operations describes the need for a force that is deployable, agile, versatile, lethal, survivable and sustainable. Three Major efforts provide technologies to achieve this vision: Future Combat Systems (FCS), the Army's top priority S&T program; Future Scout and Cavalry System (FSCS) Advanced Technology Demonstration (ATD), which provides multiple advanced technologies that are essential to the success of FCS; and Active Protection Systems (APS), which have been strongly endorsed by the Army Science Board in a 1999 Summer Study on "Full Spectrum Protection for 2025- era Ground Vehicles." Technology Areas supported by this PE 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. This program is managed primarily by the U.S. Army Tank-Automotive Research, Development and Engineering Center (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. 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 through the Naval Surface Warfare Center; the Naval Research Lab; Air Force Armaments Command; and with other ground vehicle developers within the Departments of Energy, Commerce, Transportation, and the Defense Advanced Research Projects Agency (DARPA).

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	61300	90941	97200
Appropriated Value	61735	131941	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-435		
b. SBIR / STTR	-1455		
c. Omnibus or Other Above Threshold Reductions	-246	-511	
d. Below Threshold Reprogramming	-893		
e. Rescissions		-905	
Adjustments to Budget Years Since FY 2000/2001 PB			+4914
New Army Transformation Adjustment		TBD	+46000
Current Budget Submit (FY 2001 PB)	58706	130525	148114

Change Summary Explanation: Funding: FY 2001 – The 4914 increase reflects a funding restructure of a classified program (+1900), an increase for FSCS (+3850), and other minor adjustments (-836). Projects 221 and 440 were adjusted (+46000) to reflect the New Army Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D221

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D221 Combat Vehicle Survivability	681	20440	28322	25726	19293	21535	9890	Continuing	Continuing

Mission Description and Justification: This project derives the technology needed to transform the Army into a survivable force. Advanced technologies for APS that provide protection against ground combat vehicles (e.g., smart, precision guided and other munitions) will be integrated and demonstrated. Active Protection efforts will be focused on demonstrating the necessary threat sensors, software algorithms, and hard kill countermeasures needed for an APS that is initially effective against Chemical Energy (CE) munitions (e.g., shaped charge warheads) and top attack munitions, with an ultimate goal of demonstrating an effective countermeasure against Kinetic Energy (KE) (i.e., long rod). Defeat of KE threats by an APS poses an especially difficult challenge due to the velocity, small cross section and robustness of the long rod penetrator. APS is viewed as having tremendous potential for providing enhanced protection of all combat vehicles and is an especially attractive solution for lightweight vehicle classes. Within this program, the Army has evaluated several competing approaches, one of which is a Congressionally directed fabrication/demonstration of a foreign vehicle self-protection system. Survivability technologies that are integrated and lab and field 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. Major contractors include: United Defense LP. of San Jose (prime), CA; Sanders, a Lockheed Martin Company in Nashua, NH.; TRW of Redondo Beach, CA.; Hughes Danbury, Danbury Conn.; General Dynamics Land Systems, Warren, MI.

FY 1999 Accomplishments:

- 681 - Classified program support.

Total 681

FY 2000 Planned Program:

- 1301 - In-house program office support for APS development and advanced technologies integration contract and matrix support team efforts.
- 18279 - Demonstrate detailed design, and perform APS development and testing under contract with United Defense Limited Partnership (UDLP)
  - Complete critical drawings and demonstrate fabrication of advanced technologies and APS by contractor.
  - Conduct component integration of all sensors and countermeasures integrated electronically and tested in subcontractor subsystem systems integration laboratory (SIL).
  - Demonstrate vehicle system integration with all subsystems integrated on vehicle platform; integrate software into vehicle platform and check for functionality and safety; exercise overall system on contractor vehicle SIL.
- 103 - Other government agency support.
- 135 - Purchase threat munitions test assets.
- 97 - Systems engineering support (Booz Allen Hamilton / ICRC Energy).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D221

FY 2000 Planned Program: (continued)

•	525	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	20440	

FY 2001 Planned Program:

•	1441	- In-house program office support for APS development and advanced technologies integration contract and matrix support team.
•	16495	- Continue Near Term APS development and testing of APS/advanced technologies under contract with UDLP; begin APS component integration. - Continue vehicle system integration and complete final in-shop checkout. - Perform system and subsystem performance testing with software safety and functionality test in field; perform emulation and simulation tests to incrementally exercise the system and test all functional attributes and debug software as necessary; perform live threat defeat to quantify system level performance; assess functional integration, sensor fusion, and countermeasure selection and performance.
•	174	- Other government agency support.
•	169	- Test support.
•	99	- Systems engineering support (Booz Allen Hamilton / ICRC Energy).
•	4972	- Funds will be used in support of the New Army Vision/Transformation. - This congressionally directed program demonstrates and assesses unique Full Spectrum Active Protection (FSAP) technologies to provide a single kill mechanism to defeat all classes of threats, focusing on KE defeat. - Develop FSAP concept to provide hemispherical protection against all threats for light, medium and heavy ground combat vehicles.
•	4972	- Funds will be used in support of the New Army Vision/Transformation. - This congressionally directed program utilizes survivability optimization modeling to select signature technology suites and develop hardware integration concepts for emerging signature management technologies. - Conduct an initial test evaluation of emerging signature management technologies to quantify performance and burden levels. - Develop the design of signature management hardware for full scale performance and field test evaluation in FY02.
Total	28322	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D440

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D440 Advanced Combat Vehicle Technology	23134	60956	104719	72380	146540	161052	150929	Continuing	Continuing

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. The major near term initiative funded by this project is the FSCS ATD, which transitioned from applied research PE 0602601A (Combat Vehicle and Automotive Technology) to this project in FY98. This ATD integrates advanced technologies, including sensors, survivability, advanced mobility technologies and communications into a robust vehicle platform. The FSCS ATD will then undergo technical and user evaluations. The FSCS ATD is a joint United States/United Kingdom (US/UK) FSCS/Tactical Reconnaissance Armored Combat Equipment Requirement (TRACER) program. A Memorandum of Understanding (MOU) was signed in July 1998. The acquisition strategy for the ATD resulted in both countries funding equal shares of contracts awarded to two competitive US/UK consortia in January 1999. Both countries have harmonized the User Requirements. A joint three-star review is planned 24 months after contract award to review and approve the final operational trade-offs prior to finalizing the ATD design configuration. The two consortia are: SIKA Team (Lockheed Martin (Orlando, FL)/British Aerospace (UK) joint venture with General Dynamics Land Systems (Sterling Heights, MI), Vickers (UK), and Northrop Grumman (Baltimore, MD) as subcontractors); LANCER Team (GEC Marconi (UK) prime contractor with United Defense Limited Partnership (San Jose, CA), GKN Defense (UK) and Raytheon Systems (McKinney, TX) as subcontractors). As the FSCS ATD comes to an end in FY02, emphasis will shift to the FCS. The user experimentation completed under the FSCS ATD will be a major influencing factor in the contractors approach to FCS. The FSCS ATD retains strong support by the US Army and United Kingdom and remains fully funded through completion of the ATD in FY02. Technologies and lessons learned about integration of these technologies on a C-130 transportable platform are vitally important to reduce risk and accelerate development and fielding of the FCS. FSCS also provides options for enhancing the interim force with state-of-the-art platform (e.g., survivability, mobility, electronic architecture) and advanced sensor technologies. The FCS will demonstrate the capabilities of a system of systems network centric (vis a vis platform centered) force to perform in an environment requiring multi-functional, reconfigurable capabilities. It will provide an optimized simulation validated system integrating advanced technologies to maximize joint interoperability, strategic transportability and commonality of mission roles including direct and indirect fire, air defense, reconnaissance, troop transport, counter mobility, non-lethal and C2 on the move. Contracts for the concept designs phase are to be awarded in May 2000. In 2000 technology assessments and risk reduction activities will be initiated for selected high payoff activities.

FY 1999 Accomplishments:

- 19261 - Conducted source selection and awarded FSCS ATD contracts to two US/UK consortia to complete FSCS preliminary design and interface control, began detailed design, began development of FSCS/TRACER vehicle concepts for engineering models, began development of FSCS ATD hardware and software, performed weapon systems trade-off studies and begin weapon systems development for FSCS/TRACER.
  - Transitioned the implementation of vehicle electronics (VETRONICS) open systems architecture to the FSCS ATD contractors.

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D440

FY 1999 Accomplishments: (continued)

- Began development of electronic interfaces between major subsystems of FSCS/TRACER (e.g., target acquisition, communication, crew control and displays, etc.) and incorporate sensor suite, crew station, and electronic interface into contractors design/SIL for FSCS ATD.

• 3873
- Conducted system requirement analysis for Command, Control, Communications, Computers, and Intelligence (C41) workload
- Initiated effort to implement simulation and modeling concepts to support FSCS ATD contractor efforts.
- Supported and participated in Government/contractor integrated product teams (IPTs).
- Developed model to enable Government and contractors to determine system cooling requirements given vehicle and propulsion system characteristics.

Total 23134

FY 2000 Planned Program:

• 18719
- Evaluate the affordability of hardware and software alternatives and system concepts by both contractors.
- Complete sub-system and system trade studies to define cost effective hardware configurations by both contractors.
- Develop FSCS simulations and virtual prototypes by both contractors.
- Define software requirements by both contractors.
- Conduct Ministry of Defense/Department of Defense System Design Reviews

• 26272
- Procure hardware and conduct fabrication of sub-system assemblies by both contractors.
- Design, procure and assemble SIL by both contractors.
- Demonstrate sub-system testing and evaluation by both contractors.
- Demonstrate analysis of survivability design alternatives by both contractors.

• 5699
- Perform Cost as an Independent Variable (CAIV) analysis and trade studies.
- Complete analysis to support refinement of Combined Operational Requirements Document.
- Complete Cooperative Analysis of Alternatives (CAoA) to support 3-Star Review.
- Continue support and participation in Government/contractor IPTs.

• 2898
- Continue modeling and simulation concepts in support of FSCS ATD contractor efforts.
- Investigate application of Joint Tactical Radio System (JTRS) to FSCS.

• 2898
- This congressionally directed program initiates technology risk reduction activities for FCS with contractors/Award Contracts.
- Conduct development and installation SIL for FCS.
- Develop FCS software simulation and virtual environment for concept evaluation.
- Demonstrate FCS interface/capability of system and subsystem level components in a multimission environment.

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D440

FY 2000 Planned Program: (continued)

•	2898	- This congressionally directed program uses CAV composite technology as the base or level 1 survivability level to develop concepts for multiple levels of additional modular armor and integrated into advanced structures for FCS. Determine the resulting cost-benefit at the vehicle level.
•	1572	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	60956	

FY 2001 Planned Program:

•	19108	- Complete all FSCS trade studies and finalize cost effective alternatives by both contractors. - Provide affordability data for US/UK 3-Star Affordability Review by both contractors. - Incorporate simulation and virtual prototyping results into their development process by both contractors. - Complete sub-system and SIL fabrication by both contractors.
•	42465	- Perform FSCS demonstrator vehicle fabrication and integration by both contractors. - Fabricate and evaluate survivability designs by both contractors. - Complete sub-system test and evaluation by both contractors. - Conduct contractor system shakedown test and evaluation efforts by both contractors.
•	7357	- Prepare and conduct FSCS 3-Star Affordability Review. - Prepare and release RFP for engineering and manufacturing development (EMD) phase. - Participate in contractor system and sub-system testing and evaluation. - Continue support and participation in Government/contractor IPTs.
•	35789	- Funds will be used in support of FCS and the New Army Vision/Transformation. - Complete Installation of Simulation Lab - Demonstrate Use of and complete Architecture for Integrated Data Environment. - Demonstrate Use of SIL for Component Risk Reduction and Validation. - Design and Build Virtual Test Environment. - Demonstrate Virtual Test Environment . - Robotics Risk Reduction.
Total	104719	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D441

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D441 Combat Vehicle Mobility Technology	4655	8091	7479	4699	5949	2951	0	0	33824

Mission Description and Justification: This project demonstrates the mobility technologies (suspension , track, engines, transmissions, and auxiliaries) vital for lighter, agile, deployable, and more fuel efficient ground combat vehicles. It funds an advanced mobility technology demonstration comprised of several independent technologies. The principal elements of the mobility demonstrations in FY00 are active and semi-active suspension, electric drive, and lightweight 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 to possible enable compact vehicle designs that are less vulnerable to detection, acquisition and attack by threat weapons, and (3) a need to protect vehicle subsystems under armor, 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 endurance. The lighter and smaller vehicles are necessary for enhancing deployability and lessening the logistics burden (fuel), but lighter vehicles will have significantly lower ride performance and mobility limits without new mobility technology advances compared to larger, heavier vehicles. 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 lightweight 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. Funding in this area is being leveraged through two joint Army/DARPA programs called the Combat Hybrid Power System (CHPS) and the Electric Drive Vehicle Demo Program. The latter program will transition to this Army project in FY00. The objective of the CHPS program is to design, develop and demonstrate, in a SIL, a robust electrical power architecture that can meet the requirements of future vehicles ranging from light tactical wheeled vehicles to close combat vehicles. In-house efforts are accomplished by 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 1999 Accomplishments:

•	3840	- In coordination with DARPA and ARL, tested and evaluated Silicon Carbide (SiC) power devices for motor drive controller. - Test preparations fielded for active suspension with preview sensor and algorithms underway. - Tracked tensioning system for medium combat vehicle application tested. - Developed lightweight, low maintenance band track for 25 ton combat vehicle. - Upgrades fabricated for compact high efficiency mechanical transmission laboratory evaluation.
•	815	- In coordination with DARPA, integrated and tested 1st generation CHPS architecture components in a System Integration Laboratory (SIL).
Total	4655	

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D441

FY 2000 Planned Program:

•	3294	- Configure and install on High Mobility Multi-Wheeled Vehicle (HMMWV) optimal preview sensor for active suspension. - Procure, install and evaluate compressible fluid suspension on HMMWV. - Select and evaluate electric drive components of the combat hybrid power system for installation on a mobility testbed. - Refine and demonstrate the design of SiC motor drive controller. - Fabricate and test lightweight band track for 25 ton vehicle. - Perform shakedown and performance testing of compact, high efficiency mechanical transmission in the lab.
•	2687	- Transition the CHPS SIL and Virtual Prototype from DARPA to the Army/TARDEC. - Update the DARPA CHPS Virtual Prototype models based upon information obtained from SIL assessments. - Complete the DARPA CHPS program by demonstrating in the completed SIL the feasibility of a hybrid architecture.
•	1950	- Begin integration of advanced components (high power/high energy pulse forming network, flywheel, high temperature/fast response converters and advanced high energy density batteries) in CHPS for assessment in the SIL.
•	160	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	8091	

FY 2001 Planned Program:

•	2705	- Test and refine preview feature of an active suspension system. - Demonstrate and test components of the CHPS hardware on a mobility test bed. - Complete design of 2nd generation high efficiency transmission. - Fabricate turbocharger, high temperature tribology componentry, cold start system and fuel injection system for application to commercial diesel engines for combat vehicles. - Develop band track with enhanced mine resistant characteristics.
•	3075	- Develop new system level and component level vehicle power requirements based on the next planned Army combat vehicle. - Allocate these requirements down to the vehicle hybrid electric power architecture. - Using the CHPS virtual prototype modeling tools, design vehicle-specific hybrid electric architecture. - Build advanced componentry reflecting FCS for incorporation into SIL architecture.
•	1699	- Test advanced components (high power/high energy pulse forming network, flywheel, high temperature/fast response converters and advanced high energy density batteries) in CHPS for performance assessment in the SIL.
Total	7479	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D497

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D497 Combat Vehicle Electronics	7006	5747	2997	5594	6225	5871	0	0	33440

Mission Description and Justification: This project develops and demonstrates vehicle electronics hardware and software technologies that will yield increased crew efficiencies and performance, or reduced crew size, and advances open systems architectures for ground vehicle weapon systems. These technologies include: three-dimensional (3D) audio, voice recognition, headtrackers, advanced software architecture, reusable software Application Program Interface (API), embedded simulation, and indirect and semi-autonomous driving (using available robotics technologies). Investments are in embedded training, mission rehearsal, decision aids, automation of crew functions, and ergonomic crew station designs. The program will be conducted in three phases that continually build on advancing technologies into a mobile reduced crew testbed vehicle. The first phase will develop and integrate 3D audio, voice recognition, a commander's headtracker, and an initial open systems architecture/software API and embedded simulation baseline into the testbed. It will culminate in a FY00 vehicle demonstration of a 50% crew efficiency enhancement, a 15% reduction in software cost with a 5X improvement in architecture throughput and embedded simulation integration feasibility. The second phase will advance the voice recognition, architecture/API and embedded simulation baseline and develop and integrate the semi-autonomous robotics technologies into the testbed. It will culminate in an FY04 vehicle demonstration of a 100% increase in crew efficiency (or 50% reduction in crew size) by driving and commanding the vehicle from a single crew station, a 30% reduction in software cost with a 10X increase in architecture throughput, and embedded simulation capable of full mission rehearsal. This program will build on and leverage technologies from the FSCS ATD, the Joint Robotics Demo III Program, the Crusader and the Crewman's Associate ATD. Major contract efforts will include: DCS Corp, Alexandria, VA, for software architecture; Oasis, Troy, MI, for embedded simulation; RST, Westminster, MD, and Utah State for robotics technologies; and GDLS, Sterling Heights, MI, for testbed integration and voice recognition.

FY 1999 Accomplishments:

- 250 - Designed vehicle test bed system electronics architecture.
- 3826 - Evaluated, selected, and initiated procurement of 3D audio, headtracker, voice recognition, indirect vision driving, architecture and embedded simulation technologies.
- 900 - Defined testbed software architecture and top level software design; designed and coded the first drop of the common software operating environment based on real time Common Object Request Broken Architecture (CORBA).
- 100 - Conducted solid modeling analysis of crew station structure and positioning within testbed vehicle; defined and designed two identical crew stations for testbed.
- 180 - Prepared test bed for crew station mechanical integration.
- 600 - Defined and designed graphical operating environment and reusable combat vehicle graphics tool kit.
- 700 - Defined and designed vehicle test bed embedded simulation system; procure embedded simulation image generation hardware.
- 150 - Defined and designed test environment equipment and scenario.

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D497

FY 1999 Accomplishments: (continued)

•	100	- Procured Pos/Nav and GPS system, mass memory unit, and intercom system for test bed vehicle.
•	200	- Created concept for crew station integration into TARDEC virtual prototyping environment.
Total	7006	

FY 2000 Planned Program:

•	1558	- Complete and integrate crew stations into testbed.
•	1753	- Complete software development, code and test of: mission rehearsal, graphics tool kit, graphics operating environment, user interface device drivers, drive by wire algorithms, commanders Graphics User Interface (GUI) and test simulation functions.
•	633	- Complete unit test and systems integration testing of test bed vehicle systems.
•	263	- Integrate and test technologies into vehicle testbed.
•	195	- Prepare test site for vehicle demo.
•	214	- Integrate synchronized Modular Semi-Automated Forces (MODSAF) and after action review software into embedded simulation system.
•	477	- Create 3D visual terrain data base of test site and integrate database into test bed vehicle.
•	536	- Demonstrate indirect vision, voice recognition, three-dimensional audio, advanced architecture and embedded simulation technologies in vehicle testbed.
•	118	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	5747	

FY 2001 Planned Program:

•	399	- Conduct vehicle test bed data reduction, test results analysis and identify lessons learned.
•	399	- Synthesize lessons learned into Phase II test bed vehicle requirements.
•	499	- Design advanced architecture and embedded simulation system.
•	499	- Define semi-autonomous driving concept and begin design.
•	702	- Design advanced Phase II crew stations.
•	150	- Define requirements and concept for vehicle remote control for dismounted operations.
•	349	- Define and evaluate a second crew station and define gunnery functions.
Total	2997	

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DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D502

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D502 HAECO II	772	5885	0	0	0	0	0	0	6657

Mission Description and Justification: This Congressionally directed program, which was funded in FY95 and FY97, received a one-year plus-up in FY00. This project supports the development and Army testing of the combined diesel/turbine (giesel) prototype engine. The Army contracted with the Hope-Anderson Engine Company (HAECO) to develop one giesel 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 (TACOM). The contractor is HAECO Partners Ltd., Hillsboro, Ohio.

FY 1999 Accomplishments:

•	772	- Modified contract to continue development of giesel prototype engine for Government evaluation. Demonstrated the giesel prototype at 300hp at the contractor's facility.
Total	772	

FY 2000 Planned Program:

•	5727	- Complete improvements of the existing giesel engine design. Complete testing and evaluation. - Complete application of Giesel technology into the DDC 6V53T engine. - Complete application of Giesel technology into the high power density opposed piston engine.
•	158	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	5885	

FY 2001 Planned Program: Project not funded in FY 2001.

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DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D506

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D506 Aluminum Metal Matrix Composite (NAC)	3853	6866	0	0	0	0	0	0	10719

Mission Description and Justification: This Congressionally directed program, which received a one year add in FY00, will demonstrate a manufacturing capability to strengthen track shoes by embedding SiC whiskers within the shoes. The scale up of the SiC whisker manufacturing capability has been completed, including a specification for the whiskers, optimization study, benefication trials, and furnace design and installation. Laboratory testing has been completed and the optimum whisker loading has been determined. The tooling required for the fabrication of the whisker and the squeeze cast shoe body has been designed and fabricated. In FY99, one vehicle set of track shoes of both the single pin and double pin design was cast, machined, assembled and shipped to Keweenaw Research Center for preliminary field evaluations. The optimum rubber compound (blend of EPDM and NBR) has been selected and laboratory tested for the pin bushings and track pads. A preliminary economic analysis has been conducted and coordinated with the Bradley Fighting Vehicle Program Manager. The project will produce a viable design for track shoes with increased strength and durability.

FY 1999 Accomplishments:

•	3472	- Completed wear testing of SiC reinforced aluminum metal matrix samples to determine material properties; completed final design of single pin track shoe for Bradley vehicle; completed manufacturing development work for a single pin track shoe for the Bradley vehicle, fabricated squeeze casting tooling, and developed preliminary analysis.
•	381	- Participated in Simulation Based Acquisition demonstration for the Total Life Cycle (SIM-TLC).
Total	3853	

FY 2000 Planned Program:

•	6682	- Complete preliminary field evaluation testing, fabricate track for validation testing, conduct validation testing and fabricate track shoes for qualification testing at government test sites.
•	184	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	6866	

FY 2001 Planned Program: Project not funded in FY 2001.

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DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D507

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D507 PLS Commercial Engine (NAC)	2407	0	0	0	0	0	0	0	2407

Mission Description and Justification: This one-year congressionally directed program demonstrated a heavy truck propulsion system through the leveraging and utilization of commercial engine technologies. This program supported the Program Manager for Heavy Tactical Vehicles (PM HTV) acquisition plans for heavy truck propulsion systems future pre-production contract(s) in 2002, and production contract(s) in 2004. This effort was intended to assure a complementary blend of propulsion capabilities and engine configurations based on both commercial market forces and military requirements is achieved.

FY 1999 Accomplishments:

- 2169 - Conducted a competitive solicitation to upgrade the level of technology and to provide additional improvement in the reduction of harmful emissions (All major engine manufactures were invited to submit proposals).
  - Performed and completed engine evaluation.
- 238 - Performed SIM-TLC.

Total 2407

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D515

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D515 Robotic Ground Systems	0	0	1762	4281	8860	7522	4954	Continuing	Continuing

Mission Description and Justification The Army supports development of robotic platforms to augment manned, ground and aerial reconnaissance systems, and robotic sentries for tactical headquarters and logistical nodes. In response, this project funds demonstrations of unmanned land systems for multiple tactical and logistics applications by the Army and, possibly, other services. Near-term efforts are oriented toward designs for a future combat fighting team that may employ automated, semi-automated, and manned systems. The Army's approach builds upon previous and ongoing investments, such as the Demo III program, under the Joint Robotics Program, and the Crewman's Associate Advanced Technology Demonstrator. There is no duplication of effort within the Army or DoD. Technologies proven in any robotic demonstration are expected to be transferable to other unmanned platforms as well as manned platforms to reduce operator workload.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program:

•	1762	- Begin vehicle design and define technology interfaces with Army Research Laboratory and Industry; award primary vehicle integration contract. - Evaluate mission alternatives and select vehicle platform for technology integration.
Total	1762	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D532

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D532 Abrams Engine	0	4905	0	0	0	0	0	0	4905

Mission Description and Justification: This one year congressionally directed program provides a jump-start for a new propulsion system for production and phased integration into the Abrams tank fleet with potential application to the Crusader program. The objective is to reduce Abrams Operating and Support (O&S) costs. Additionally, a new propulsion system will yield a lighter, more reliable, more fuel efficient, and easier to repair engine, replacing the current AGT 1500 tank engine designed in the 1960's and produced through 1992.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

- 4470 - Design and demonstrate a new propulsion system for Abrams tank fleet completed.
- 303 - Provide Government support.
- 132 - Small Business Innovative Research/Small Business Technology Transfer Programs.

Total 4905

FY 2001 Planned Program: Project not funded in FY 2001

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D533

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D533 Technology Transfer Center	0	7847	0	0	0	0	0	0	7847

Mission Description and Justification: This one year congressionally directed program will transition developments in advanced high performance aerospace metallic alloys and processing/joining methods to demanding ground combat and tactical vehicle structures and armor in order to achieve the major weight reductions required by future ground systems for deployability, mobility and survivability. The performance of conventional alloys used in ground vehicles for decades has been literally "maxed out". The ground vehicle design community must now exploit high performance materials and structures if they expect to achieve any significant gain.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	2864	- Establish ballistic performance of Aluminum-Lithium alloys known as Weldalite (space shuttle center tank) of alloy plate, across full range of armor piercing and fragment threats.
•	2864	- Complete development of the solid-state welding process known as Friction Stir Weldling, for Weldalite alloy plate, over the full range of plate thickness. - Establish physical, mechanical and ballistic response of Friction Stir weldments.
•	1908	- Complete development of an advanced fusion welding processes for Single-Melt, low-cost grade of titanium alloys. - Establish physical, mechanical and ballistic response of titanium ballistic structures.
•	211	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	7847	

FY 2001 Planned Program: Project not funded in FY 2001

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D539

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D539 Mobile Parts Hospital	0	2943	0	0	0	0	0	0	2943

Mission Description and Justification: This one year congressionally directed program will design and demonstrate off-site capability to fabricate parts on demand. The Mobile Parts Hospital (MPH) will be capable of reverse engineering, scanning, or electronically measuring current and non available parts that have or do not have engineering data available. This data will allow the MPH to quickly (near real time) fabricate the part to maintain vehicle combat readiness. This capability will be demonstrated at a self-contained mini parts fabrication center while deployed at a remote site.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	2864	- Complete designing, demonstration, and validation of the off-site capability to fabricate parts on demand. Provide the MPH with reverse engineering and simulation hardware and software to reverse engineer individual automotive repair parts which will be converted into machine language that will then be fed into a forming and/or flexible machine to produce the parts.
•	79	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	2943	

FY 2001 Planned Program: Project not funded in FY 2001

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D540

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D540 Improved HMMWV Research	0	5885	0	0	0	0	0	0	5885

Mission Description and Justification: The objective of this one year congressionally directed program is to explore new and innovative technical solutions to existing shortcomings within the current designs of the Light Tactical Vehicle Fleet. These solutions could be found through enhanced manufacturing processes/improved/optimized materials; or complete redesign of the existing platform with its components. The aging light tactical vehicle fleet continues to have a O&S cost growth directly related to age. Innovative approaches in achieving this program's objective should result in technologies directly transferable into vehicles being used or planned to be used in the light fleet.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	5727	- Establish partnering within auto industry to develop and influence efforts on ultra-light steel and the influence on weight, corrosion control, and vehicle design and manufacturing architecture. - Complete research for state of the art and beyond technologies and establish map for implementing into Army's inventory. - Complete research of dual use platforms and determine risks involved in achieving acceptable reliability and durability into Army's operational environments. - Complete economic analyses that assures new technologies and/or platforms would enhance performance of vehicles at reduced costs.
•	158	- Small Business Innovative Research/Small Business Technology Transfer Programs.
Total	5885	

FY 2001 Planned Program: Project not funded in FY 2001

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **3 - Advanced Technology Development**	PE NUMBER AND TITLE **0603006A Command, Control and Communications Advanced Technology**

COST *(In Thousands)*	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	22892	27612	21505	23775	22421	26000	25936	Continuing	Continuing
D247 Tactical C4 Technology Integration	11843	11321	12429	13838	12706	14793	14766	Continuing	Continuing
D257 Digital Battlefield Communications (DBC)	4773	4723	3813	4766	5446	6441	5938	Continuing	Continuing
D592 Space Applications Technology	2421	4702	5263	5171	4269	4766	5232	Continuing	Continuing
D596 Field Laser Radar Demo	0	6866	0	0	0	0	0	0	6866
D617 Global Broadcast System (GBS) Information Management	3855	0	0	0	0	0	0	0	3855

A. Mission Description and Budget Item Justification: This program element will develop and demonstrate Command, Control, Communications, and Computers (C4) technology to provide the soldier with distributed, mobile, secure, fully automated spread spectrum radio networks with integrated space technologies. Commercial communication technologies are continuously investigated and leveraged whenever possible. Multimedia inter-networked communications will be demonstrated while on-the-move (OTM) with commercial based standard gateway connectivity to both high-speed and legacy communication assets. The Multifunctional On-the-move Secure Adaptive Integrated Communications (MOSAIC) Advanced Technology Demonstration (ATD) will provide the communications technology foundation that will enable the emerging the Future Combat Systems (FCS) and Army 2010 concepts by demonstrating the ability for command posts to seamlessly and automatically support high volume, secure multimedia traffic over variable range and bandwidth transmissions while operating in a dispersed OTM fashion. The tactical Command and Control (C2) protect ATD will provide protection technologies for tactical internet C2 systems against modern network attacks. The space applications technology project will demonstrate novel applications of space assets for Army missions and support space technology integration. The Global Broadcast System (GBS) information management system developed a prototype for the First Digitized Division (FDD) network architecture. These projects develop technology to integrate communications systems and prototype products to enhance the survivability and efficiency of Army tactical C4 systems. This program also tests and evaluates net radio, common user, advanced antenna concepts, and distributed communications equipment and automated network management aids in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the other Services. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **3 - Advanced Technology Development**	PE NUMBER AND TITLE **0603006A Command, Control and Communications Advanced Technology**

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	23747	20883	21508
Appropriated Value	24109	27883	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-362		
b. SBIR / STTR	-528		
c. Omnibus or Other Above Threshold Reductions		-103	
d. Below Threshold Reprogramming	-233		
e. Rescissions	-94	-168	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-3
Current Budget Submit (FY 2001 PB)	22892	27612	21505

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D247

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D247 Tactical C4 Technology Integration	11843	11321	12429	13838	12706	14793	14766	Continuing	Continuing

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. This project includes the MOSAIC ATD with the development, adaptation, and integration of communications for mobile operations required for future command post operations. This technology also provides the communications capabilities required by the FCS. This project includes the Tactical C2 Protect (TC2P) ATD that provides protection technologies for tactical internet command and control information systems, components and data, against modern network attacks. This project also performs development of OTM ultra-high frequency (UHF), super high frequency (SHF), and extremely high frequency (EHF) satellite communications technology; interfaces mobile UHF satellite communications radios to combat net radio technology using commercial standard data packet protocols; and is developing technologies that are required for a complete future Joint Tactical Radio System (JTRS).

FY 1999 Accomplishments:

- 2988 – Developed and delivered Wideband Radio Network (WRN) products: wideband network radio (WNR), WRN testbed (WRNT), software development environment (SDE), and wideband (WB) waveform.
  – Tested and evaluated new JTRS WB waveforms and DARPA Global Mobile (GloMo) technology.
- 5013 – Demonstrated integrated digital battlefield communications (DBC) ATD technologies in support of high-capacity OTM digitized communications and split-based operations.
  – Integrated and demonstrated enhanced commercial terrestrial Personal Communications System (PCS) capability in the Army's warfighter information network proof of concept.
  – Demonstrated integrated phased array antenna to meet OTM radio access point communications requirements.
  - Demonstrated wideband high frequency communications technology, with access to the tactical internet, for transmitting maneuver and intelligence data from long range surveillance for units that are beyond-line-of-sight.
- 3842 – Demonstrated unmanned aerial vehicle based battlefield paging.
  – Fully integrated and demonstrated end-to-end unmanned aerial vehicle based surrogate communication (SHF) satellite capability, including ground component.
  – Demonstrated a surrogate for UHF low earth orbit (LEO) Multiple Beyond-line-of-sight Communications (MUBLCOM) capability (leverages DARPA development).
  – Built and demonstrated airborne switching capability integrated with SHF surrogate satellite communication payload.

Total 11843

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D247

FY 2000 Planned Program:

- 4346 - Investigate and evaluate information protection technologies for the upper tactical internet with focus on network access protection, intrusion detection and host level protection.
- 3575 - Integrate wideband power amplifier control signal interface within the WRNT.
  - Conduct a cosite performance test and evaluation of the UHF multiplexer.
  - Investigate and develop an extended frequency wideband power amplifier (EF-WBPA) (400-2000 Mhz).
  - Integrate laboratory testbed equipment within the WRNT.
- 1740 - Conduct an initial review of existing and proposed (LEO/ medium earth orbit (MEO)) wideband commercial satellite communication (SATCOM) technologies and capabilities. Develop a fast recovery modem for EHF OTM narrowband communication.
  - Test JTRS multiband OTM antenna prototypes.
  - Develop modeling and simulation tools to evaluate performance of multiple antennas on multiple vehicles used in Tactical Operation Centers (TOCS).
- 1381 - Develop, fabricate and test alternative technologies for phased array antennas with goal of cost reduction.
- 279 - Small Business Innovation Research / Small Business Technology Transfer Programs

Total 11321

FY 2001 Planned Program:

- 6693 -Investigate and evaluate information protection technologies for the upper tactical internet expanding the effort to address security management and malicious code detection and eradication. Integrate and test command and control protection solutions in a field environment.
- 2891 - Integrate very high frequency (VHF)/ UHF radio frequency (RF) receiver/transmitter multiplexer into single box.
  - Conduct performance testing on the Wideband Power Amplifier (WBPA) (30-450MHz).
  - Conduct performance testing on the EF-WBPA.
  - Evaluate UHF multiplexer and WBPA prototypes through WRNT and field test.
- 2845 - Develop a fast recovery modem for Ka Band LEO/MEO OTM wideband communication .
  - Exhibit capability of JTRS compatible OTM antenna, and begin development of expanded bandwidth OTM antenna (2 GHz).

Total 12429

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D257

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D257 Digital Battlefield Communications (DBC)	4773	4723	3813	4766	5446	6441	5938	Continuing	Continuing

Mission Description and Justification: The objective of the MOSAIC ATD is to provide networked communications systems that support short range dispersed wireless elements (< 1 km), medium range dispersed wireless elements (< 10 km) and range extended dispersed wireless elements (> 10 km). Multiple wireless transmission facilities provide the user flexibility to traverse varied terrain over wide areas, which can improve system robustness and reduce vulnerability. The overall system will provide a scaleable capability that allows the user to have the best wireless communications system available based on current operating conditions. The selection of these multiple wireless systems will be automated to ease the burden on the operator. To provide this highly reliable mobile communications infrastructure, the communications assets will seamlessly assign user bandwidth as a function of range. In addition, automated reconfiguration of the routing protocols without operator intervention will occur. This program will use DARPA's Airborne Communications Node (ACN) communications payload to provide a networked, beyond line of sight, capability. Its inclusion allows command post elements to be dispersed in excess of 15 km to support split based operation associated with FCS operations. The ability to seamlessly and automatically support multimedia traffic over variable range and bandwidth transmission systems while the vehicles are in motion also will be demonstrated. Mobile elements will demonstrate minimally interrupted communications, which support, data, voice, real time multimedia and video teleconference (VTC) services. In order to show connectivity in this ATD, the communications system will dynamically operate over several different transmission systems including a wireless local area network (LAN), packet radio, wideband cellular radio, unmanned arial vehicles (UAV's), and satellites in a minimally interrupted manner.
This Project is shared with PE0603006A D247.

FY 1999 Accomplishments:

- 2730 – Demonstrated mobile radio access point. Integrated and demonstrated Digital Battlefield Communications (DBC) ATD radio access point with OTM high capacity trunk radio and phased array antenna capable of mobile operation.
  – Integrated OTM, high capacity, trunk radio and mobile phased array antenna into the radio access point.
  – Developed, evaluated and demonstrated dual band airborne communications relay antenna improvements to provide consistent gain across the coverage area for improved range extension communications.
  – Demonstrated a dual band airborne communications relay package capable of supporting 45-Mbps communications
- 2043 – Integrated and demonstrated secure tactical PCS capability into the warfighter information proof of concept in support of the DBC ATD.
  – Inserted and evaluated digital battlefield communications technologies in the Joint Space-based Common Operational Picture Enhancement (JSCOPE) demonstration.
  – Integrated and demonstrated enhanced asynchronous transfer mode (ATM) features into the radio access point and the Army's warfighter information proof of concept.
  – Demonstrated Army application of satellite PCS technology to provide a highly mobile, handheld, worldwide communications capability.

Total 4773

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D257

FY 2000 Planned Program:

•	1964	- Develop a security architecture to consider MOSAIC security issues up front and generate solutions to improve performance and reduce costs. - Extend existing communications testbed into a ground mobile testbed to provide an environment to demonstrate the concepts of mobile, seamless communications between the mobile trunking backbone communications and to the subscriber, lower data rate users. - Develop capability to enhance communications services to mobile, wireless tactical user such as voice, data, video, e-mail, file transfer, web browsing, video conferencing, etc.
•	2666	- Investigate and identify communications technologies to support distributed mobile wireless tactical operations centers. - Identify and mature key technologies developed under the DARPA Global Mobile (GloMo) program to support networked OTM communications. -Analyze and develop communications architecture for the FCS.
•	93	- Small Business Innovation Research / Small Business Technology Transfer Programs
Total	4723	

FY 2001 Planned Program:

•	1568	- Integrate networking and link layer technologies for the future generation tactical internet into the ground mobile testbed. - Explore methods to achieve guaranteed quality of service associated with real-time, internet protocol based, multimedia communications over tactical asynchronous transfer mode backbone networks. - Enhance commercial personal communications technology currently being adapted to tactical applications to provide system elements that safeguard against inherent system vulnerabilities. - Leverage commercial wireless LAN technology to provide fast Ethernet connectivity for mobile and ad-hoc networks where wired networks are inappropriate for existing infrastructures.
•	2245	- Integrate and demonstrate the matured DARPA GloMo program technology to support networked OTM communications. These technologies will be integrated into the ground mobile testbed. - Integrate, demonstrate and evaluate communications technologies to support distributed mobile wireless tactical operations centers and FCS in the ground mobile testbed. - Integrate enhanced communications services capability for mobile wireless tactical users into ground mobile testbed. - Integrate, evaluate and demonstrate key technologies developed under the DARPA ACN program for extended range networked communications with the ground mobile testbed. - Complete development of communications architecture for the FCS.
Total	3813	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology
	PROJECT: D592

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D592 Space Applications Technology	2421	4702	5263	5171	4269	4766	5232	Continuing	Continuing

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) and space control (space surveillance) to improve warfighting capabilities and operations other than war.

FY 1999 Accomplishments:

- 618 - Baselined overhead sensor configuration for unmanned air vehicle and space applications with initial demonstration of spectral data; upgraded sensor components for improved performance.
- 1367 - Developed an air platform battlefield ordnance awareness infrared sensor design with onboard processing; developed signature collection and processing algorithms for technology demonstration.
- 436 - Completed laser communications air to ground terminal technology demonstration and verified satellite to ground pointing and tracking software; transition to Space and Missile Defense Battle Lab to participate in Ballistic Missile Defense Organization (BMDO) funded laser communications space to ground demonstration for tactical internet evaluation.

Total 2421

FY 2000 Planned Program:

- 1010 - Demonstrate a hyperspectral sensor in the 1-2.5, micron wavebands, and improved cueing and clutter rejection via polarization using ground test. - Initiate Long Wave Infrared (LWIR) Acousto-Optic Tuneable Filter (AOTF) development.
- 3093 - Demonstrate battlefield ordnance awareness infrared sensor to detect artillery and rocket firings; develop identification, targeting, and simultaneous explosive ordnance events software; collect signature data in various tactical environments for technical requirements definition.
- 485 - Develop radar phenomenology document and complete conceptual space surveillance technology design requirements.
- 114 - Small Business Innovation Research / Small Business Technology Transfer Programs

Total 4702

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D592

FY 2001 Planned Program:

•	1054	- Demonstrate on board spectral/polarization data processing, and hyperspectral spatial and temporal signature processing with sensor using airborne testing. Complete Long Wave Infrared (LWIR) Acousto-Optic Tuneable Filter (AOTF) development.
•	3225	- Complete battlefield ordnance awareness infrared signature database development; demonstrate algorithms for near real-time processing of ordnance events; develop initial set of Army technical ordnance reporting requirements for integration in fire support and DOD space based infrared systems.
•	984	- Complete space surveillance threat database development and evaluate radar algorithms for technology demonstration.
Total	5263	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communications Advanced Technology PROJECT D596

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D596 Field Laser Radar Demo	0	6866	0	0	0	0	0	0	6866

Mission Description and Justification: The objective of this one year Congressional special interest project (innovative sensor enhancement integration technology (ISEIT)) was for Space and Missile Defense Command to do a proof-of-principle (POP) demonstration to develop and validate a solid state infrared sensor system which collects and fuses non-collocated dissimilar sensor data in response to the operational needs of seven of the eight US Special Operations Command's (USSOCOM) SP6 flagship capabilities. These flagship capabilities are the USSOCOM link to supporting the mission needs statement and the operational concepts of joint vision 2010. This effort is a new start and is not related to previous efforts. This demonstration will include delivery of a prototype infrared sensor, fusion engine, and operational software.

FY 1999 Accomplishments: Program not funded in FY 1999.

FY 2000 Planned Program:

- 6682 - This one year congressional special interest effort will demonstrate a prototype infrared sensor and a prototype fusion engine with software.
- 184 - Small Business Innovation Research / Small Business Technology Transfer Programs

Total 6866

FY 2001 Planned Program: Program not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603006A Command, Control and Communications Advanced Technology
	PROJECT: D617

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D617 Global Broadcast System (GBS) Information Management	3855	0	0	0	0	0	0	0	3855

Mission Description and Justification: The objective of this one year Congressional special interest project was to develop, install and evaluate an operational prototype global broadcast service/information management (IM) system for the Army first digitized division network architecture. 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. GBS/IM will provide efficient high data rate connectivity between many distributed information sources and warfighters who receive the broadcast directly on small, inexpensive user terminals. Broadcast data includes digitized imagery, logistics data, weather data, maps, operational orders (e.g., Air Tasking Order), and video.

FY 1999 Accomplishments:

•	1355	- Completed evaluation of the DARPA Battlefield Awareness Data Dissemination (BADD) Phase 2 Advanced Concept Technology Demonstration (ACTD) Information Dissemination Management (IDM) application and unique architecture needs to apply emerging Army Battle Command System information technology. - Completed demonstration of wide band, high-speed transmission of Map Files.
•	2500	- Completed the development of a Tactical IDM (T-IDM) System Architecture that establishes T-IDM as a "User Owned and Operated System". - Completed the development of a T-IDM Experimentation Plan and stand-up a Developmental Server in the CECOM Testbed and at the Ft Hood Central Test Facility.
Total	3855	

FY 2000 Planned Program: Program not funded in FY 2000.

FY 2001 Planned Program: Program not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603007A Manpower, Personnel and Training Advanced Technology PROJECT A792

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A792 Personnel Performance and Training	2869	4981	3072	3115	3151	3726	3910	Continuing	Continuing

A. **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. 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 is also a key goal of this program. Research and development (R&D) 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-site training, assessment, and feedback; and evaluating the effectiveness of compressed gunnery training strategies for the Reserve Component. R&D will also design innovative methods and technologies to develop effective leaders for small team operations and for developing Battle Commanders for the digitized battlefield. Work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This PE is managed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences.

FY 1999 Accomplishments:

- 2869
  - Developed prototype platoon and company team training support packages for Force XXI (digital) operations in the Close Combat Tactical Trainer (CCTT).
  - Refined and expanded applications of the prototype Commanders' Integrated Training Tool (CITT) for the CCTT and other simulation environments, including digital operations.
  - Developed and evaluated methods that assess unit command climate, and analyzed trends related to soldier, training, quality of life, and readiness issues.
  - Developed and demonstrated procedures for transferring training and assessment techniques, developed for the Army Special Forces, to other, conventional Army units.
  - Completed research design to assess the capability of the BeamHit small arms simulator to support rifle marksmanship training in the Reserve Component (RC).

Total 2869

FY 2000 Planned Program:

- 4887
  - Develop and refine performance assessment tools for digital unit training in the CCTT and other simulation environments.
  - Assess utility of Force XXI training packages, focusing on those produced by units using the CITT and other available tools.
  - Conduct an annual assessment of Army command climate, identifying trends and new issues of concern to soldiers.
  - Compare distance learning to traditional up-front training of procedural and cognitive artillery skills to determine skill acquisition and retention effects.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603007A Manpower, Personnel and Training Advanced Technology PROJECT A792

FY 2000 Planned Program: (continued)

- Develop strategy that reduces live fire engagements needed to support weapons qualification, focusing on the Reserve Component.
- Develop prototype methods to enhance the Special Forces personnel assessment process, including new recruitment strategies and adaptability assessment tools.
- Develop aircrew coordination training program.

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

Total 4981

FY 2001 Planned Program:

• 3072
- Develop and demonstrate new training and performance assessment technologies that prepare operators and commanders to take advantage of evolving digital systems.
- Conduct annual assessment of Army command climate, identifying trends and new issues of concern to soldiers.
- Evaluate strategy that reduces live fire engagements needed to support weapons qualification, focusing on the Reserve Component
- Test Internet delivery of collaborative learning over time versus platform instruction.

Total 3072

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	2949	3030	3074
Appropriated Value	3021	5030	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-72		
b. SBIR / STTR	-42		
c. Omnibus or Other Above Threshold Reductions		-14	
d. Below Threshold Reprogramming	-26		
e. Rescissions	-12	-35	
Adjustments to Budget Years Since FY 2000/2001 PB			
Current Budget Submit (FY 2001 PB)	2869	4981	3072

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603105A Military Human Immunodeficiency Virus (HIV) Research PROJECT DH29

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DH29 Military HIV	5497	5931	5899	5911	6050	6818	6838	Continuing	Continuing

A. Mission Description and 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 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 the 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.

FY 1999 Accomplishments:

- 5497 Conducted Phase 1 clinical trial of subtype B HIV vaccine candidates (subtype B is predominant in the U.S.) and demonstrated that prime boost regimens of these two candidates are immunogenic, though the study is ongoing and all conclusions are preliminary. Completed Phase 1 clinical trial of a DNA candidate vaccine against subtype B HIV and determined that this first-generation product was safe but did not induce sufficient immune response. Completed testing of subtype E HIV vaccine candidates (subtype E is predominant in Southeast Asia and Africa) in mice and determined that they were safe and immunogenic. Completed a Phase 1 trial demonstrating the feasibility of immune reconstitution, that is, removing immune cells from an HIV-infected individual, stimulating those cells and then reinfusing the stimulated cells into that patient.

Total 5497

FY 2000 Planned Program:

- 5771 Conduct clinical studies to slow progression and prevent immune deficiency related to HIV infection. Develop a vaccine process to prevent HIV infection of all genotypes of HIV-1. Establish the genetic and phenotypic correlates of drug resistance as a clinical tool.
- 160 Small Business Innovative Research/Small Business Technology Transfer Research Programs.

Total 5931

FY 2001 Planned Program:

- 5889 Transition to advanced development a test for simple and rapid forward diagnosis of HIV infection. Conduct a Phase 0/1 study of a novel vaccine vector for the prevention of HIV-1. Conduct Phase 0/1 study of oligomeric protein vaccines. Conduct clinical evaluation of novel methodologies for detection of antiretroviral drug resistance. Both Phase 0/1 trials are necessary before proceeding to Milestone 1 for advanced development.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603105A Military Human Immunodeficiency Virus (HIV) Research — PROJECT: DH29

Total 5889

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	5672	5976	5926
Appropriated Value	5710	5976	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-38		
b. SBIR / STTR	-151		
c. Omnibus or Other Above Threshold Adjustments		-24	
d. Below Threshold Reprogramming			
e. Rescissions	-24	-21	
Adjustments to Budget Years Since FY 2000/2001 PB			-37
Current Budget Submit (FY 2001 PB)	5497	5931	5889

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238A Air Defense/Precision Strike Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	10236	24435	21307	15997	15049	12929	12768	Continuing	Continuing
D177 Joint Air/Land/Sea Precision Strike Demonstration	9803	24435	21307	15997	15049	12929	12768	Continuing	Continuing
D546 Synthetic Apeture Radar Target Recognition and Location System	433	0	0	0	0	0	0	0	12580

A. **Mission Description and Budget Item Justification:** The objective of this program element is to locate, identify, and kill high-value, time-critical targets and to assess damage within tactically meaningful timelines. This Program Element funds the Joint Precision Strike Demonstration program which integrates advanced technologies in reconnaissance and surveillance; target acquisition; strike planning; weapon delivery; and damage assessment and implements these in a sensor-to-shooter architecture to reduce overall timelines from hours to minutes. This work is closely coordinated with the other Services and the User community to seek joint solutions and incorporate new operational concepts. This program developed the Joint Integration and Evaluation Center (JIEC), which combines live and simulated entities into a virtual battlefield testbed, and continues to evolve the JIEC capabilities for designing, conducting, measuring, and assessing system of systems demonstrations and experiments to identify and quantify system solutions to precision strike and counterfire needs. The JIEC and this methodology enabled the FY95-98 Precision/Rapid Counter-Multiple Rocket Launcher Advanced Concept technology Demonstration (ACTD) to provide the Commander in Chief, United Nations Command (Korea) a significantly improved capability to defeat the North Korean 240mm Multiple Rocket Launcher. Other on-going efforts in this program element are the Theater Precision Strike Operations ACTD, the Joint Continuous Strike Environment ACTD, and the Joint Intelligence, Surveillance and Reconnaissance demonstration. Previous work included the Synthetic Aperture Radar Target Recognition and Location System (STARLOS) real-time Aided Target Recognition (AiTR) technology, which completed in FY 1999. 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 and is consistent with the resource constrained Army Science and Technology Master Plan, the Army Modernization Plan, and the Joint Warfare Science and Technology Plan and supports Army Warfighting Experiments (AWEs).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	9907	24618	21434
Appropriated Value	9973	24618	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-66		
b. SBIR / STTR	-256		
c. Omnibus or Other Above Threshold Reductions		-99	
d. Below Threshold Reprogramming	623		
e. Rescissions	-38	-84	
Adjustments to Budget Years Since FY 2000/2001 PB			-127
Current Budget Submit (FY 2001 PB)	10236	24435	21307

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D177

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D177 Joint Air/Land/Sea Precision Strike Demonstration	9803	24435	21307	15997	15049	12929	12768	Continuing	Continuing

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) significantly enhanced the capability to locate, track, and defeat the North Korean 240mm MRL threat. The Commander in Chief, United Nations Command (CINCUNC) 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 approved 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 Engagements through the real time/near real time synchronization of US/Coalition assets. TPSO is providing enhancements to the C2/Strike Planning Process, Shared Situational Awareness, Joint/Combined Interoperability, and the Transition to Reinforcement scenario. JPSD makes use of simulation-based design and the Joint Integration and Evaluation Center (IEC) for Joint Concept Development and System Assessment. This project includes funding to support the Army share of the Joint Continuous Strike Environment (JCSE) ACTD which will provide the Commander Joint Task Force (CJTF) with automated target prioritization, continuous weapons availability monitoring, optimized weapon-target pairing and dynamic airspace deconfliction. The Joint Intelligence, Surveillance and Reconnaissance (JISR) effort will provide near real time Intelligence, Surveillance and Reconnaissance (ISR) data to the Brigade/Early Entry Force Commander. It also will provide the CINC, CJTF and other component commander with the ground tactical picture. Efforts in this project are managed by the Director, Joint Precision Strike Demonstration Project Office, Fort Belvoir, VA, Program Executive Officer, Intelligence, Electronic Warfare, and Sensors (PEO-IEW&S), Fort Monmouth, NJ. The Prime contractor is Raytheon, Bedford, MA.

FY 1999 Accomplishments:

- 9803 - Participated in Commander-in Chief United Nations Command (CINCUNC) warfighting exercises, Reception Staging Onward Movement & Integration (RSOM&I), Foal Eagle, Summer-Ex and Ulchi Focus Lens (UFL), documenting warfighting functional requirements and integrating emerging technologies/capabilities for the Theater Precision Strike Operations (TPSO) ACTD.
  - Provided CINCUNC with enhanced technical command and control capabilities for conduct of synchronized Joint/Combined deep operations and precision strikes for TPSO.
  - Executed the rapid prototyping capabilities at the JIEC at Fort Belvoir, the CTSF at Fort Hood, TX and D&SABL at Fort Sill, OK.
  - Expanded the Joint Precision Strike Demonstration threat database to integrate joint systems into the simulation environment supporting TPSO evaluations.
  - Refined the JIEC analytical capability to measure performance and effectiveness so those objective conclusions can be made regarding the military utility of the demonstrated technologies and concepts.
  - Conducted technical reviews and demonstrations to assess the contribution of emerging technologies to TPSO.
  - Planned the FY99 baseline scenario exercise and assessed the communications infrastructure necessary to conduct the demonstration.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D177

FY 1999 Accomplishments: (continued)

- Transitioned to a High Level Architecture (HLA) environment that supports simulating Man in the Loop (MITL) for FY00 demonstration.

Total 9803

FY 2000 Planned Program:

- 17776 - Participate in Commander-in- Chief United Nations Command (CINCUNC) warfighting exercises to document functional requirements supporting pre-prototype design and integration objectives for the Theater Precision Strike Operations (TPSO) ACTD.
  - Plan and execute a demonstration, stimulated by simulations, of a counterfire battle for an unreinforced Korean scenario. Pre-prototype developmental systems in the Deep Operations Coordination Center will be operated by United States Forces Korea (USFK) soldiers in a Man-in-the-Loop (MITL) mode for a proof of concept, early user evaluation in a realistic warfighting environment. The pre-prototype systems will be compatible with Army Command, Control, Communication, Computers and Intelligence (C4I) acquisition programs. The demonstration will include Republic of Korea (ROK) observation in preparation for ROK participation in the planned FY 01 Demonstration for the TPSO ACTD.
  - Conduct rapid prototyping operations at the Joint Integration & Evaluation Center (JIEC), in conjunction with the Central Technical Support Facility (CSTF), the Depth & Simultaneous Battle Lab (D&SBL), Battle Command Battle Lab, as well as Air Force, Navy and Marine Corps activities, to develop pre-prototype systems for the TPSO ACTD. The prototyping is designed to facilitate the coordination, planning and synchronization of joint and combined forces.
  - Expand, upgrade and implement the High Level Architecture (HLA) environment and automated Data Collection Architecture for the TPSO ACTD. This will be used to stimulate the FY00 and FY01 Man-in-the-Loop (MITL) demonstrations. Provide the data collection capability required to make credible warfighting assessments.
  - Conduct technical reviews for TPSO ACTD, to assess the warfighting effectiveness of the emerging technologies integrated into the pre-prototype systems under development.

817 - Validate and coordinate Joint Continuous Strike Environment (JCSE) requirements in targeting Time Sensitive Surface Targets. Participate in Fleet Battle Experiment.

1500 - Expand the analytical capability of the Joint Integration and Evaluation Center (JIEC). Provide additional connectivity to TRADOC Battle Labs and Joint Battle Center (JBC) to expand on current connectivities with Army, Air Force and Navy Battle Labs. Provide enhanced Joint user/developer testbed for rapid prototyping of new systems.

3693 - Define Joint Intelligence Surveillance Reconnaissance (JISR) technology demonstration program requirements. Define data collection architecture. Design and begin integration of JISR family of models, and JISR testbed as part of the JIEC.

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

Total 24435

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D177

FY 2001 Planned Program:

•	21082	- Participate in CINCUNC warfighting exercises to refine the functionality of pre-prototype systems demonstrated during the FY 00 Demonstration. - Plan and execute a simulation/stimulated demonstration, employing a scenario representative of the transition from an unreinforced Korean Theater to a reinforced Korean Theater. Both ROK and U.S. forces, including the U.S. Army III Corps, will participate in a MITL fashion both in the GCC DOCC and at the critical external nodes. They will operate the objective, residual capability candidate systems developed during the TPSO ACTD in a realistic warfighting environment. - Conduct rapid prototyping operations at the JIEC, Fort Belvoir, in conjunction with the CTSF, the D&SABL, as well as the Air Force, Navy and Marine Corps activities, to refine the functionality and improve the capability of the pre-prototype systems evaluated during the FY 00 Demonstration. - Conduct technical reviews to assess the warfighting value added by each pre-prototype, residual system, and candidate system during the demonstration. Determine which candidate systems exhibit sufficient maturity and capability to warrant qualification as an ACTD "Leave Behind". - Develop transition and sustainment plans to support the "Leave Behind" Systems for TPSO during the period of interim capability (FY 02-03).
	225	- Evaluate and validate the value added of Joint Continuous Strike Environment (JCSE) system integration.
Total	21307	

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238A Air Defense/Precision Strike Technology

PROJECT: D546

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D546 Synthetic Apeture Radar Target Recognition and Location System	433	0	0	0	0	0	0	0	12580

Mission Description and Justification: This project demonstrated the feasibility of locating and identifying high value targets from an Army designated aerial platform. The focus of the program was 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 were located with airborne sensors and identified with a real-time AiTR system. In FY 97, the Synthetic Aperture Radar Target Recognition and Location System (STARLOS) AiTR effort for the Joint Precision Strike Demonstration (JPSD) Precision/Rapid Counter Multiple Rocker Launcher (MRL) Advanced Concept Technology Demonstration (ACTD) was completed. This AiTR capability was integrated in a ground control station and successfully demonstrated against the North Korean 240mm MRL threat. The STARLOS program was then actively involved in the adaptation of its technology into the next generation sensors being procured for the Tactical Unmanned Aerial Vehicle (TUAV) program. The program direction was to utilize STARLOS technology to provide AiTR aids and processing capabilities that would enhance the Human Machine Interface and would alleviate the analytic requirements of the TUAV operator. This program has been 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, Communications and Electronics Command (CECOM) Research & Development Engineering Center (RDEC), Fort Monmouth, NJ.

FY 1999 Accomplishments:

•	433	- Completed investigation on the utilization of a Common Aided Target Recognition (AiTR) capability and technical reviews with the Training & Doctrine Command Systems Manager Unmanned Aerial Vehicle (TSM UAV) and Battle Command Battle Lab (Fort Huachuca) on the incorporation of an AiTR solution for the Multi-Mission Common Modular Unmanned Aerial Vehicle (UAV) Sensors.
Total	433	

FY 2000 Planned Program: Project not funded in FY 2000

FY 2001 Planned Program: Project not funded in FY 2001

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270A Electronic Warfare (EW) Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	10911	16060	15359	13818	11159	10504	20152	Continuing	Continuing
DK15 Advanced Communications Electronics Countermeasures Demonstration	2699	6852	5326	6563	3217	2006	11249	Continuing	Continuing
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	8212	9208	10033	7255	7942	8498	8903	Continuing	Continuing

A. **Mission Description and 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 threat electronic systems. The intent is to disrupt their operation, denying the enemy use of their command, control and communication (C3) assets and provide alerts/warnings to tactical commanders. 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 EW CM and electronic support/electronic intelligence (ES/ELINT) for self protection from radar, electro-optical (EO), and infrared (IR) 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 also is developed. Work in these projects will lead to technology applications that will significantly contribute to winning the battlefield information war by controlling the electromagnetic spectrum. Work in this PE supports the Multispectral CM Advanced Technology Demonstration (ATD), Integrated Situation Awareness and Targeting (ISAT) ATD, the Integrated CM (ICM) technology demonstration and provides component technology for the hit avoidance technology demonstration. Work in this program element adheres to tri-service Reliance agreements on EW. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology

B. Program Change Summary:	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 / 2001 PB)	11425	16169	17008
Appropriated Value	11508	16169	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-83		
b. SBIR / STTR	-264		
c. Omnibus or Other Above Threshold Reductions		-59	
d. Below Threshold Reprogramming	-204		
e. Rescissions	-46	-50	
Adjustments to Budget Years Since (FY 2000 / 2001 PB)			-449
New Army Transformation Adjustment		TBD	-1200
Current Budget Submit (FY 2001 PB)	10911	16060	15359

Change Summary Explanation: Funding – FY 2001: Project joint intelligence, surveillance, and reconnaissance was adjusted to reflect the new Army Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603270A Electronic Warfare (EW) Technology		PROJECT: DK15

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK15 Advanced Communications Electronics Countermeasures Demonstration	2699	6852	5326	6563	3217	2006	11249	Continuing	Continuing

Mission Description and Justification: This project supports the Army's concept for Force XXI intelligence operations. Communications countermeasure and counter-countermeasure technologies are demonstrated to provide information warfare and information operations capabilities to intercept, identify, locate and manipulate threat computer networks and their components. Electronic attack products provide the capability to disrupt, deny, degrade or destroy enemy threat computer networks or information resident in those networks. Knowledge gained from demonstration and testing of these technologies and techniques is used to assess vulnerabilities of friendly systems and to develop protection capabilities. In addition, data fusion techniques are being integrated and transitioned to program managers to demonstrate a joint intelligence, surveillance, and reconnaissance product for brigade level and below. Data from traditional intelligence sensors and from non-traditional sources will be integrated to provide situational awareness of red and blue forces. User friendly tools and visualization technology will be demonstrated to provide quality data in a timely manner to enable friendly commanders to operate effectively within the decision cycle of threat commanders. This project focuses on testing, evaluating, and integrating specific information warfare and information operations components, hardware, and software to provide flexible, modern systems and upgrades to existing systems to achieve information dominance, protect the force, and shape the battlespace.

FY 1999 Accomplishments

- 1892 – Conducted demonstration against modern communication signals using the field programmable gate array analysis/control system.
  – Performed laboratory and field evaluation of capabilities against more complex modern communication signals.
  – Evaluated command and control attack capabilities against existing security architecture and participate in lab testing to evaluate next generation information assurance tools.
  – Established program with Navy for integration of "non-standard" collectors for Time Difference of Arrival (TDOA).
  – Transitioned ES/Electronic Attack techniques to information warfare system.
- 807 – Demonstrated and evaluated, through simulation, an automatic target tracking capability based on combined airborne survivability equipment/ moving target indicator (MTI).
  – Upgraded operator planning and sensor management tool to integrate air and ground based capabilities. Begin transition to GUARDRAIL system.
  – Evaluated effectiveness of integrating various traditional and non-traditional sensor products to enhance intelligence, surveillance and reconnaissance (ISR) at the Brigade level.

Total 2699

FY 2000 Planned Program:

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology
	PROJECT DK15

•	1761	Integrate signal intelligence (SIGINT)/MTI sensor cross-cueing and situation displays into the common ground station and all source analysis system. Complete transition of operator planning tool to GUARDRAIL.

FY 2000 Planned Program: (continued)

•		– Designate system architecture and begin prototyping for joint ISR technology demonstration. Identify joint experiments.
•	762	– Integrate technology to provide intelligence collection, counter measures, counter-counter measures capabilities and alerts/warnings for tactical units to enable interception, identification, and geolocation of threat emitters in the presence of decoys, deception, and jamming. – Develop prototype remotely reprogrammable payload to support close-in ,pre-filtering for electronic mapping of the battlefield. – Begin assessment of collection, timing allocation and operational concept of multi-function capability through Battle Lab Distributed Interactive Simulation (DIS) experiments.
•	4186	– Demonstrate capability to develop and launch both radio frequency (RF) and wired-based attacks against Army information systems as a tool to validate protection mechanisms. – Perform field testing / validation of Army First Digitized Division command and control protection systems against developed attacks. – Conduct vulnerability assessment to evaluate level of security achieved /tool suitability based on test results. – Iteratively revise protect/attack tools to counter newly identified threats.
•	143	– Small Business Innovation Research / Small Business Technology Transfer Programs.
Total	6852	

FY 2001 Planned Program:

•	1492	– Integrate wide band conformal antenna, adaptive angle of arrival power control, and specific emitter identification technology for advanced intelligence collection and countermeasure modular building blocks and prototype in tactical software radio test bed. – Develop prototype of multi-function RF collector; perform additional Battle Lab DIS experiments to further refine operational concept.
•	3834	– Provide an information operation capability to search for, intercept, identify, locate and manipulate computer networks and their components to detect and recognize threat computers and information resident in those computers. – Provide an information operation capability to disrupt, deny, degrade or destroy information resident in threat computers or computer networks or the computers and networks themselves. – Design and conduct distributed simulation experiments to support development efforts and training for integrated command and control protect and attack capabilities, culminating in a field test for the digitized division by FY02. Provide results/recommendations to Program Executive Officer C3S and Program Executive Officer IEW and jointly develop a transition and integration plan. – Interactively revise protect/attack tools to counter newly identified threats.
Total	5326	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology	PROJECT DK16

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	8212	9208	10033	7255	7942	8498	8903	Continuing	Continuing

Mission Description and Justification: This program demonstrates the feasibility and effectiveness of non-communication EW hardware and software countermeasure technologies for aircraft, ground vehicles, and the dismounted soldier which provides self-protection against radar, optical, EO, and IR threats. Integrated multispectral radar and IR CM will be demonstrated to provide present and future Army aircraft with full spectrum protection against advanced missiles and integrated air defense systems that can near simultaneously direct radar and IR homing missiles and fuzed anti-aircraft artillery fire. ISAT ATD and ICM technology demonstration will demonstrate an integrated multispectral suite of precision warning sensors that will provide Army aviation and ground vehicles with full dimensional protection, and demonstrate a "non-traditional " use of electronic combat systems to provide precision targeting, combat identification, and real time situation awareness updates to other aircraft, ground vehicles, and command and intelligence fusion centers.

FY 1999 Accomplishments:

- 6624 – Completed integration and survivability integration lab testing of the multispectral CM ATD test bed.
  – Completed captive seeker tests that demonstrated the new capability to jam and defeat advanced pseudo imaging and imaging surface to air missiles (SAM).
  – Transitioned alternative laser technologies, jamming waveforms, fiber optic cable and missile detection algorithms as technology options for suite of integrated IR CM (SIIRCM) product improvement.
- 987 Developed requirements and design architecture for ISAT ATD that will demonstrate multispectral threat warning, geo-location, emitter identification, and situation awareness technology upgrades to the suite of integrated RF CM (SIRFCM).
- 601 – Integrated digital and hardware-in-the-loop jamming effects models of advanced IR SAMs, anti tank guided missiles (ATGMs) and RF SAM systems into the survivability integration lab to support demonstration of ICM technologies.

Total 8212

FY 2000 Planned Program:

- 7615 Conduct distributed interactive simulations with aviation and ground users to refine integrated sensors and targeting functional modes and operator interfaces.
  – Investigate multi-wavelength missile warning sensor technologies that will provide extended range detection of missile launches, reduce false alarms, and provide sufficient signature data to allow discrimination of anti-tank from anti-aircraft missiles.
  – Investigate laser warning technologies that provide the capability to locate and discriminate between laser designators, laser range finders, and laser beamriders.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology PROJECT DK16

FY 2000 Planned Program: (continued)

– Identify communication links, and define variable message format requirements needed to transmit reports of missile launch, laser designator, laser range finder, laser beamriders and radar locations and emitter identification data from aircraft to ground vehicles and command/intelligence fusion centers.
– Investigate new instantaneous/time refined techniques to precisely locate surveillance and targeting air defense radars
– Investigate algorithms/software for correlating missile warning data and digital terrain elevation data to provide geolocation of missile launch locations.
– Conduct modeling and simulation activities with the Air Maneuver Battle Lab to refine technology architecture for advanced situational awareness and targeting concepts

•	1354	– Develop and conduct hardware-in-the-loop tests of an advanced coherent RF jammer modulator/transmitter to defeat coherent phased array radars and anti-aircraft artillery employing RF fuzes. – Develop and evaluate techniques to counter a new generation of IR tracked, command-to-line-of-sight surface- to-air and ATGMs directed against aviation.
•	239	– Small Business Innovation Research / Small Business Technology Transfer Programs.
Total	9208	

FY 2001 Planned Program:

•	8327	– Conduct distributed interactive simulations with aviation and ground users to evaluate integrated sensors and targeting functions; define demonstration scenarios and performance measures. – Complete development of compact, multi-wavelength missile warning sensor modules. – Complete development of data fusion software/circuit card modules that provide geolocation of missile launches, radars, laser designators, laser range finders and laser beamriders and identify emitters. – Complete development of data fusion software modules to generate situation awareness displays and messages, and select and manage countermeasure responses based on the specific threat. – Integrate ISAT hardware/software modules into testbed and conduct hardware-in-the-loop simulation and testing to verify end-to-end functionality.
•	1706	– Develop, integrate and test component technologies for an ICM capability. - Integrate and test DARPA and Army Research Laboratory microwave and millimeter wave power modules to replace traditional traveling wave tube assemblies to reduce transmitter weight and increase reliability and jamming power output.
Total	10033	

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603280A Joint Tactical Radio

PROJECT: D155

COST (In Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D155 Joint Tactical Radio System *	13404	0	0	0	0	0	0	0	24405

A. Mission Description and Budget Item Justification: The mission of the Joint Tactical Radio System (JTRS) Joint Program Office (JPO) is to develop a Software Communications Architecture (SCA) and software waveforms that will enable the Services to acquire a family of affordable, scaleable, high-capacity, interoperable Line of Sight (LOS) and Beyond Line of Sight (BLOS) radios. The Army is the Executive Service for this joint program. The singular functionality of current stovepipe systems requires a commensurate number of unique, noninteroperable radio systems. These systems lack the connectivity and throughput capacity to support required simultaneous networked voice, video, and data operations with low probability of intercept over multiple frequency bands. These inadequacies are addressed by requirements in the JTRS Operational Requirements Document (ORD). In addition, each unique current radio system requires significant allocation of space, weight, power, and cooling on weapons systems platforms, and has a costly logistics infrastructure. In addition to addressing the problems associated with stovepipe radios, the JTRS program will provide a significant increase in capability while providing a solid foundation for interoperability, and for achieving network connectivity across the Radio Frequency (RF) spectrum. This program element will provide definition and development of an open standard Software Communications Architecture. This architecture will support software versions of legacy military waveforms as well as new military and commercial waveforms. The open standards based architecture will provide the path for future hardware and software growth of delivered systems by allowing the Services to take advantage of advances in technology being driven by the commercial wireless communications marketplace. The overall JTRS program will provide software programmable and hardware configurable digital radio systems that demonstrate increased interoperability, flexibility and adaptability. 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 (C4I) Systems supporting the warfighters' goal of realizing a fully digitized battlespace.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	15600	0	0
Appropriated Value	10100		
Adjustments to Appropriated Value			
a. Congressional General Reductions	-67		
b. SBIR / STTR	-266		
c. Omnibus or Other Above Threshold Reductions			
d. Below Threshold Reprogramming *	3677		
e. Rescissions	-40		
Adjustments to Budget Years Since FY 2000/2001 PB			
Current Budget Submit (FY 2001 PB)	13404	0	0

Change Summary Explanation: Below threshold reprogramming increased FY 99 funding (restructured from FY 98) for appropriate funding of SCA development.

*FY99 funding in current database is shown as 9405. Next update will include approved reprogramming (see para. B), which increased total funding to 13404.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603280A Joint Tactical Radio
	PROJECT D155

FY 1999 Accomplishments:

•	10500	Continued development of JTRS Software Communications Architecture (SCA), building on a baseline definition derived from previous Industry Consortium activities.
•	1579	Continued JPO Technical Support
•	1325	Continued JPO Program Support
Total	13404	

FY 2000 Planned Program: Program is funded in Project D162, PE0604280A, Budget Activity 5.

FY 2001 Planned Program: Program is funded in Project D162, PE0604280A, Budget Activity 5.

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	59366	51188	25107	24942	32489	53980	52447	0	299519
D206 Missile Simulation	2311	2755	2442	2780	3122	3622	3333	0	20365
D263 Future Missile Technology Integration (FMTI)	7055	19822	13371	9382	2452	18126	16713	0	86921
D380 Multi-Platform Launcher	5588	4365	0	0	0	0	0	0	9953
D486 Rapid Force Projection Simulation	4890	0	0	0	0	0	0	0	4890
D493 Rapid Force Projection Demonstration	16168	16949	0	0	0	0	0	0	33117
D496 Enhanced Fiber Optic Guided Missile (EFOG-M)	18630	0	0	0	0	0	0	0	18630
D549 2.75 Inch Anti-Air Technology Demonstration (TD)	2590	0	0	0	0	0	0	0	2590
D550 Counter Active Protection System	2134	1990	5466	5461	2481	0	0	0	17532
D567 Low Cost Precision Kill (LCPK) for 2.75 Inch Rockets	0	5307	3828	0	0	0	0	0	9135
D655 Hypervelocity Technology Demonstration (TD)	0	0	0	7319	24434	24354	24300	0	80407
D704 Advanced Missile Demonstrations	0	0	0	0	0	7878	8101	0	15979

A. 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 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **3 - Advanced Technology Development**	PE NUMBER AND TITLE **0603313A Missile and Rocket Advanced Technology**

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.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	71394	43639	24011
Appropriated Value	71896	51639	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-502		
b. SBIR / STTR	-1715		
c. Omnibus or Other Above Threshold Reductions		-195	
d. Below Threshold Reprogramming	-10313		
e. Rescissions		-256	
Adjustments to Budget Years Since (FY 2000/2001 PB)			+1035
New Army Transformation Adjustment			+61
Current Budget Submit (FY 2001PB)	59366	51188	25107

Change Summary Explanation: Funding - FY 1999: Project D493 Rapid Force Projection Demonstration was adjusted (-10313) for higher Army priorities.
FY 2001: Project D206 Missile Simulation was adjusted (-397) to reflect the new Army Vision/Transformation.
Project D263 Future Missile Technology Integration (FMTI) was adjusted (+6990) to reflect the new Army Vision/Transformation.
Project D380 Multiple Launch Rocket System Smart Tactical Rocket (MSTAR) was adjusted (-6532) to reflect the new
Army Vision/Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D206

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D206 Missile Simulation	2311	2755	2442	2780	3122	3622	3333	0	20365

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 (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. 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. Work is performed by the Aviation and 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 1999 Accomplishments:

- 1493 - Completed development of the first stage of a computer-controlled precision signal measurement instrument (target verification monitor) for microwave and MMW radar HWIL simulation capabilities (currently supporting LONGBOW missile and PAC-3)
  - Integrated dichroic beam combiner, IR scene projection, and MMW signal generation technology for support of dual-spectrum (MMW/IR) HWIL simulation into a dual-spectrum HWIL simulation capability (applicable to Brilliant Anti-Tank Preplanned Product Improvement (BAT P3I) , Sense and Destroy Armor (SADARM), and Medium Extended Air Defense System (MEADS)).
  - Implemented improvements to the temporal and spatial non-uniformity correction scheme for the IR laser diode array projector (LDAP) with a consequent improvement in overall projector performance (supporting Theater High Altitude Air Defense (THAAD), BAT P3I, FMTI).
  - Investigated application of spatial light modulators to IR scene projector technology as an alternative to LDAP and resistive element integrated circuit arrays with the objective of devising "leap ahead" IR scene projector technology.
  - Improvements were completed to realtime dynamic IR scene generator software (benefits THAAD, BAT P3I, FMTI)
- 818 - Achieved modernization of the Electro-Optical Simulation System for support of Enhanced Fiber Optic Guided Missile (EFOG-M) and FMTI.
  - Implemented Upgrades to the AMCOM Distributed Simulation Center (DSC) realtime processing, data display and virtual prototype simulator and planned HLA compliance.
  - Upgraded battlefield test bed capabilities to support DSC exercises with integrated live, virtual and constructive forces. Commenced conversion to HLA compliance.

Total 2311

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D206

FY 2000 Planned Program:

•	2008	- Extend technology for dual-spectrum (passive IR, active MMW) simulation capability to support HWIL simulation of air and missile defense interceptor kill vehicles (applicable to MEADS and Atmospheric Interceptor Technology (AIT)). - Initiate technology investigations for tri-mode HWIL simulation to support Modernized HELLFIRE development. - Integrate HWIL capabilities for simulation of passive IR guided missile seekers and onboard tracking, guidance, and navigation processors with system ground equipment and test and evaluation physical environment conditioning simulators to apply and extend the principles of Simulation Based Acquisition to end-to-end missile system simulations (applicable to THAAD, National Missile Defense (NMD), AIT, and Anti-Satellite (ASAT)). - Integrate resistive element integrated circuits for IR scene projection with drive electronics and non-uniformity correction hardware/software (applicable to all IR missile seeker simulations). Implement into HWIL simulation capabilities. - Implement improvements to MMW signal generation to support high-speed digital processing of intermediate frequency signals in the digital domain for radio frequency guided missiles and submunitions. - Investigate means of implementing a HWIL simulation capability for active IR and laser detection and ranging (LADAR) guidance systems. - Develop a flight table-mountable laser diode array projector (LDAP) IR scene projector to eliminate requirements for synthetic line-of-sight representation of missile-target relative motion in HWIL simulations (applicable to all IR guided missiles and submunitions).
•	677	- Extend battlefield test bed and Distributed Simulation Center capabilities to support Simulation Based Acquisition principles and investigate future battle-fighting techniques via live, constructive, and virtual simulations. - Upgrade software tools and virtual prototype applications to HLA compliance. Improve realtime computer-generated forces to support R&D requirements. - Implement improvements in the synthetic battlefield environmental effects capability to represent actual conditions with greater realism.
•	70	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	2755	

FY 2001 Planned Program:

•	1820	- Complete the development of a dual-spectrum (passive IR, active MMW) simulation capability to support HWIL simulation of air and missile defense interceptor kill vehicles (applicable to MEADS and Atmospheric Interceptor Technology (AIT)). - Continue technology development of Modernized HELLFIRE HWIL simulation, including trichroic beam combiner, semiactive laser mode, and MMW signal radiation. - Continue the development of HWIL capabilities for simulation of passive IR (and dual spectrum) guided missile seekers and onboard tracking, guidance, and navigation processors with system ground equipment and test and evaluation physical environment conditioning simulators for end-to-end missile system HWIL simulations (applicable to THAAD, NMD, AIT, and ASAT). - Develop technology components applicable to implementation of a HWIL simulation capability for active IR (LADAR) guidance systems.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D206

FY 2001 Planned Program: (continued)

- Demonstrate a flight table-mountable LDAP IR scene projector to eliminate requirements for synthetic line-of-sight representation of missile-target relative motion in HWIL simulations (applicable to all IR guided missiles and submunitions).
- Investigate and apply techniques for extending digital signal processing to signal generation of MMW radio frequency (RF) signals to improve HWIL simulator RF performance (bandwidth, sensitivity, low noise characteristics) to match or exceed developments in RF seeker technology.

• 622 - Further extend battlefield test bed and Distributed Simulation Center capabilities to support Simulation Based Acquisition principles and investigate future battle-fighting techniques via live, constructive, and virtual simulations.
- Increase realism and fidelity of simulated dirty battlefield in virtual simulation applications to support refined weapon system design, development, and technology insertions.
- Provide improved model fidelity for Army aviation and missile battlefield simulation applications to predict and evaluate weapon system performance with greater accuracy.

Total 2442

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology	PROJECT: D263

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D263 Future Missile Technology Integration (FMTI)	7055	19822	13371	9382	2452	18126	16713	0	86921

Mission Description and Justification: This project provides for the demonstration of advanced tactical missile technologies including seekers, propulsion, airframes, 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 IR seeker technology capable of long range lock, variable thrust propulsion allowing system range extension and thus stand off 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, and airframe 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 IR signal and image processing, and wide band secure data links. The objective of the Modernized HELLFIRE Technology Effort is the demonstration and integration of dual or multi-mode seeker concepts, controllable thrust rocket motors (gels or pintle-controlled solids), automatic target recognition (ATR), and wide-band secure datalinks. Seeker technology will address imaging infrared, millimeter wave, and laser radar (LADAR) seeker technologies combined with the existing semi-active laser, in order to provide precision strike and fire-and-forget guidance modes without major modifications to the host platform. Affordable, controllable thrust rocket motors, such as gelled bipropellants or pintle-controlled solids, will be demonstrated to provide longer ranges and shorter flight times while increasing system robustness in the Air-to-Ground (ATG) and Ground-to-Ground (GTG) roles. ATR will be demonstrated permitting true fire-and-forget at targets beyond visual range. Finally, secure wide-band datalink hardware, allowing target position updates during missile flight, will be demonstrated. These efforts are a risk mitigation effort in support of a FY03 EMD start for Modernized HELLFIRE and are supported by the Air-to-Ground Missile System (AGMS) PM. This program will leverage technologies developed and demonstrated under the Future Missile Technology Integration (FMTI) program as well as the ongoing Defense Advanced Research Projects Agency (DARPA) Advanced Fire Support System (AFSS) program and will be executed in two phases: 1) the first phase will conduct detailed analysis of the above technologies for maturity, packaging, risk, and cost. 2) The second phase will design, fabricate, integrate and test a prototype Modernized Hellfire missile through live-fire demonstrations as part of the AFSS program. 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; Raytheon Systems Company, Tucson, AZ; Alliant Techsystems, Hopkins, MN; Marconi Aerospace Defense Systems, Austin, TX; The Boeing Company, Duluth, GA; Northrop-Grumman Corporation, Baltimore, MD; and Lockheed Martin Vought Systems, Ft. Worth, TX.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D263

FY 1999 Accomplishments:

•	1445	- Conducted detailed seeker trade studies to assess imaging IR, millimeter wave, and laser radar (LADAR) seeker technologies combined with the existing semi-active laser into dual-mode seeker that will fulfill Modernized HELLFIRE requirements. - Developed detailed program plan. - Evaluated seeker concepts for contract award.
•	5610	- Performed flight test of FMTI program missile including gel bipropellant propulsion system.
Total	7055	

FY 2000 Planned Program:

•	6076	- Downselect to best Modernized Hellfire (Mod HF)/ Advanced Fire Support System (AFSS) Air-to-Ground (ATG) and Ground-to-Ground (GTG) seeker concept(s) based on FY 99 seeker tradeoff studies. - Award contract(s) to design captive flight and missile flight seekers for integration on AFSS missiles.
•		- Identify alternative Mod HF/AFSS seeker which offers higher payoff and greater risk than selected primary seeker.
•	5540	- Investigate best controllable thrust rocket motor from competing gel and pintle-solid designs for Mod HF/AFSS ATG and GTG missions. - Investigate best Automatic Target Recognition (ATR) hardware and software which best meet ATG and GTG mission requirements for Mod HF/AFSS.
•	7708	- Perform flight test of FMTI full-up missile (Congressional plus-up).
•	498	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	19822	

FY 2001 Planned Program:

•	4505	- Complete hardware design and begin fabrication of seekers. - Conduct bench and tower test of prototype seekers. - Begin preparations for seeker/missile flight test program.
•	1876	- Conduct controllable propulsion trade study for MHF/CM. - Conduct analysis of alternative propulsion systems. - Conduct analysis of fuel/oxidizer chemistry to enhance performance. - Complete controllable thrust motor development. - Conduct static test firings of controllable thrust motor. - Test ATR hardware/software. - Test guidance datalink.
•	6990	- Funds will be used in support of the New Army Vision/Transformation.
Total	13371	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology	PROJECT: D380

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D380 Multi-Platform Launcher	5588	4365	0	0	0	0	0	0	9953

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, designed, developed, and flight tested a low cost guidance and control system for the MLRS free-flight rocket, (Guided MLRS). The guidance system makes use of inertial and Global Positioning System (GPS) low cost component technologies. The improvements made to the Guided MLRS results in both a more lethal force and a reduced logistics burden, which is especially important for early entry. This phase completed in FY 98 and has transitioned to EMD. 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 HIMARS program will complete in FY 2000 and is currently in the final year of the RFPI ACTD extended user evaluation. The HIMARS program transitions to EMD in FY 2000. 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 1999 Accomplishments:

•	5588	- Provided maintenance, spares, replacements, and repairs for HIMARS residuals, to be evaluated by the user as a part of the Rapid Force Projection Initiative Advanced Concept Technology Demonstration (ACTD) extended user evaluation. - Provided improved hydraulic pump for increased reliability. - Provided government furnished equipment to contractor. - Provided support for interim HIMARS maintenance facility. - Implemented user recommended improvements. - Updated and improved rocket algorithm for increased accuracy.
Total	5588	

FY 2000 Planned Program:

•	1837	- Complete support for residual HIMARS launchers as part of RFPI ACTD extended user evaluation.
•	2425	- MSTAR program is currently being terminated and the funding will be reprogrammed to higher priority Army programs.
•	103	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	4365	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D486

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D486 Rapid Force Projection Simulation	4890	0	0	0	0	0	0	0	4890

Mission Description and Justification: The Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) Simulation Support Plan and the RFPI Study Plan provided a detailed description of the simulation and analysis efforts used to support the RFPI program. These efforts completed in FY 1999. Scenario development, force-on-force modeling, and simulation were 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 were performed under the guidance and supervision of the Integrated Battlefield Simulation and Analysis Team (IBSAT). Simulations and analyses supported the determination of value-added proposed technologies for the RFPI ACTD and were utilized to determine the mix and number of developmental sensors used in the Advanced Warfighting Experiment (AWE) and subsequently determined the residual quantities and support requirements. Work was performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. Major contractors were Computer Science Corporation, Huntsville, AL, and Nichols Research Corporation, Huntsville, AL.

FY 1999 Accomplishments:

•	960	- Provided virtual simulation resources to support real/virtual experiments during the residual period.
•	1550	- Applied RFPI technologies to excursion scenarios to include urban, varying terrain, weather, and countermeasures.
		- Performed post ACTD model-experiment-model runs and analysis.
		- Performed excursion runs and analysis.
•	1670	- Provided support for manned simulator residual.
•	710	- Performed final operational effectiveness analysis.
Total	4890	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology	PROJECT D493

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D493 Rapid Force Projection Demonstration	16168	16949	0	0	0	0	0	0	33117

Mission Description and Justification: The integrated system of systems concept of this Advanced Concept Technology Demonstration (ACTD) provided lightweight, responsive precision fires to destroy threat armor forces during day, night, and adverse weather. The ACTD evaluated 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 consisted 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 included both manned and unmanned air and ground systems. The sensor architecture was based on the unit equipment, as documented in the U.S. Army Intelligence Master Plan and the U.S. Army Modernization Plan, and was augmented with other sensors and processors, as required, to ensure forward sensors are properly cued. Tactical sensors (organic and advanced) received cueing information from these sensors to rapidly focus them on targets. The ACTD included both simulation and field demonstration phases, and encouraged 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 was completed in 4QFY98, followed by an extended user evaluation of residual quantities. Integrated demonstration work was 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 1999 Accomplishments:

•	4235	- Provided maintenance, replacement parts, and spares in direct support of user units.
		- Provided spare batteries, cables, and other replacement parts for communications equipment.
		- Provided RFPI integrated logistics support, personnel, analysis, and training.
•	8320	- Provided training on residual equipment for experiment units.
		- Provided residual support for hunter/killer systems/LDTOC.
		- Provided analysis of field experiment
•	3613	- Provided analysis and support including countermeasure/counter-countermeasure analysis.
Total	16168	

FY 2000 Planned Program:

•	10897	- Provide support for residual RFPI elements including disposition of residual hardware.
		- Provide training on residual elements to user units.
		- Provide spares/replacement parts for residual elements.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology	PROJECT D493

FY 2000 Planned Program: (continued)

•	1862	- Provide analysis and support, including support for possible milestone reviews/transition to procurement.
		- Provide comprehensive ACTD final report.
•	3779	- Evaluate select RFPI residuals in Joint Contingency Force (JCF) Advanced Warfighting Experiment (AWE).
•	411	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	16949	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D496

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D496 Enhanced Fiber Optic Guided Missile (EFOG-M)	18630	0	0	0	0	0	0	0	18630

Mission Description and Justification: This program completed in FY 1999. 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 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.

FY 1999 Accomplishments:

•	12738	- Conducted 4 guided test vehicle developmental missile flight tests. - Conducted warhead test, impact fuze sensor/propulsion evaluation, production flight readiness test, fiber optic cable testing, fire unit burn-in road test, and live developmental missile flight tests. - Conducted captive flight testing, missile electromagnetic interference testing and Y2K certification. - Continued systems support for ACTD hardware for the XVIII Airborne Corps. - Evaluated tactics, techniques, and procedures and validate war fighting operations and firing doctrine.
•	1093	- Performed test planning, test facility/range operations, test data reduction, and provided targets and target support for simulated missile flights, developmental missile flight tests, and environmental, safety, transportability, and lethality testing.
•	2248	- Provided integrated product team support from a wide variety of functional areas. - Provided facilities and support to development process, including hardware-in-the-loop, hardware/software integration and verification of system capabilities.
•	2551	- 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	18630	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D549

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D549 2.75 Inch Anti-Air Technology Demonstration (TD)	2590	0	0	0	0	0	0	0	2590

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 IR (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 compatibility with existing STINGER launchers and retain STINGER's excellent capability against fixed wing aircraft. This program completed in FY 99. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

FY 1999 Accomplishments:

•	1490	- Completed endgame and IRCCM signal processing algorithms. - Completed HWIL simulation. - Performed HWIL missile flight simulations.
•	1100	- Developed platform/launcher interfaces. - Performed captive carry air-to-air tests. - Performed environmental tests.
Total	2590	

FY 2000 Planned Program: Project not funded in FY 2000.

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D550

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D550 Counter Active Protection System	2134	1990	5466	5461	2481	0	0	0	17532

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. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

FY 1999 Accomplishments:

•	2134	- Completed 2nd generation test bed APS radar.
		- Fabricated, integrated, and tested 2nd generation RF countermeasure flight prototypes.
Total	2134	

FY 2000 Planned Program:

•	1936	- Complete 1st iteration monolithic microwave integrated circuit (MMIC) component development for 3rd generation RF countermeasure.
		- Begin development of brassboard activity detector, 1st iteration antennas, and brassboard base band module.
•	54	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	1990	

FY 2001 Planned Program:

•	5466	- Complete brassboards of 3rd generation RF countermeasures demonstrate functionality using 1st iteration MMICs
		- Complete 2nd iteration MMIC component development
		- Begin design and fabrication of 3rd generation RF test bed
		- Begin integration to missile test bed airframes
Total	5466	

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D567

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D567 Low Cost Precision Kill (LCPK) for 2.75 Inch Rockets	0	5307	3828	0	0	0	0	0	9135

Mission Description and Justification: This project provides for demonstration of a low cost, accurate (1-m CEP) guidance and control package for the 2.75-inch Hydra-70 rocket that provides a stand-off range (≥ 6 km) capability against specified non-tank point targets. The retrofit guidance package will allow utilization of large existing Hydra 70 rocket motor, warhead, and fuze inventories. This capability will provide for a high single shot probability of hit (pH≥ 0.7) against the long range target, exceeding the current unguided 2.75-inch rocket baseline by 1 or 2 orders of magnitude and thereby providing a 4 to 1 increase in stowed kills at one third the cost per kill compared to current guided missiles. The resulting decrease in logistics burden is of significant benefit to a CONUS-based force projection Army and of particular importance in a rapid force projection scenario. In addition, the increased accuracy will minimize collateral damage, reduce risk of fratricide, and will reduce mission times and sorties resulting in increased system survivability. The program will demonstrate technologies and techniques to overcome barriers such as providing a low cost, producible strapdown mechanism for precision guidance; robust design for rolling airframe applications; component packaging in 2.75 - inch airframe; structural, vibration and shock considerations for guidance package retro-fit to current 2.75 - inch Hydra-70 rockets; and stand-off range target acquisition and engagement techniques to address current free-rocket launch and flight dispersions. Work will be performed by the Research, Development, and Engineering Center, U. S. Army Aviation and Missile Command, Redstone Arsenal, Al.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	2955	- Award contract(s) for design and fabrication of laser guidance package(s) and associated flight test support.
•	1739	- Perform risk reduction captive test vehicle flight tests.
•	485	- Develop 6 degrees of freedom (DOF) simulation Monte-Carlo performance prediction simulations. Validate with hardware-in-the-loop (HWIL) tests of prototype guidance section(s).
•	128	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program
Total	5307	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D567

FY 2001 Planned Program:

•	3500	- Perform HWIL evaluations of contractor guidance section.
		- Perform ground launched guided test vehicle flights of contractor guidance sections.
•	328	- Upgrade and validate 6-DOF simulation(s).
		- Support pre/post flight predictions/analysis.
Total	3828	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	22651	47117	20894	22976	23544	26810	30759	Continuing	Continuing
D608 Countermine & Barrier Development	20725	27536	18250	20041	20615	21939	22983	Continuing	Continuing
D624 Ground Penetrating Radar Technology	1926	0	0	0	0	0	0	0	8531
D683 Anti-Personnel Landmine (APL) Alternatives	0	19581	2644	2935	2929	4871	7776	Continuing	Continuing

A. Mission Description and Justification: This program element develops and demonstrates robust countermine technologies. Operation Desert Storm and operations in Bosnia have highlighted the need for new equipment to detect and neutralize land mines. The Army's highest priority Countermine requirements are in-stride detection and breaching, close-in detection, area clearance and neutralization of landmines. Advanced Technology Demonstrations (ATDs), advanced warfighting experiments, and modeling and simulation activities will be performed to assess maturity of technology and system concepts. Specific efforts include remote detection of minefields and detection of individual mines from handheld, ground vehicles and aerial platforms, all of which must work against both metallic mines and low/non-metallic mines. Multi-sensor fusion will be used in vehicle-mounted mine detectors with confirmation sensors to significantly increase operational tempo (OPTEMPO) while achieving high mine detection rates with extremely low false alarm rates. Airborne multispectral/hyperspectral minefield detectors will be assessed for contingency applications and developed for a light weight plug and play approach for mission specific applications to optimally sense surface-laid and buried mines in varying vegetative, soil and diurnal conditions. Alternative systems for anti-personnel landmines and innovative concepts for minefield clearance also will be explored. 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. Anti-Personnel Landmine Alternatives (APLA) efforts continue the work started in PE 603121D8Z and the concept exploration study congressional plus up in 604808A. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	23777	47456	44935
Appropriated Value	23944	47456	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-167		
b. SBIR / STTR	-572		
c. Omnibus or Other Above Threshold Reductions		-184	
d. Below Threshold Reprogramming	-460		
e. Rescissions	-94	-155	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-24041
Current Budget Submit (FY 2001 PB)	22651	47117	20894

Change Summary Explanation: Funding – FY 2001: funding transferred to PE 0604808 for near term anti-personnel landmine alternatives.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology PROJECT D608

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D608 Countermine & Barrier Development	20725	27536	18250	20041	20615	21939	22983	Continuing	Continuing

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 ground vehicles and aerial platforms, all of which must work against both traditional (metallic) mines and mines made from advanced materials. Teleoperated sensors for standoff and integrated neutralization concepts will be evaluated in the Mine Hunter/Killer ATD. The Mine Hunter/Killer will be capable of detecting and destroying mines at maneuver speeds. Multi-sensor fusion will be combined with confirmation sensor technologies to allow a significant reduction in false alarms affording a considerable increase in operational tempo. Airborne multispectral/hyperspectral minefield detectors will be assessed for contingency applications and developed for a light weight airborne minefield detector plug and play approach for mission specific applications to optimally sense surface-laid and buried mines in varying vegetative, soil and diurnal conditions. The preliminary approach for area clearance will be identified. These projects support advanced technology demonstrations, advanced warfighting experiments, and modeling and simulation assessments which include the Navy, Army, and USMC joint countermine Advanced Concept Technology Demonstration (ACTD).

FY 1999 Accomplishments:

- 1743 – Developed models and simulations for joint countermine ACTD technologies and integrated new architecture into the service models. Received favorable final user report on novel system military suitability.
  – Conducted assault-on-objective battle lab experiment and assessed contribution of new countermine technology to survivability and mobility of assault forces.
- 9085 – Integrated prototype detection and neutralization technologies into Mine Hunter/Killer ATD.
  – Conducted baseline evaluation of sensor fusion algorithms
  – Evaluated precision neutralization technology against surface and buried AT mines in various soils, overburdens, and environmental conditions.
- 9897 – Completed requirements analysis and technology trade-offs for lightweight imaging multispectral airborne minefield detection technology.
  – Collected mine signature data to support finalization of phenomenology studies and mine detection algorithm development.
  – Identified critical sensor technologies for airborne minefield detection.

Total 20725

FY 2000 Planned Program:

- 9236 – Evaluate mine hunter/killer integration of close-in detection and neutralization capability with a goal of dramatically improving the rate at which maneuver/transport lanes are cleared versus current capabilities.
  – Evaluate tele-operation capability of mine hunter/killer for an on-route mission scenario.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology PROJECT D608

FY 2000 Planned Program: (continued)

- Identify and evaluate downselected precision neutralization technology against surface and buried AT mines in various soils, overburden and environmental conditions with the goal of demonstrating greater than a 90% probability of kill for a neutralization capability.

•	14100	– Develop minefield detection aided target recognition (ATR) algorithms to improve airborne minefield detection performance (increase probabilities of detection and reduce false detection rates). – Perform ground and airborne data collections against buried and surfaced emplaced mines using multiple sensors that will provide data to support phenomenology investigations, multi/hyperspectral ATR algorithm development, and algorithm performance evaluations for ground and airborne mine/minefield detection sensors. – Develop system and component requirements/specifications of a lightweight multispectral detection sensor optimized for surface minefield detection. Sensor will be compatible with future tactical/short range UAVs (weight goal less than 65 lbs.) and capable of performing in a broad range of environments. – Perform benchmark demonstration of the multi/hyperspectral minefield detection capability to establish multi/hyperspectral minefield detection performance baseline.
•	910	– Analyze data from Joint Countermine ACTD demo II and apply lessons learned to detection and area clearance technology programs. – Provide support for JCM C4I transition efforts. .
•	2618	– Obtain ACTD approval from OSD and initiate Joint Area Clearance (JAC) ACTD planning – Develop mission scenarios for Warfighter Exercises – Obtain test components and develop assessment strategy. – Initiate component evaluation.
•	672	– Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.
Total	27536	

FY 2001 Planned Program:

•	3490	– Evaluate candidate confirmation technologies in support of the False Alarm Reduction for Improved OPTEMPO STO. – Establish initial confirmation sensor technical benchmark
•	13839	– Transition of the Lightweight Airborne Multispectral Mine Detection (LAMD) EMD contingency package to PM-MCD. – Design a lightweight multispectral detection sensor for surface minefield detection that is compatible with current/future tactical/short range UAVs and capable of performing in a broad range of environments and initiate development of prototype system demonstrator. – Initiate development of advanced minefield detection ATR algorithms and enhance fusion approaches to improve airborne minefield detection of buried and surface emplaced mines (increase probabilities of detection and reduce false detection rates).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology PROJECT D608

FY 2001 Planned Program: (continued)

- Develop and design a test and evaluation strategy that will fully test the ability of lightweight multi/hyperspectral technology to achieve the Army's airborne minefield detection requirements.

•	921	– Finalize JAC ACTD demo planning with warfighter. – Develop user operational concept and perform component evaluation. – Conduct initial Warfighter Exercises
Total	18250	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology PROJECT D624

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D624 Ground Penetrating Radar Technology	1926	0	0	0	0	0	0	0	8531

Mission Description and Justification: This one year, Congressional special interest program developed and evaluated stand-off ground penetrating radar (GPR) technologies for mine detection.

FY 1999 Accomplishments:

- 1926 – Initiated upgrade of Phase I system into the Phase II forward looking system.
  – Enhanced power amplifiers for better antenna gain, improved digitizers for increased processing capability, and new processors for high rate of advance and yielding enhanced detection capability.
  – Enhanced and integrated differential Global Positioning System (D-GPS) system to enable inertial navigation and improved mine location.
  – Evaluated and added software to enhance sensor fusion performance using both the GPR and FLIR sensors.

Total 1926

FY 2000 Planned Program: Program not funded in FY 2000

FY 2001 Planned Program: Program not funded in FY 2001

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology PROJECT D683

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D683 Anti-Personnel Landmine (APL) Alternatives	0	19581	2644	2935	2929	4871	7776	Continuing	Continuing

Mission Description and Justification: This project provides advanced technology demonstrations of alternative systems for anti-personnel landmines (APLs). This includes alternatives to anti-personnel submunitions used in mixed anti-tank (AT) landmine systems and possibly the entire mixed landmine system themselves. The alternative systems will include surveillance systems, command and control systems, and overwatch fires which will be evaluated and developed in parallel to provide similar capabilities that are now provided by APLs and APL submunitions in mixed AT systems. Distributed simulation will be used to evaluate new concepts and modify tactics and procedures. Prototype components and system architectures will be constructed and evaluated in system field tests. This effort continues the work started in PE 603121D8Z and concept exploration study congressional plus up in 604808A.

FY 1999 Accomplishments: Project not funded in FY 1999

FY 2000 Planned Program:

- 4530 - Complete Concept exploration studies
- 7524 - Evaluate the use of low cost sensors for remote detection, assessment and early warning of targets/penetrations. Leverage commercial and current military sensors and build prototypes for field test.
  - Evaluate current command, control, communications, and computer (C4) components and optimize implementation for use in landmine alternative system architecture. Include assessment of communications vulnerability, investigate novel low cost, short range communications devices for minefield components and sensor networking, and digitize minefield operations to provide situational awareness. Build prototypes for field test.
  - Evaluate the use of advanced deterrent and fuzing systems including wide area munitions and nonlethal technology for insertion to landmines for anti-handling capability and/or to provide man-in-the-loop overwatch fire capability. Build prototypes for field tests.
- 3000 - Evaluate modifying current mixed delivery systems for use with landmine alternative system concepts
- 2000 - Use distributed modeling to modify tactics and procedures for landmine alternative system
- 2000 - Model and develop advance technology sensors, communications and next generation scatterable munition components and subsystems for mid term mixed mine alternative solutions.
- 527 - Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.

Total 19581

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology PROJECT D683

FY 2001 Planned Program:

•	2000	– Develop and demonstrate an adaptable network of expendable day/night imaging sensors, low cost point detectors and new deterrent devices for force protection and landmine alternative roles.
•	644	– Test advanced technology brassboards for landmine alternatives concept development.
Total	2644	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603607A Joint Service Small Arms Program PROJECT D627

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D627 Joint Service Small Arms Program (JSSAP)	12532	8760	4469	5804	5905	6308	6613	Continuing	Continuing

A. Mission Description and Justification: The objective of this Program Element (PE) is to develop and demonstrate advanced technologies that integrate into individual and crew-served weapons with greater lethality, utility and range at a significantly reduced weight. The Joint Service Small Arms Program (JSSAP) includes the Objective Crew-Served Weapon (OCSW) Advanced Technology Demonstration (ATD) and the new Joint Service Combat Shotgun. The Objective Individual Combat Weapon (OICW) transitioned to the Program Manager for Small Arms, PE 060480A, in FY99. It demonstrated an individual weapon capable of hitting obscured targets with a 300-500% increase in probability of hit and increased effective range of 1000 meters. OCSW demonstrates the next generation crew-served weapon with improved combat effectiveness such as being able to hit obscured targets and a reduced weight of 65-75% over weapons it replaces. This weapon is designed to replace selected M2 machine guns, MK19 grenade machine guns and M240 machine guns. The Joint Service Combat Shotgun will demonstrate a weapon with high combat versatility and reduced logistics burden. All JSSAP efforts follow the Joint Service Small Arms Master Plan (JSSAMP) and the approved Joint Service Science and Technology Objectives (JSSTO). The also meet their respective Mission Need Statements and Operational Requirement Documents. This work is also consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The US Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ, primarily manages this PE. Work in this PE is derived, and fully integrated with, the 6.2 efforts found in PE 0602623A (Joint Service Small Arms Program) and PE 0602624A (Weapons and Munitions Technology). JSSAP OICW and OCSW Technology Base efforts transition to PE 0604802A (Weapons and Munitions Engineering Development) and PE 0604601A (Objective Crew-Served Weapon - Engineering Development), respectively. Transition paths have been established in coordination with Program Manager (PM) Small Arms; USMC Director, Ground Weapons; and US Special Forces Operations Command (SOCOM).

FY 1999 Accomplishments:

•	7204	- Completed hardware build for OICW ATD.
•	1467	- Conducted OICW live fire simulation/field test and prepared for Milestone I. - Conducted OICW transition activities and completed ATD.
•	3861	- Integrated initial system design refinements into OCSW prototype weapon. - Conducted OCSW 2000 meter dispersion critical test demo; completed precision air burst design effort plus fragmentation study. - Designed OCSW fire control system and addressed interface for combat identification (friend/foe), plus Land Warrior interoperability. - Completed joint combat shotgun selection and operational and engineering testing.
Total	12532	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603607A Joint Service Small Arms Program
	PROJECT D627

FY 2000 Planned Program:

•	1200	- Complete OCSW system design refinements of a lightweight (less than 50 lb.) weapon (gun, pintle, traverse and elevation, and tripod).
•	1300	- Demonstrate OCSW fuze setting in rapid-fire (3-5 round burst mode).
•	2139	- Build and test initial OCSW fire control system.
		- Conduct 1000-2000 meter firing tests of OCSW launched, high explosive, airburst munition.
•	3900	- Ensure robust fuze design and system reliability; build ATD simulator
	221	- Small Business Innovation Research/ Small Business Technology Transfer (SBIR/STTR) Programs
Total	8760	

FY 2001 Planned Program:

•	311	Demonstrate OCSW interface with Land Warrior and Future Warrior advanced warfighting experiments; demonstrate functionality
•	1040	Demonstrate OCSW thermal module capability, leveraging OICW and other applicable technologies.
•	2158	Complete planning of OCSW safety release testing; fabricate and test initial hardware.
•	960	Conduct initial system level demonstration of integrated OCSW: weapon/ammunition/fuze/fire control.
Total	4469	

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 / 2001 PB)	9608	4869	5468
Appropriated Value	9673	8869	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-65		
b. Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Program	-242		
c. Omnibus or Other Above Threshold Reductions		-34	
d. Below Threshold Reprogramming	+3204		
e. Rescissions	-38	-75	
Adjustments to Budget Years Since (FY 2000 / 2001 PB)			-999
Current Budget Submit (FY 2001 PB)	12532	8760	4469

Change Summary Explanation: Funding – FY 1999: Reprogrammed 3204 from various sources for OICW program.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)		DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603654A Line-of-Sight Technology Demonstration	PROJECT D460

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
D460 LOSAT Technology Demonstration	15126	37845	50727	57127	28243	0	0	0	391629

A. Mission Description and Budget Item Justification: Project D460-LOSAT Technology Demonstration: This program focuses on the 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. The LOSAT weapon system consists of a kinetic energy (KE) missile launcher mounted on a heavy High Mobility Multi-purpose Wheeled Vehicle (HMMWV) chassis. LOSAT offers a near-term advanced capability for overwhelming armor destruction with a high rate of fire, increased range, and increased force survivability. LOSAT, deployed in the early entry force, will provide the decisive edge to win swiftly with minimum causalities and provides an assault support weapon capability. LOSAT is strategically and tactically deployable, giving Commanders and decision makers greater flexibility. The performance of this hypervelocity kinetic energy missile (velocity of a mile per second) is not affected by the proliferation of emerging threat active protective systems and enhanced reactive armors which are both rapidly becoming available on the global marketplace. LOSAT was initiated as a DoD-approved Advanced Concept Technology Demonstration (ACTD) program in FY1998 to position the technology for future acquisition decisions; demonstrate subsystem capabilities in flight tests and dirty battlefield environments; evaluate the utility of the LOSAT technology for the early entry forces; demonstrate an integrated HMMWV-based LOSAT system in-flight test and advanced warfighting experiments; and evaluate affordability issues. The ACTD program is a cost-effective means to assess the operational value of LOSAT to the early entry force through deployment with the XVIII Airborne Corps while longer-term applied research efforts continue for a small Compact Kinetic Energy Missile and an objective Medium Combat Vehicle. The work in this program element is consistent with the Army Science and Technology Master Plan, and the Army Modernization Plan.

The funding in PE 0604819A, Budget Activity 5 (FY 01 $26.8M, FY 02 $21.5M, FY 03 $14.1M, FY 04 $14.9M, FY 05 $15.9M) will be used to support the New Army Vision/Transformation by adding additional design activities, reducing risk, completing system qualification testing, and adding additional Operational tests to support transition to limited production of the LOSAT Weapon System, with production funds starting in FY 04.

FY 1999 Accomplishments:

- 8490 - Completed Fire Unit electronics and mechanical conceptual designs.
- 4040 - Completed Missile electronics and mechanical conceptual designs.
- 1340 - Completed Fire Unit software preliminary requirements development and analysis, and initiated preliminary software design.
- 615 - Conducted Inertial Measurement Unit Spin & Shock Test and analysis.
- 230 - Completed Fire Unit controls/displays baseline development, and initiated supplier analysis.
- 280 - Initiated Fire Unit prototype tooling and test equipment design.
- 131 - Continued Virtual Prototype Simulator design update.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)		DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603654A Line-of-Sight Technology Demonstration	PROJECT D460

Total 15126

FY 2000 Planned Program:

- 18871 - Complete Fire Unit electronic preliminary designs including six major line replaceable units and interior mechanical preliminary designs.
- 7760 - Complete Missile electronic and mechanical preliminary designs.
- 2425 - Conduct Launch effects planning, test, and analysis.
- 1820 - Complete Fire Unit exterior structural design.
- 2430 - Continue Fire Unit software design and analysis.
- 1700 - Fabricate Fire Unit structural prototype for Launch Effects test.
- 850 - Continue Fire Unit test equipment design.
- 970 - Complete Virtual Prototype Simulator upgrade.
- 1019 - Small Business Innovative Research/Small Business Technology Transfer

Total 37845

FY 2001 Planned Program:

- 28857 - Complete Fire Unit electronic and interior mechanical detail designs, conduct design reviews, and initiate fabrication.
- 10720 - Complete Missile electronic and mechanical detail designs, conduct design reviews, and initiate fabrication.
- 5670 - Conduct Risk Reduction flight test planning, tests, and analysis.
- 2210 - Complete tooling design and initiate fabrication.
- 2000 - Complete Fire Unit software design and code, and initiate system level testing.
- 770 - Complete design, and initiate fabrication of training devices and prototype simulators.
- 500 - Initiate Missile software update design, code, and test.

Total 50727

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603654A Line-of-Sight Technology Demonstration PROJECT D460

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	11920	41619	52940
Appropriated Value	12000	38000	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-80		
b. SBIR / STTR	-316		
c. Omnibus or Other Above Threshold Reduction		-155	
d. Below Threshold Reprogramming	+3570		
e. Rescissions	-48		
Adjustments to Budget Years Since FY 2000/2001 PB		0	-2213
Current Budget Submit (FY 2001 PB)	15126	37845	50727

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	25402	42262	33341	37741	37026	32905	32340	Continuing	Continuing
DK70 Night Vision Advanced Technology	9153	18493	18517	21159	18812	20702	20609	Continuing	Continuing
DK86 Night Vision, Airborne Systems	11203	18251	6154	4582	9457	9391	9259	Continuing	Continuing
DK89 Millimeter Wave Technology	3371	0	0	0	0	0	0	0	3371
DC63 DC63	0	0	0	0	0	0	0	0	3958
DC65 DC65	1675	2382	2360	2857	2870	2812	2472	Continuing	Continuing
DC67 DC67	0	3136	6310	9143	5887	0	0	0	25028

A. Mission Description and Budget Item Justification: This program element (PE) develops and demonstrates new and improved tactical night vision and electronic sensor technologies for surveillance, reconnaissance, target acquisition, air defense, pilotage, and driving technology to meet future Army requirements and applications. This technology will provide the capability to acquire and engage hostile targets at longer 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 that provide rapid automatic target acquisition and generation of battlefield intelligence data. This will 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. Improved linkages between distributed sensors and command, control, communications, computers and intelligence (C4I) systems will enable timely and seamless transmission and understanding of sensor information across multiple battlefield users. Efforts also are 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. Advanced tactical reconnaissance and surveillance sensor technologies will provide improved real-time capabilities for imaging intelligence (IMINT) and measurement and signature intelligence (MASINT) applications. 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

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology

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: Raytheon., Dallas, TX; Raytheon, 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.; ThermoTrex Corporation.

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	27273	36628	37035
Appropriated Value	27460	42628	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-187		
b. SBIR / STTR	-692		
c. Omnibus or Other Above Threshold Reductions		-161	
d. Below Threshold Reprogramming	-1069		
e. Rescissions	-110	-205	
Adjustments to Budget Years Since FY 2000/2001 PB			+37
New Army Transformation Adjustment		TBD	-3731
Current Budget Submit (FY 2001 PB)	25402	42262	33341

Change Summary Explanations: Funding – FY 2001 : Projects were adjusted to reflect the new Army Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology		PROJECT DK70

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK70 Night Vision Advanced Technology	9153	18493	18517	21159	18812	20702	20609	Continuing	Continuing

Mission Description and Justification: This project will develop and demonstrate affordable and high performance, sensor/multisensor technologies that increase the probability of detection, extend the range, and reduce the target acquisition timelines. The multi-function staring sensor suite (MFS3) ATD will demonstrate a modular reconfigurable sensor suite that integrates an advanced, broad-band staring infrared sensor with multi-function laser and acoustic technologies for application to future scout, fire support, and air defense missions. This technology demonstration will provide ground combat and amphibious assault vehicles with compact affordable sensor options for long range non-cooperative target recognition and air defense against low signature unmanned aerial vehicles and long range helicopters. A next generation, low power, uncooled infrared sensor also will be developed to provide affordable technology upgrades to applications such as Thermal Weapons Sights (TWS), Objective Crew Served Weapon (OCSW), Objective Individual Combat Weapon (OICW), future Cost Effective Targeting Systems and the Javelin anti-tank weapon system. Sensor-to-C4I interface architectures will be demonstrated to enable timely and seamless transmission as well as visualization and understanding of sensor information across multiple battlefield users.

FY 1999 Accomplishments:

- 9153 – Developed reconfigurable, open architecture sensor backplane that fully integrates aperture, power, and signal processing requirements for infrared, laser, and acoustic sensor components.
  - Developed and implemented risk reduction efforts for multifunction staring sensor suite infrared sensor components.
  - Completed design trade-offs and evaluations of broad-band (mid-wave and long-wave) staring infrared sensor technologies.
  - Conducted preliminary efforts to develop broad band high-speed infrared sensor for rapid wide area search and long range target identification.
  - Continued development of the multifunction staring sensor suite virtual prototype to facilitate design/performance trade-offs, user evaluations of operational modes and non-machine interfaces.

Total 9153

FY 2000 Planned Program:

- 13234 Complete multifunction staring sensor suite system operation mode simulation with Mounted Maneuver Battlelab to optimize user interface.
  - Fabricate signal processing backplane, and sensor gimbal and stabilization assembly required to implement panoramic search capability
  - Complete fabrication of the multifunction staring sensor suite broad band staring thermal imaging sensor to satisfy the objective surveillance and target acquisition requirements of future scout, fire support, and air defense systems.
  - Conduct user demonstrations and evaluations of manually operated, 3-field of view broad band and mid wave sensors and characterize target recognition and identification performance. Specific emphasis will be placed on demonstrating the utility of the ultra narrow field of view for long-range target identification.
  - Transition performance and engineering data to support the future scout and cavalry system affordability in-process review.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology PROJECT DK70

FY 2000 Planned Program: (continued)

– Complete the multi-function laser simulation, trade-off, and design analyses, and transition data to support requirements definition of Army laser horizontal technology integration.

– Conduct multifunction staring sensor suite data collections, using the broad band thermal imaging sensor, to support training of the automatic target recognition software needed for high probability of detection/recognition, wide-area search modes.

- 2819 – Complete performance and design requirements and system concept modeling and field experimentation for a modular sensor that incorporates an improved generation of uncooled infrared technology, and smart power management architecture to provide improved performance and reduce the weight and power burden for the individual soldier .

– Conduct system design analysis and field data collection of Cost Effective Targeting Sensor with multi-sensor alternatives and flash laser illumination for target identification.

– Define focal plane, image processing, and image stabilization requirements to meet or exceed the Javelin command launch unit range performance for multiple sensor applications to include TWS, OCSW, OICW, Javelin and future Cost Effective Targeting System.

– Design power management architecture and low power electronics to reduce power consumption to a level such that a 72-hour operational mission can be executed using only one primary battery.

- 2000 - This one year Congressional special interest effort will fabricate and demonstrate fire fighting and damage control systems consisting of helmet mounted infrared camera, power supply, image projection device, transmitter/receiver, and computer with interface and software to support complete voice activated system controls.

- 440 – Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.

Total 18493

FY 2001 Planned Program:

- 14200 – Complete development of multifunction laser hardware and integration into the multifunction staring sensor suite.

– Complete development of aided target detection/recognition algorithm hardware/software (multispectral detection, moving target indication, and mid wave spatial detection/recognition) and integration into the multifunction staring sensor suite.

- 3920 – Develop 640x480 uncooled focal plane array with increased sensitivity.

– Complete design of low power electronics and power management which reduces power consumption by 60% compared to currently fielded systems such as the Thermal Weapon Sight.

– Complete design of lightweight optics, electronic, and mechanical interfaces to enable the low power uncooled infrared sensor technology to be readily reconfigured for applications such as the individual soldier thermal weapons sight, objective crew served weapon, or Javelin antitank weapon.

- 397 – Complete definition and development of hardware and software modules required to demonstrate the sensor-to-C4I interface architecture in a scout platform and mine detection platform.

– Complete development of data/image compression technology and techniques required to provide sensor data over limited bandwidth communications links.

Total 18517

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)			DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology		PROJECT DK86

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK86 Night Vision, Airborne Systems	11203	18251	6154	4582	9457	9391	9259	Continuing	Continuing

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 heads up displays, and obstacle warning technology to enhance the operational effectiveness and survivability of currently fielded and future attack, scout, cargo and utility helicopters. These technologies will significantly enhance the survivability of Army aviation assets during nap-of-the-earth flights and day/night/adverse weather conditions. Reduced exposure to air defense artillery, surveillance systems, and smart missiles will also be realized. Advanced helicopter pilotage (AHP) demonstrations will provide a high-quality dual-spectrum pilotage sensor and the displays needed to provide this imagery to the pilot. 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 PEO Aviation programs. In conjunction with PEO Aviation, the advanced integrated targeting suite (AITS) will demonstrate a millimeter wave electronically scanned antenna radar fused with the IR/EO targeting sensor to achieve automated detection, recognition, and identification at extended ranges for transition to Comanche. Advanced aviators night vision goggles (ANVG) ATD will demonstrate a lightweight wide field-of-view (FOV) (40 x 100 deg) low cost panoramic night pilotage capability for the air warrior. Multi-mission, unmanned aerial vehicle (UAV) sensor ATD will demonstrate affordable, high performance EO/IR payload for transition to PM TUAV/ PM NVRSTA. Ultra light weight, modular sensors will be developed for the Small Unit/Mini UAV. 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. Complete design and fabrication of a Wire Obstacle and Detection System that will provide a much-needed military capability to pilots, given the hazardous conditions in which some military mission must be flown. Develop a mini class UAV platform with GFE sensor, launch system, ground station capability and automated flight control.

FY 1999 Accomplishments:

- 3419
  - Developed performance and design requirements for multi-mission electro-optic/infrared sensor payloads for tactical and short range unmanned aerial vehicles.
  - Completed design of high performance, lightweight staring infrared sensor for wide area reconnaissance, and precision targeting.
  - Completed design of lightweight multispectral/hyperspectral payload for measurement and signature intelligence.
- 7784
  - Established baseline performance of ATR algorithm probability of detection, classification, recognition, identification, probability of false alarm/false target reports.
  - Developed architecture for on-the-move multisensor aided target recognition algorithm that combines laser range mapping and laser target profile data with infrared imagery for automated air/land enhanced reconnaissance and targeting advance technology demonstration.
  - Defined design modifications for baseline laser rangefinder/designator and initiated fabrication to provide the increased pulse repetition rates necessary to operate in range mapping and target profiling modes during high-speed dynamic flight missions.

Total 11203

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology
	PROJECT DK86

FY 2000 Planned Program:

•	2200	– Conduct initial developmental efforts of the ANVG program for demonstrating high resolution, wide field of view, helmet mounted sensor. – Conduct HTI sensor/system approach for application for both aviation and infantry to provide improved performance for pilotage, driving and dismounted operations under various battlefield conditions. – Perform human interface study for aviation and infantry applications. – Identify HTI design tradeoffs. – Develop image intensification (I2) tube enhancements for improved performance.
•	5000	– Complete development and fabrication of high performance staring electro-optic/infrared (EO/IR) and multi/hyperspectral modular sensor payloads. – Complete environmental testing for shock, vibration, temperature, altitude, etc. to ensure the EO/IR UAV payloads are ready for aircraft integration and flight tests. – Develop and test mechanical interface for rapid and simple "plug in/plug out" modularity, electrical interface to include cables, connectors, power, and informational interface to include data links, command and control, mission planning, and ground checkout. – Develop mechanical mockups to demonstrate rapid interchangeability between high performance EO/IR, multi/hyperspectral and radar sensor payloads on a tactical UAV platform. – Integrate on manned platform and conduct instrumented flight-testing under dynamic flight conditions to verify functionality of the payloads and down links.
•	4168	– Demonstrate FLIR performance upgrade and perform image data collections for algorithm enhancements. – Complete coding of algorithm modifications needed to achieve enhanced detection and classification performance against stationary and moving targets for search on the move. – Perform aircraft testbed system integration of multi-function laser with electro-optic target acquisition sensor for final airborne data collection trials and performance demonstrations – Demonstrate rapid target insertion / algorithm training process for achieving automatic detection and cueing performance against new/emerging target threats.
•	3000	– This one year Congressional special interest project will develop and demonstrate a wire detection and obstacle avoidance system.
•	1000	– This one year Congressional special interest project will develop and demonstrate a prototype Mini UAV platform with GFE sensor, launch system, ground station capability and automated flight control.
•	2423	– Develop on-the-move FLIR/targeting radar sensor fusion algorithms to improve aircraft survivability during reconnaissance and attack missions.
•	460	– Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.
Total	18251	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology
	PROJECT DK86

FY 2001 Planned Program:

- 1514 – Fabricate sensor mockups for cockpit/equipment integration evaluations.
  – Complete critical design and initiate fabrication of air warrior version of the ANVG sensor package.
- 2000 – Integrate high performance electro-optic/infrared and multi/hyperspectral sensor payloads on a tactical UAV/manned reconnaissance platforms and conduct operational demonstration and user warfighting experiments to support military assessments.
  – Develop and transition performance and technical design data to PM NVRSTA and PM TUAV to support final development of operational requirements and engineering development specifications for TUAV Block 2 procurement.
- 2660 - Complete integration of air/land enhanced reconnaissance and targeting technologies with demonstration aircraft and conduct airborne flight evaluations to demonstrate increased operational benefits derived from multi-function laser and ATR algorithm enhancements when performing search on-the-move, acquiring targets in defilade or obscured, or at extended range.
  – Develop and transition performance and technical design data to support technology insertions decision by individual PEO Aviation platform managers (Comanche, Apache, and future scout cavalry vehicle).

Total 6174

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology	PROJECT DK89

COST *(In Thousands)*	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK89 Millimeter Wave Technology	3371	0	0	0	0	0	0	0	3371

Mission Description and Justification: This one year Congressional special interest project conducted passive millimeter wave imaging technology research, which will be used to demonstrate a potential all-weather, mission enabling capability on a helicopter platform. Flight tests were conducted to establish the feasibility of pilotage and targeting in adverse weather such as dense fog and medium rain. This program specifically addressed Special Operations Forces high priority capability. Other potential applications for the completed system include seeing through closed doors and walls in military operations in urban terrain.

FY 1999 Accomplishments:

•	3371	- An upgraded passive millimeter wave camera (PMC) was completed and flight tests were conducted. Passive MMW images were obtained from various altitudes of areas in and around Mojave, CA at true video frame rates.
Total	3371	

FY 2000 Planned Program: This project is not funded in FY 2000.

FY 2001 Planned Program: This project is not funded in FY 2001.

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603728A Environmental Quality Technology Development

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	1327	1616	2708	2687	3847	3974	Continuing	Continuing
002 Environmental Compliance Technology	0	1327	1616	2708	1841	1442	680	Continuing	Continuing
025 Pollution Prevention Technology	0	0	0	0	846	2405	3294	Continuing	Continuing

A. Mission Description: The focus of this program is to conduct demonstrations to mature technology which will assist Army installations in becoming environmentally compatible without compromising readiness or training. This program will include technology demonstrations for: restoration of sites contaminated with toxic and/or hazardous materials resulting from Army operations; pollution prevention to minimize the Army's use and generation of toxic chemicals and hazardous wastes; compliance with environmental laws by control, treatment, and disposal of hazardous waste products; and conservation of natural and cultural resources while providing a realistic environment for mission activities. This program will include demonstrations of proof of technological feasibility and assessment of operability and producibility that could lead to a capability for Army use, including technology transition from the laboratory to operational use. No other program exists that is appropriate for this work. The program is supported by the Office of the Secretary of Defense's Technology Area Review and Assessment Process. This project supports Army efforts to demonstrate technology to improve the Army's ability to achieve environmental compliance at its installations and its rework and production facilities. Technology demonstrated within this project will focus on reducing the cost of treating hazardous effluents from Army installations including ammunition plants, depots and arsenals to satisfy increasingly stringent wastewater and air pollutant discharge standards. Army facilities are now subject to fines and facility shutdowns for violation of Federal, state, and local air and wastewater discharge regulations. This technology is essential to control and reduce the generation of wastes to satisfy hazardous waste reduction goals and to avoid future hazardous waste disposal costs and liabilities to the Army. Efforts under this project will enable the Army to prevent pollution at installations, facilities operations, and to comply with the myriad of Federal, state, and host country regulations dealing with hazardous wastewater, air emissions, and solid wastes. The primary developing agency for this project is the U.S. Army Engineer Research and Development Center (ERDC).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728A Environmental Quality Technology Development

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	0	1337	1626
Appropriated Value		1337	
Adjustments to Appropriated Value			
a. Congressional General Reductions			
b. SBIR / STTR			
c. Omnibus or Other Above Threshold Reductions		-5	
d. Below Threshold Reprogramming			
e. Rescissions		-5	
Adjustments to Budget Years Since FY 2000/2001 PB			-10
Current Budget Submit (FY 2001 PB)	0	1327	1616

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603728A Environmental Quality Technology Development

PROJECT: 002

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
002 Environmental Compliance Technology	0	1327	1616	2708	1841	1442	680	Continuing	Continuing

Mission Description and Justification: The focus of this program is to conduct demonstrations to mature technology which will assist Army installations in becoming environmentally compatible without compromising readiness or training. This program will include technology demonstrations for: restoration of sites contaminated with toxic and/or hazardous materials resulting from Army operations; pollution prevention to minimize the Army's use and generation of toxic chemicals and hazardous wastes; compliance with environmental laws by control, treatment, and disposal of hazardous waste products; and conservation of natural and cultural resources while providing a realistic environment for mission activities. This program will include demonstrations of proof of technological feasibility and assessment of operability and producibility that could lead to a capability for Army use, including technology transition from the laboratory to operational use. No other program exists that is appropriate for this work. The program is supported by the Office of the Secretary of Defense's Technology Area Review and Assessment Process. This project supports Army efforts to demonstrate technology to improve the Army's ability to achieve environmental compliance at its installations and its rework and production facilities. Technology demonstrated within this project will focus on reducing the cost of treating hazardous effluents from Army installations including ammunition plants, depots and arsenals to satisfy increasingly stringent wastewater and air pollutant discharge standards. Army facilities are now subject to fines and facility shutdowns for violation of Federal, state, and local air and wastewater discharge regulations. This technology is essential to control and reduce the generation of wastes to satisfy hazardous waste reduction goals and to avoid future hazardous waste disposal costs and liabilities to the Army. Efforts under this project will enable the Army to prevent pollution at installations, facilities operations, and to comply with the myriad of Federal, state, and host country regulations dealing with hazardous wastewater, air emissions, and solid wastes. The primary developing agency for this project is the U.S. Army Engineer Research and Development Center (ERDC).

FY 1999 Planned Program: Project not funded in FY 1999

FY 2000 Planned Program:

•	605	- Begin technology demonstration of cost effective technologies to remove, characterize, and dispose of or reuse sources of Army-peculiar lead hazards (to be completed in FY03).
•	686	- Begin technology demonstration of hazardous air pollutant emission control technologies of Army unique pollutants (to be completed in FY05).
	36	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR).
Total	1327	

FY 2001 Planned Program:

•	899	- Demonstrate cost effective technologies to remove, characterize, and dispose of or reuse sources of lead hazards.
•	717	- Demonstrate hazardous air pollutant emission control technologies of Army unique pollutants.
Total	1616	

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	16270	15762	5207	4725	2916	5009	5346	0	Continuing
DT08 Combat Engineering Systems	2188	3746	5207	4725	2916	5009	5346	0	Continuing
DT12 Rapid Terrain Visualization	14082	12016	0	0	0	0	0	0	50844

A. 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 to correct 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	15523	15881	5240
Appropriated Value	15564	15881	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-41		
b. SBIR / STTR	-59		
c. Omnibus or Other Above Threshold Reductions		-64	
d. Below Threshold Reprogramming	+814		
e. Rescissions	-8	-55	
Adjustments to Budget Years Since FY 2000/2001 PB			-33
Current Budget Submit (FY 2001PB)	16270	15762	5207

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE: February 2000
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology	PROJECT: DT08

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DT08 Combat Engineering Systems	2188	3746	5207	4725	2916	5009	5346	0	Continuing

Mission Description and Justification: This project will demonstrate, at full scale, a capability to conduct logistics-over-the-shore (LOTS) operations at sea-state 3 (wave height – approx. 3 to 5 feet); 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 (wave height – approx. 1 to 3 feet) 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 (wave height – approx. 5 to 8 feet) 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. The work is performed by the U.S. Army Engineer Research and Development Center (ERDC). Note: Sea-state is a measure of wave height and frequency of maximum wave energy.

FY 1999 Accomplishments:

•	261	- Deployed ocean-scale RIBS and successfully collected data required for optimal RIBS design and mooring system; developed initial design for prototype RIBS.
		- Established mooring/anchoring load requirements for RIBS.
•	1927	- Evaluated selected geo-materials for soft soil (beach) stabilization and surfacing.
		- Developed initial Integrated Logistics Barge design for RIBS and Roll-On/Roll- Off Discharge Facility deployment.
Total	2188	

FY 2000 Planned Program:

•	3146	- Complete engineering design for full-scale rapidly installed breakwaters based on detailed engineering analyses, laboratory tests, and ocean scale field tests; provide the capability to rapidly stabilize beach sands with minimum logistics burdens and reduced engineer equipment .
•	499	- Develop concept for RIBS Advanced Technology Demonstration (ATD) to include RIBS deployment and sandy beach field demonstration.
		- Complete field test of mid-scale final version ATD RIBS.
	101	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	3746	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology PROJECT DT08

FY 2001 Planned Program:

•	4064	- Deploy full-scale RIBS and mooring system at operational length (1000 ft) and complete final design of ATD demonstration version of RIBS to include mooring system.
•	1143	- Provide plan, acquire materials for a sandy beach demonstration of technology developed to enhance coastal JLOTS access roads and staging areas.
Total	5207	

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

DATE: February 2000

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology

PROJECT: DT12

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DT12 Rapid Terrain Visualization	14082	12016	0	0	0	0	0	0	50844

Mission Description and Justification: The Rapid Terrain Visualization (RTV) Advanced Concept Technology Demonstration (ACTD) will develop the first airborne capability to rapidly generate (within ~72 hours) high-resolution digital terrain maps. This capability to rapidly generate digital terrain data does not exist today. These map products will include very high-resolution (10 meter, 3 meter, 1 meter) 3-D digital terrain elevation data and digital map features like roads, rivers and vegetation. Digital terrain products are the critical foundation for planning, rehearsing, targeting and executing modern warfare. The RTV ACTD will provide the first and only stand-alone digital terrain data collection and generation system to meet this critical warfighting requirement. This revolutionary all weather day/night system will reduce the timelines for delivery of digital maps from years to days and increase the accuracy and resolution of products by over 100%. This system will be based on a de Havilland DHC-7 aircraft, and will include a Light Detection and Ranging (LIDAR) Laser and an Interferometric Synthetic Aperture Radar (IFSAR). The aircraft will be deployed in FY01 to support a wide variety of XVIII Airborne Corps missions.

This project is managed by the Joint Precision Strike Demonstration (JPSD) Project Office, Fort Belvoir, VA, Program Executive Office, Intelligence, Electronic Warfare and Sensors (PEO-IEW&S), Fort Monmouth, NJ.

Contractors include: Raytheon, Bedford, MA; SAIC, Rosslyn, VA; MRJ, Oakton, VA; TASC, McLean, VA; EO-IR Measurements, Spotsylvania, VA; and MTC, Shrewsbury, NJ. Participating government laboratories include: Topographic Engineering Center (TEC), Alexandria, VA; Army Research Laboratory, Adelphi, MD; Communications and Electronics Research, Development and Engineering Center, Ft. Monmouth, NJ, and Sandia National Laboratories, Albuquerque, NM.

FY 1999 Accomplishments:

- 6562 - Acquired and processed high-resolution digital elevation data set and commercial satellite imagery in direct support of XVIII Airborne Corps Warfighter Exercises (WFXs).
  - Exploited multi-spectral and radar imagery to accelerate the terrain feature extraction process using the prototype RTV database generation system.
- 7520 - Iteratively upgraded workstations and RTV software at XVIII Airborne Corps and III Corps.
  - Demonstrated RTV process in the Joint Integration and Evaluation Center (JIEC) at TEC, including capabilities for rapid elevation data collection and semi-automated extraction of feature data.
  - Extended selected RTV capabilities from XVIII Airborne Corps to selected III Corps elements for further user evaluation.
  - Completed modifications to deHavilland-7 Aircraft, including installation and integration of RTV Interferometric Synthetic Aperture Radar (IFSAR) sensor and onboard processing capability.
  - Conducted evaluation of sensor and products and collect "ground truth" for IFSAR data verification.

Total 14082

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology PROJECT DT12

FY 2000 Planned Program:

•	6058	- Complete integration and testing of high-resolution elevation data collection capability on DASH-7 aircraft. - Demonstrate integrated end-to-end RTV process.
•	3782	- Acquire and process digital terrain data using DASH-7 aircraft collection platform and commercial satellite sources in direct support of XVIII Airborne Corps WFXs. - Extend RTV system upgrades and capabilities to topographic units within III Corps.
•	1853	- Complete upgrade of workstations and software to objective capability in the IEC and XVIII Airborne Corps and evaluate in WFX.
	323	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	12016	

FY 2001 Planned Program: Project not funded in FY 2001.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY **3 - Advanced Technology Development**	PE NUMBER AND TITLE **0603772A Advanced Tactical Computer Science and Sensor Technology**

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	18406	27392	15613	20462	22316	20594	26176	Continuing	Continuing
D101 Tactical Automation	13261	17989	10444	15367	16746	15448	19575	Continuing	Continuing
D243 Sensors and Signal Processing	5145	6460	5169	5095	5570	5146	6601	Continuing	Continuing
D285 Collaborative Telemaintenance	0	2943	0	0	0	0	0	0	2943

A. **Mission Description and Justification:** This program element develops and demonstrates technologies that provide 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; remote projection of maintenance expertise for rapid system repair and reduced logistics footprint; unmanned air vehicle surveillance; and hostile weapons location. Command Post XXI (CP XXI) will provide the enabling technology for the Future Combat Systems (FCS) to have a mobile command post. The US Army Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ primarily manages this PE. 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 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 /2001 PB)	18257	22610	19111
Appropriated Value	18456	27610	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-199		
b. SBIR / STTR	-341		
c. Omnibus or Other Above Threshold Reductions		-87	
d. Below Threshold Reprogramming	+562		
e. Rescissions	-72	-131	
Adjustments to Budget Years Since (FY 2000 /2001 PB)			-1774
New Army Transformation Adjustment		TBD	-1724
Current Budget Submit (FY 2001 PB)	18406	27392	15613

Change Summary Explanation: Funding – FY 2001: Projects were adjusted to reflect the new Army Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology PROJECT D101

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D101 Tactical Automation	13261	17989	10444	15367	16746	15448	19575	Continuing	Continuing

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 address Army-unique command and control (C2) deficiencies in the area of combined arms operations. Specifically, this project develops technology solutions for digital information transfer and display of horizontal battlefield situation awareness data; synchronization of combined and joint forces; and C2 on-the-move. Key technologies used include: expert-system and artificial-intelligent-agent decision support technology; advanced database and distributed database architectures; data compression; advanced man-machine interfacing; robust information filtering; advanced information display technology; dynamic 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 C2 (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. The CP XXI ATD will demonstrate digital C2 hardware and software technologies for a functionally and physically agile, rapidly deployable, split-based headquarters. This will enable commanders to execute distributed operations. CP XXI also will provide enabling technologies for FCS. The Logistics C2 (Log C2) ATD will develop course-of-action analysis and support software tools for combat service support and operational commanders. Joint developer/user warfighting demonstrations will be conducted in conjunction with the Mounted, Dismounted, Battle Command, and Combat Service Support Battle Labs. Products will be transitioned to Program Executive Offices (PEOs) (e.g., Command, Control and Communications Systems (C3S), etc.) for integration within their systems and subsequent fielding.

FY 1999 Accomplishments:

- 5328 – Defined/demonstrated information and data flow requirements, command and control element interfaces, and transitional data requirements to provide faster, more accurate, more intuitive mission tailored information to the commander/staff at brigade, division and corps level.
- 3663 – Conducted modeling and simulation supporting critical event course of action analysis to streamline mission planning and rehearsal timelines and provide more rapid mission order execution.
- 4020 – Conducted systems architecture analyses for multi-echelon command and control functions in a Joint environment.
- 250 – Determined logistics operations planning criteria (LOPC) and combat service support (CSS) data requirements critical for the development of automatic decision support tools needed to reduce planning times for the Force XXI decision cycle.

Total 13261

FY 2000 Planned Program:

- 4877 – Scale, tailor and expand visualization products/tools to the battalion/company level to provide faster, more accurate, more intuitive mission tailored information to the commander/staff at brigade/division level.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology PROJECT D101

FY 2000 Planned Program: (continued)

•	3019	–	Develop a human-in-the-loop simulation capability to provide real-time course of action analysis (COAA) and revision during its execution within a wargame simulation.
•	3715	–	Demonstrate execution monitoring tools which monitor mission plans and alert commanders to significant variation in expectations or execution of the plan, thereby allowing repair/modification of mission plans and resynchronization of forces as required.
•	2112	–	Demonstrate automated decision support software tools to enable combat commanders to plan weapon system crewing.
		–	Demonstrate enhanced logistics COAA capability for reduced planning time and increased number of operational scenarios evaluated.
•	1943	–	Select technologies and develop architecture approach for a command post capable of dispersed, highly mobile and on-the-move operation.
		–	Develop semi-automated course of action (COA), COAA, and data warehousing capabilities
•	1986	–	The objective of this one year congressional special interest effort is to develop enhanced physical and communications security features and improve the ruggedness of the handheld Digital Intelligence Situation Mapboard, which will interchange and display map-based situational awareness information among individual dismounted soldiers and base stations.
•	337	–	Small Business Innovation Research / Small Business Technology Transfer Programs
Total	17989		

FY 2001 Planned Program:

•	4420	–	Demonstrate deliberate COA software with logistics data inputs and automatic alerts for rapid replanning.
		–	Demonstrate decision support software that optimizes weapon system management based on current fuel, ammunition and major end item situational awareness to improve readiness and resource utilization.
•	6024	–	Demonstrate in the laboratory initial semi-automated COA and COAA tools for a command post capable of dispersed, highly mobile and on-the-move operation.
Total	10444		

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology PROJECT D243

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D243 Sensors and Signal Processing	5145	6460	5169	5095	5570	5146	6601	Continuing	Continuing

Mission Description and Justification: The objective of this project is to develop and demonstrate advanced radar and signal processing technologies for reconnaissance, surveillance, target acquisition, counter battery, and navigation applications. Multi-mission, common module, unmanned aerial vehicle (UAV) sensors ATD will demonstrate an interchangeable, lightweight, low cost synthetic aperture/moving target indicator radar (SAR/MTI) and electro-optic/infrared sensor payload (being developed in PE 0603710A) to provide manned and tactical unmanned air vehicles with wide area, all weather surveillance capability. A new generation of ultra-wideband radar, jointly developed by the Army, DARPA, and Air Force, will provide foliage and ground penetrating technology for aerial surveillance and targeting. An electronically scanned radar will be demonstrated to provide army reconnaissance and attack helicopters with a highly reliable, affordable, multirole sensor for targeting, combat identification, and terrain avoidance.

FY 1999 Accomplishments:

- 3614
  - Completed SAR/MTI receiver, transmitter component and antenna array design.
  - Completed SAR and MTI mode algorithm definition .
  - Completed built-in test (BIT) and calibration mode design.
  - Completed design of gimbal/payload housing with mechanical and electrical interfaces defined.
- 1531
  - Completed frequency allocation coordination with National Telecommunications and Information Administration and Federal Aviation Administration for the foliage penetration (FOPEN) system.
  - Completed final design review of all FOPEN hardware and software
  - Airworthiness Release documents reviewed to include Electrical Load Analysis, Substantiation Reports, Certification Plan, Flutter Analysis and Structural Analysis
  - Completed installation of very high frequency antenna feed networks in RC-12D
  - Completed bench testing of ground control and display station components

Total 5145

FY 2000 Planned Program:

- 3876
  - Complete MTI/SAR sensor development, subsystem integration and perform laboratory bench testing to verify functionality.
  - Test sensor payloads under environmental extremes for shock, vibration, temperature, altitude, etc.
  - Develop and test mechanical interface for "plug in/plug out" modularity, electrical interface to include cables, connectors, power, etc, and informational interface to include datalinks, command and control, mission planning, and ground checkout.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology PROJECT D243

FY 2000 Planned Program: (continued)

		– Conduct instrumented flight testing under dynamic flight conditions to characterize MTI/SAR sensor performance in surveillance and targeting roles.
•	2435	– Conduct engineering flight tests to characterize the capabilities of the FOPEN SAR in detecting tactical targets hidden by foliage and/or camouflage cover. – Refine the algorithms to reduce false alarms to enhance the effectiveness of the automatic target detection and cueing in providing valid targets. – Conduct verification test to evaluate the achieved performance against the exit criteria and determine the readiness of a FOPEN SAR for participation in operational demonstration.
•	149	– Small Business Innovation Research / Small Business Technology Transfer Programs
Total	6460	

FY 2001 Planned Program:

•	3177	– Complete airborne testing of multimission UAV MTI/SAR sensor payload and data collection and verify performance through data analysis. – Participate in operational demos for military assessment of multifunctional sensor suite on tactical UAV.
•	1992	– Evaluate ground post processing of FOPEN data with a goal of reducing the clutter false alarms by an order of magnitude such that the image analyst can effectively discriminate tactical targets embedded in heavy foliage. – Conduct user tests to demonstrate the real-time application of a FOPEN SAR to meet the need of an all weather detection of concealed threat targets. – Demonstrate/validate the concept of operation for using the FOPEN SAR to support the mission of potential users such as European Command, Southern Command, and Drug Enforcement Administration.
Total	5169	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology PROJECT D285

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D285 Collaborative Telemaintenance	0	2943	0	0	0	0	0	0	2943

Mission Description and Justification This one year Congressional special interest project expands and validates CECOM's telemaintenance pilot. This capability is needed to project maintenance expertise remotely anywhere, anytime, to rapidly solve fielded system diagnostic and repair problems. The goal is to reduce the cost and logistics footprint associated with current manually-based maintenance methods.

FY 1999 Accomplishments: Project not funded in FY 1999.

FY 2000 Planned Program:

•	2864	–	Design, develop, integrate, and validate the architecture for a collaborative Telemaintenance capability.
•	79	–	Small Business Innovation Research / Small Business Technology Transfer Programs
Total	2943		

FY 2001 Planned Program: Project not currently funded in FY 2001.

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