UNCLASSIFIED

Supporting Data FY 1997 Budget Estimate
Submitted to Congress - March 1996

DESCRIPTIVE SUMMARIES OF THE

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

RESEARCH, DEVELOPMENT, TEST AND EVALUATION
Army Appropriation, Budget Activities 1, 2 and 3

DEPARTMENT OF THE ARMY
OFFICE OF THE SECRETARY OF THE ARMY (FINANCIAL MANAGEMENT and COMPTROLLER)

"READINESS THROUGH MODERNIZATION"

VOLUME I

19960514 027

UNCLASSIFIED

DTIC QUALITY INSPECTED 1

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY FY 1997

VOLUME I
Budget Activities 1, 2 and 3

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

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1997 RDT&E, ARMY
PROGRAM ELEMENT DESCRIPTIVE SUMMARIES

INTRODUCTION AND EXPLANATION OF CONTENTS

1. General. This section has been prepared for the purpose of providing information concerning the Army Research, Development, Test and Evaluation program. The Descriptive Summaries are comprised of R-2 (Budget Item Justification Sheet) and R-3 (RDT&E Program Element/Project Cost Breakdown) Exhibits which provide narrative information on all RDT&E program elements and projects for the FY 1995, 1996, 1997 time period.

2. Relationship of the FY 1997 Budget Submission to the FY 1996 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/BH50, BH53, BH55	Communications Research	0601102A/AH48
0602618A/AH80, 0603004A/DL94	Electric Gun Technology	0602618A/AH75
0602786A/AH20	Countermine Technology	0602712A/AH24
0603001A/DXXA, 0603710A/DK70, 0603772A/D101, 0604713A/D667	Force XXI Soldier	0603001A/DJ50
0603019A/DB94	Tractor Dump	0203735A/DC64
0603734A/DT08, 0602784A/A855 & AT42, and 0602782A/A779	Rapid Battlefield Visualization	0603734A/AT12
0603645A/D409 & DB88	Artillery Systems Dem/Val	0603854A/D505

A. Program Element Restructures (Continued)

OLD PE/PROJECT	NEW PROJECT TITLE	NEW PE/PROJECT
0603771A/DE20	Industrial Preparedness Man Tech	0708045A/DE25
0604645A/D2KT	AFAS Operational Test	0604854A/D2KT
0604645A/D417 & D418	CRUSADER - ED*	0604854A/D503
0604715A/DC91	Interactive Simulaton	0604760A/DC77
0604759A/DC55	Synthetic Theater of War	0604760A/DC73
0203740A/DC49	Gobal Command and Control System	0303150A/DC86
0303142A/D386	SCAMP Block II	0603856A/D389
0604759A/DC55	Developmental Simulation Technology	0604760A/DC74
0604817A/D482	All Services Cbt Ident Eval Team (ASCIET)	0604817A/D901
0605801A/MM43	Soldier Systems Command	0605801A/MM58
0605898A/MM03	Command Headquarters - MRDC	0605801A/M881
0303142A/D384	SMART-T Operational Test	0303142A/D2PT

Applicable portions of PE 0605896A, Base Operations - RDT&E, "J" Operation of Utilities and "M" Other Engineering, were restructured to a new PE 0605879A, Real Property Services (RPS).

* CRUSADER was previously known as Advanced Field Artillery System(AFAS) and Future Armored Resupply Vehicle (FARV).

B. FY 1997 Developmental Transitions.

FROM PE/PROJECT	PROJECT TITLE	TO PE/PROJECT
0602303A/A213	Counter Active Protection	0603313A/D550
0603774A/D131	Long Range Advanced Scout Surv Sys (LRAS3)	0604710A/DL74

C. Establishment of New FY 1997 Program Elements/Projects. There are no major system new starts. Minor new initiatives for FY 1997 are shown below with asterisks. The remaining programs listed are outyear initiatives beyond FY 1997 or were previously funded from other Defense appropriations. The Tractor programs are initiatives moved from other programs.

TITLE	PE/PROJECT
Tractor Zinc	0602786A/AC60
Tractor Quake	0602786A/AC61
Tractor Union	0603005A/DC62
2.75" Anti-Air Techology Demonstration*	0603313A/D549
Tractor Quake	0603710A/DC63
Intelligent Support to Force XXI*	0305123A/DH12
Tactical Unmanned Ground Vehicle (TUG-V)	0604641A/DE47
Integrated Broadcast System*	0604739A/D702
Non-Lethal Programs*	0604802A/D712
Firefinder Preplanned Product Improvement (P3I)*	0604823A/DL85
ATCAS	0605854A/D509
Pyrotechnic Reliability and Safety*	0605805A/D296
Joint Aerostat Program Office	0102419A/DE55
Joint Tactical Ground Station (JTAGS)*	0208053A/M635
Bradley A3 IOTE*	0203735A/D2TT
Abrams IOTE*	0203735A/D2UT

D. FY 1997 programs for which funding was shown in the FY 1996 President's Budget Submit (February 1995), but which are no longer funded.

PE/PROJECT	TITLE	BRIEF EXPLANATION
0203735A/D392	AGS Improvements	Program terminated.
0603001A/DC44	Tactical Logistics	Funds transferred to Soldier Survivabiltiy.
0603005A/A340	Producibility Technology	Lower priority effort became unfunded.
0604645A/D413	Armored Gun System (AGS)	Program terminated.
0605803A/M731	GIDEP/AGED	Project completed in FY 1996.
0605805A/D293	Field Artillery Ammunition (NATO)	Funds transferred to higher priority programs.

Descriptive summaries for PE 0603806A - NBC Defense Systems, AD and PE 0604806A - NBC Defense Systems, ED are not provided in this Army submission. Since these programs were transferred to Defense RDT&E in FY 1996, program details are available in the Defense RDT&E submission under PE 0603884BP and PE 0604384BP.

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

0203735A/DC64	0603005A/DC82	0603238A/D182/D189
0203744A/DB75	0603009A	0603322A
0203806A	0603012A	0603639A
0203808A	0603013A	0603647A
0301359A	0603017A	0603710A/DC63
0602104A	0603018A	0603851A
0602122A	0603019A	0604649A/DG15
0602788A	0603020A	
0603122A		

TABLE OF CONTENTS

BUDGET ACTIVITY
PROGRAM ELEMENT

	PE	PROGRAM ELEMENT TITLE	PAGE
#1 - BASIC RESEARCH			
1	0601101A	In-House Laboratory Independent Research	1
2	0601102A	Defense Research Sciences	12
3	0601104A	University and Industry Research Centers	86
#2 - EXPLORATORY DEVELOPMENT			
4	0602105A	Materials Technology	106
5	0602120A	Sensors and Electronic Survivability	111
6	0602211A	Aviation Technology	121
7	0602270A	Electronic Warfare (EW) Technology	129
8	0602303A	Missile Technology	136
9	0602308A	Modeling and Simulation Technology	140
10	0602601A	Combat Vehicle and Automotive Technology	146
11	0602618A	Ballistics Technology	160
12	0602622A	Chemical, Smoke and Equipment Defeating Technology	168
13	0602623A	Joint Service Small Arms Program	173
14	0602624A	Weapons and Munitions Technology	175
15	0602705A	Electronics and Electronic Devices	186
16	0602709A	Night Vision Technology	192
17	0602712A	Countermine Systems Exploratory Development	195
18	0602716A	Human Factors Engineering Technology	198
19	0602720A	Environmental Quality Technology	204

TABLE OF CONTENTS

BUDGET ACTIVITY
PROGRAM ELEMENT

	PE	PROGRAM ELEMENT TITLE	PAGE
#2 - EXPLORATORY DEVELOPMENT - Continued			
20	0602782A	Command, Control, Communications Technology	223
21	0602783A	Computer and Software Technology	229
22	0602784A	Military Engineering Technology	234
23	0602785A	Manpower/Personnel/Training Technology	248
24	0602786A	Logistics Technology	253
25	0602787A	Medical Technology	268
26	0602789A	Army Artificial Intelligence Technology	288
#3 - ADVANCED DEVELOPMENT			
27	0603001A	Logistics Advanced Technology	290
28	0603002A	Medical Advanced Technology	310
29	0603003A	Aviation Advanced Technology	332
30	0603004A	Weapons and Munitions Advanced Technology	348
31	0603005A	Combat Vehicle and Automotive Advanced Technology	357
32	0603006A	Command, Control and Communication Advanced Technology	369
33	0603007A	Manpower, Personnel and Training Advanced Technology	381
34	0603105A	Military Human Immunodeficiency Virus (HIV) Research	386
35	0603238A	Air Defense/Precision Strike Technology	388
36	0603270A	Electronic Warfare (EW) Technology	394
37	0603313A	Missile and Rocket Advanced Technology	399
38	0603606A	Landmine Warfare and Barrier Advanced Technology	420

TABLE OF CONTENTS

BUDGET ACTIVITY
PROGRAM ELEMENT

	PE	PROGRAM ELEMENT TITLE	PAGE
#3 - ADVANCED DEVELOPMENT - Continued			
39	0603607A	Joint Service Small Arms Program	425
40	0603654A	Line-of-Sight Technology Demonstration	428
41	0603710A	Night Vision Advanced Technology	430
42	0603734A	Military Engineering Advanced Technology	437
43	0603759A	Chemical/Biological Defense and Smoke Advanced Technology Development	444
44	0603771A	Army Industrial Preparedness Manufacturing Technology	445
45	0603772A	Advanced Tactical Computer Science and Sensor Technology	449
#4 - DEMONSTRATION AND VALIDATION			
46	0603308A	Army Missile Defense Systems Integration	457
47	0603619A	Landmine Warfare and Barrier - Advanced Development	460
48	0603627A	Smoke, Obscurant and Target Defeating System - Advanced Development	465
49	0603640A	Artillery Propellant Development	469
50	0603645A	Armored Systems Modernization - Advanced Development	474
51	0603649A	Engineering Modification Equipment - Advanced Development	492
52	0603653A	Advanced Tank Armament System	497
53	0603713A	Army Data Distribution System	502
54	0603730A	Tactical Surveillance System - Advanced Development (TIARA)	511
55	0603745A	Tactical Electronic Support Systems - Advanced Development (TIARA)	515
56	0603747A	Soldier Support and Survivability	519
57	0603760A	Distributive Interactive Simulations - Advanced Development	537

TABLE OF CONTENTS

BUDGET ACTIVITY
PROGRAM ELEMENT

	PE	PROGRAM ELEMENT TITLE	PAGE
#4 - DEMONSTRATION AND VALIDATION - Continued			
58	0603766A	Tactical Exploitation of National Capabilities (TENCAP) - Demonstration/Validation (TIARA)	540
59	0603774A	Night Vision Systems - Advanced Development	545
60	0603790A	NATO Research and Development	549
61	0603801A	Aviation - Advanced Development	555
62	0603802A	Weapons and Munitions - Advanced Development	569
63	0603804A	Logistics and Engineering Equipment - Advanced Development	576
64	0603805A	Combat Service Support Control System Evaluation and Analysis	611
65	0603807A	Medical Systems - Advanced Development	623
66	0603854A	Artillery Systems Demonstration and Validation	640
67	0603856A	SCAMP BLK II (Space)	645
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT			
68	0604201A	Aircraft Avionics	648
69	0604220A	Armed, Deployable OH-58D	654
70	0604223A	Comanche	657
71	0604270A	Electronic Warfare (EW) Development	667
72	0604315A	Tri-Service Standoff Attack Missile (TSSAM)	690
73	0604321A	All Source Analysis System (TIARA)	692
74	0604325A	Follow-On To TOW	701
75	0604604A	Medium Tactical Vehicles	704
76	0604609A	Smoke, Obscurant and Target Defeating System - Engineering Development	709

TABLE OF CONTENTS

BUDGET ACTIVITY
PROGRAM ELEMENT

	PE	PROGRAM ELEMENT TITLE	PAGE
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT - Continued			
77	0604611A	Javelin	713
78	0604619A	Landmine Warfare	717
79	0604622A	Family of Heavy Tactical Vehicles	721
80	0604633A	Air Traffic Control	728
81	0604640A	Advanced Command and Control Vehicle	733
82	0604641A	Tactical Unmanned Ground Vehicle	738
83	0604642A	Light Tactical Wheeled Vehicle	741
84	0604645A	Armored Systems Modernization (ASM) - Engineering Development	746
85	0604649A	Engineer Mobility Equipment Development	758
86	0604710A	Night Vision Systems - Engineering Development	768
87	0604713A	Combat Feeding, Clothing, and Equipment	783
88	0604715A	Non-System Training Devices - Engineering Development	806
89	0604716A	Terrain Information - Engineering Development (TIARA)	824
90	0604739A	Integrated Broadcast Service - Modules	829
91	0604740A	Tactical Surveillance System - Engineering Development	832
92	0604741A	Air Defense Command, Control, Intelligence - Engineering Development	840
93	0604746A	Automatic Test Equipment Development	852
94	0604760A	Distributive Interactive Simulations - Engineering Development	864
95	0604766A	Tactical Exploitation of National Capabilities (TENCAP) - Engineering & Manufacturing Development (TIARA)	877
96	0604768A	Brilliant Anti-Armor (BAT) Submunition	886
97	0604770A	Joint Surveillance/Target Attack Radar System	900
98	0604778A	Positioning Systems Development (Space)	910

TABLE OF CONTENTS

BUDGET ACTIVITY
PROGRAM ELEMENT

	PE	PROGRAM ELEMENT TITLE	PAGE
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT - Continued			
99	0604780A	Combined Arms Tactical Trainer (CATT)	917
100	0604801A	Aviation - Engineering Development	922
101	0604802A	Weapons and Munitions - Engineering Development	927
102	0604804A	Logistics & Engineer Equipment - Engineering Development	951
103	0604805A	Command, Control, Communications Systems - Engineering Development	992
104	0604807A	Medical Materiel/Medical Biological Defense Equipment - Engineering Development	1010
105	0604808A	Landmine Warfare/Barrier - Engineering Development	1026
106	0604814A	Sense and Destroy Armor Munition - Engineering Development	1035
107	0604816A	Longbow	1044
108	0604817A	Combat Identification - Engineering & Manufacturing Development	1062
109	0604818A	Army Tactical Command and Control Hardware & Software	1071
110	0604820A	Radar Development	1079
111	0604823A	Firefinder	1086
#6 - MANAGEMENT SUPPORT			
112	0604256A	Threat Simulator Development	1089
113	0604258A	Target Systems Development	1092
114	0604759A	Major Test and Evaluation Investment	1097
115	0605103A	Rand Arroyo Center	1107
116	0605301A	Army Kwajalein Atoll	1111
117	0605601A	Army Test Ranges and Facilities	1117

TABLE OF CONTENTS

BUDGET ACTIVITY / PROGRAM ELEMENT	PE	PROGRAM ELEMENT TITLE	PAGE
#6 - MANAGEMENT SUPPORT - Continued			
118	0605602A	Army Test Technology and Sustaining Instrumentation	1135
119	0605604A	Survivability/Lethality Analysis	1144
120	0605605A	DOD High Energy Laser System Test Facility (HELSTF)	1171
121	0605606A	Aircraft Certification	1173
122	0605702A	Meteorological Support to Research, Development, Testing & Evaluation Activities	1175
123	0605706A	Materiel Systems Analysis	1181
124	0605709A	Exploitation of Foreign Items	1186
125	0605712A	Support of Operational Testing	1191
126	0605801A	Programwide Activities	1205
127	0605802A	International Cooperative Research and Development	1212
128	0605803A	Technical Information Activities	1214
129	0605805A	Munitions Standardization Effectiveness and Safety	1231
130	0605853A	Environmental Conservation	1242
131	0605854A	Pollution Prevention	1248
132	0605856A	Environmental Compliance - Research, Development, Testing & Evaluation	1255
133	0605876A	Minor Construction - Research, Development, Testing & Evaluation	1263
134	0605878A	Maintenance and Repair - Research, Development, Testing & Evaluation	1270
135	0605879A	Operation of Utilities & Other Engineering	1277
136	0605896A	Base Operations - Research, Development, Testing & Evaluation	1281
137	0605898A	Management Headquarters (Research and Development)	1288

TABLE OF CONTENTS

BUDGET ACTIVITY
PROGRAM ELEMENT

	PE	PROGRAM ELEMENT TITLE	PAGE
#7 - OPERATIONAL SYSTEM DEVELOPMENT			
138	0102419A	Aerostat Joint Program Office	1293
139	0203726A	Advanced Field Artillery Tactical Data System	1296
140	0203735A	Combat Vehicle Improvement Programs	1305
141	0203740A	Maneuver Control System	1333
142	0203744A	Aircraft Modifications/Product Improvement Program	1347
143	0203752A	Aircraft Engine Component Improvement Program	1359
144	0203758A	Digitization	1364
145	0203801A	Missile/Air Defense Product Improvement Program	1368
146	0203802A	Other Missile Product Improvement Programs	1382
147	0208010A	Joint Tactical Communications Program (TRI-TAC)	1403
148	0208053A	Joint Tactical Ground System (TIARA)	1407
149	0303140A	Communications Security (COMSEC) Equipment	1410
150	0303142A	Satellite Communications (SATCOM) Ground Environment (SPACE)	1420
151	0303150A	Army Global Command and Control System (AGCCS)	1449
152	0305128A	Security and Intelligence Activities	1453
153	0603778A	Multiple Launch Rocket System Product Improvement Program	1456
154	0708045A	Army Industrial Preparedness Manufacturing Technology	1471

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Advanced Command and Control Vehicle	0604640A	733
Advanced Field Artillery Tactical Data System	0203726A	1296
Advanced Tactical Computer Science and Sensor Technology	0603772A	449
Advanced Tank Armament System	0603653A	497
Aerostat Joint Program Office	0102419A	1293
Air Defense Command, Control, Intelligence - Engineering Development	0604741A	840
Air Defense/Precision Strike Technology	0603238A	388
Air Traffic Control	0604633A	728
Aircraft Avionics	0604201A	648
Aircraft Certification	0605606A	1173
Aircraft Engine Component Improvement Program	0203752A	1359
Aircraft Modifications/Product Improvement Program	0203744A	1347
All Source Analysis System (TIARA)	0604321A	692
Armed, Deployable OH-58D	0604220A	654
Armored Systems Modernization (ASM) - Engineering Development	0604645A	746
Armored Systems Modernization - Advanced Development	0603645A	474
Army Artificial Intelligence Technology	0602789A	288
Army Data Distribution System	0603713A	502
Army Global Command and Control System (AGCCS)	0303150A	1449
Army Industrial Preparedness Manufacturing Technology	0708045A	1471
Army Industrial Preparedness Manufacturing Technology	0603771A	445
Army Kwajalein Atoll	0605301A	1111
Army Missile Defense Systems Integration	0603308A	457
Army Tactical Command and Control Hardware & Software	0604818A	1071
Army Test Ranges and Facilities	0605601A	1117

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Army Test Technology and Sustaining Instrumentation	0605602A	1135
Artillery Propellant Development	0603640A	469
Artillery Systems Demonstration and Validation	0603854A	640
Automatic Test Equipment Development	0604746A	852
Aviation - Advanced Development	0603801A	555
Aviation - Engineering Development	0604801A	922
Aviation Advanced Technology	0603003A	332
Aviation Technology	0602211A	121
Ballistics Technology	0602618A	160
Base Operations - Research, Development, Testing & Evaluation	0605896A	1281
Brilliant Anti-Armor (BAT) Submunition	0604768A	886
Chemical, Smoke and Equipment Defeating Technology	0602622A	168
Chemical/Biological Defense and Smoke Advanced Technology Development	0603759A	444
Comanche	0604223A	657
Combat Feeding, Clothing, and Equipment	0604713A	783
Combat Identification - Engineering & Manufacturing Development	0604817A	1062
Combat Service Support Control System Evaluation and Analysis	0603805A	611
Combat Vehicle and Automotive Advanced Technology	0603005A	357
Combat Vehicle and Automotive Technology	0602601A	146
Combat Vehicle Improvement Programs	0203735A	1305
Combined Arms Tactical Trainer (CATT)	0604780A	917
Command, Control and Communication Advanced Technology	0603006A	369
Command, Control, Communications Systems - Engineering Development	0604805A	992
Command, Control, Communications Technology	0602782A	223
Communications Security (COMSEC) Equipment	0303140A	1410

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Computer and Software Technology	0602783A	229
Countermine Systems Exploratory Development	0602712A	195
Defense Research Sciences	0601102A	12
Digitization	0203758A	1364
Distributive Interactive Simulations - Advanced Development	0603760A	537
Distributive Interactive Simulations - Engineering Development	0604760A	864
DOD High Energy Laser System Test Facility (HELSTF)	0605605A	1171
Electronic Warfare (EW) Technology	0603270A	394
Electronic Warfare (EW) Technology	0602270A	129
Electronic Warfare (EW) Development	0604270A	667
Electronics and Electronic Devices	0602705A	186
Engineer Mobility Equipment Development	0604649A	758
Engineering Modification Equipment - Advanced Development	0603649A	492
Environmental Compliance - Research, Development, Testing & Evaluation	0605856A	1255
Environmental Conservation	0605853A	1242
Environmental Quality Technology	0602720A	204
Exploitation of Foreign Items	0605709A	1186
Family of Heavy Tactical Vehicles	0604622A	721
Firefinder	0604823A	1086
Follow-On To TOW	0604325A	701
Human Factors Engineering Technology	0602716A	198
In-House Laboratory Independent Research	0601101A	1
Integrated Broadcast Service - Modules	0604739A	829
International Cooperative Research and Development	0605802A	1212
Javelin	0604611A	713

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Joint Service Small Arms Program	0603607A	425
Joint Service Small Arms Program	0602623A	173
Joint Surveillance/Target Attack Radar System	0604770A	900
Joint Tactical Communications Program (TRI-TAC)	0208010A	1403
Joint Tactical Ground System (TIARA)	0208053A	1407
Landmine Warfare	0604619A	717
Landmine Warfare and Barrier - Advanced Development	0603619A	460
Landmine Warfare and Barrier Advanced Technology	0603606A	420
Landmine Warfare/Barrier - Engineering Development	0604808A	1026
Light Tactical Wheeled Vehicle	0604642A	741
Line-of-Sight Technology Demonstration	0603654A	428
Logistics & Engineer Equipment - Engineering Development	0604804A	951
Logistics Advanced Technology	0603001A	290
Logistics and Engineering Equipment - Advanced Development	0603804A	576
Logistics Technology	0602786A	253
Longbow	0604816A	1044
Maintenance and Repair - Research, Development, Testing & Evaluation	0605878A	1270
Major Test and Evaluation Investment	0604759A	1097
Management Headquarters (Research and Development)	0605898A	1288
Maneuver Control System	0203740A	1333
Manpower, Personnel and Training Advanced Technology	0603007A	381
Manpower/Personnel/Training Technology	0602785A	248
Materials Technology	0602105A	106
Materiel Systems Analysis	0605706A	1181
Medical Advanced Technology	0603002A	310

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Medical Materiel/Medical Biological Defense Equipment - Engineering Development	0604807A	1010
Medical Systems - Advanced Development	0603807A	623
Medical Technology	0602787A	268
Medium Tactical Vehicles	0604604A	704
Meteorological Support to Research, Development, Testing & Evaluation Activities	0605702A	1175
Military Engineering Advanced Technology	0603734A	437
Military Engineering Technology	0602784A	234
Military Human Immunodeficiency Virus (HIV) Research	0603105A	386
Minor Construction - Research, Development, Testing & Evaluation	0605876A	1263
Missile and Rocket Advanced Technology	0603313A	399
Missile Technology	0602303A	136
Missile/Air Defense Product Improvement Program	0203801A	1368
Modeling and Simulation Technology	0602308A	140
Multiple Launch Rocket System Product Improvement Program	0603778A	1456
Munitions Standardization Effectiveness and Safety	0605805A	1231
NATO Research and Development	0603790A	549
Night Vision Advanced Technology	0603710A	430
Night Vision Systems - Advanced Development	0603774A	545
Night Vision Systems - Engineering Development	0604710A	768
Night Vision Technology	0602709A	192
Non-System Training Devices - Engineering Development	0604715A	806
Operation of Utilities & Other Engineering	0605879A	1277
Other Missile Product Improvement Programs	0203802A	1382
Pollution Prevention	0605854A	1248
Positioning Systems Development (Space)	0604778A	910

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Programwide Activities	0605801A	1205
Radar Development	0604820A	1079
Rand Arroyo Center	0605103A	1107
Satellite Communications (SATCOM) Ground Environment (SPACE)	0303142A	1420
SCAMP BLK II (Space)	0603856A	645
Security and Intelligence Activities	0305128A	1453
Sense and Destroy Armor Munition - Engineering Development	0604814A	1035
Sensors and Electronic Survivability	0602120A	111
Smoke, Obscurant and Target Defeating System - Advanced Development	0603627A	465
Smoke, Obscurant and Target Defeating System - Engineering Development	0604609A	709
Soldier Support and Survivability	0603747A	519
Support of Operational Testing	0605712A	1191
Survivability/Lethality Analysis	0605604A	1144
Tactical Electronic Support Systems - Advanced Development (TIARA)	0603745A	515
Tactical Exploitation of National Capabilities (TENCAP) - Demonstration/Validation (TIARA)	0603766A	540
Tactical Exploitation of National Capabilities (TENCAP) - Engineering & Manufacturing Development (TIARA)	0604766A	877
Tactical Surveillance System - Advanced Development (TIARA)	0603730A	511
Tactical Surveillance System - Engineering Development	0604740A	832
Tactical Unmanned Ground Vehicle	0604641A	738
Target Systems Development	0604258A	1092
Technical Information Activities	0605803A	1214
Terrain Information - Engineering Development (TIARA)	0604716A	824
Threat Simulator Development	0604256A	1089
Tri-Service Standoff Attack Missile (TSSAM)	0604315A	690
University and Industry Research Centers	0601104A	86

ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Weapons and Munitions - Advanced Development	0603802A	569
Weapons and Munitions - Engineering Development	0604802A	927
Weapons and Munitions Advanced Technology	0603004A	348
Weapons and Munitions Technology	0602624A	175

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

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

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	12826	13950	14701	16055	17103	17626	18690		Continuing	Continuing
A91A In-House Laboratory Independent Research - Army Materiel Command	7180	9255	9893	10803	11727	12112	13062		Continuing	Continuing
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	4840	3817	3910	4269	4369	4480	4573		Continuing	Continuing
A91D In-House Laboratory Independent Research - Corps of Engineers	695	753	768	840	860	883	901		Continuing	Continuing
A91E In-House Laboratory Independent Research - Army Research Institute of Behavioral and Social Sciences	111	125	130	143	147	151	154		Continuing	Continuing

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. For example, ILIR research at the Missile Command Research, Development, and Engineering Center (MRDEC) led to the development of a hydrogen/hydrocarbon gas generator for air-breathing propulsion systems. This effort will be integrated into the MRDEC 6.2 core Propulsion program. Armament Research, Development and Engineering Center (ARDEC) ILIR research investigated dynamic effects on gun tubes and determined methods for controlled tank cannon gun tube vibrations. This effort transitioned to a 6.2 Smart Barrel Actuator program for tank main guns. ILIR research on a low heat rejection engine at the Tank-Automotive Research, Development and Engineering Center (TARDEC) played a major role in engine improvements that were implemented in both M109 Howitzer and Paladin upgrades, approximately 700 total Army vehicles. Other potential spin-offs from this TARDEC ILIR program to tactical trucks and tracked combat vehicles are being considered. Since its establishment by DoD Directive number 3201.4, dated October 8, 1993, the Army's ILIR program has supported

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research

and will continue to promote the 1987 Defense Science Board Summer Study on Technology Base Management's recommendation to attract and retain top flight science and engineering PhDs. The projects in this PE explore fundamental concepts in science and technology and therefore are correctly placed in Budget Activity 1.

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: A91A

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A91A In-House Laboratory Independent Research - Army Materiel Command	7180	9255	9893	10803	11727	12112	13062		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project A91A - In-House Laboratory Independent Research (ILIR) - Army Materiel Command:** This project provides the initial ILIR allocation for Research, Development and Engineering Centers (RDECs) in the Army Materiel Command (AMC).

FY 1995 Accomplishments:

- 7180 -Missile RDEC - Demonstrated photonic band gap control of spontaneous emissions; developed revolutionary beam propagation code; demonstrated demarcation of noise from chaos; developed general theory for digital servo-tracking controllers; demonstrated utilization of temporal IR exhaust plume signatures for missile detection.
  -Armaments RDEC - Performed experiments in acoustics, target recognition, robotics, quantum-well materials for high speed optical switching, software architecture, and warhead phenomena; developed catalysts for environmentally acceptable synthesis of energetic materials.
  -Tank-Automotive RDEC - Analyzed the Laplacian Pyramid Model of target cue and detection to better predict human performance; developed and evaluated intelligent suspension control systems to optimize the cross country performance of HMMWVs; derived fundamental insights into the physical mechanisms and phenomena of advanced diesel engines .
  -Natick RDEC - Continued to apply fractal analyses to molecular absorption on rough surfaces; developed a predictive model of responses to product dissatisfaction in closed environments; investigated dynamics of molecular migration in food and its effects on temperature, viscosity and texture; conducted spectroscopic analysis to determine molecular structure/polarizability relationship for application to high performing non-linear optical materials.
  -Edgewood RDEC - Developed artificial viruses via molecular simulation and modeling based upon defective interfering virus reaction; developed magnetic bead fluorescence assays for three bacilli; expanded computational prototype test bed to simulate state-of-the-art passive Fourier Transform infrared spectrometer.
  -Aviation RDEC - Investigated the effects of leading and trailing edge rotor blade design and expanded knowledge of rotor behavior in forward flight; developed a neural network based helicopter simulator system; developed and evaluated a slotted airfoil rotor blade.
  -Communications-Electronics RDEC - Investigated concepts in human and machine vision; implemented novel data fusion applications to map automation process; explored ceramic antenna arrays, conformal and microstrip antennas..

Total 7180

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91A

FY 1996 Planned Program:

- 9081 -Missile RDEC - Improve fast learning neural networks for system control; continue development of photonic band edge technology; develop methodology for characterization of gel propellants; develop algorithms for prediction of helicopter signatures and missile detection.
  -Armaments RDEC - Evaluate unique phenomena in energetic materials, barrel coatings to reduce barrel wear, dynamic modeling for weapons design and materials for passive shielding from low frequency magnetic fields; continue research in weaponry-unique robotics, voice control and software architecture; support research in superconductivity and hypervelocity physics.
  -Tank-Automotive RDEC - Develop nonlinear models of compliant structures, heat transfer mechanisms for cold start engine phenomena, and non-invasive thermal imaging of engine combustion phenomena.
  -Natick RDEC - Apply fractal analyses to biodegradable materials; examine selected metallic macrocycles for non-linear optical and excited state properties..
  -Edgewood RDEC - Link virus simulants with detector molecules (fluorochromes, etc.) and begin screen for reactivity; define most promising theory for correlation of adsorption equilibria with adsorbent properties; use molecular modeling to determine the optimum substrate configuration of dipeptides for improving the performance of nerve agent degrading enzymes; prepare bidentate sulfur containing ligands for ruthenium as candidate dopants for a surface to be used for a light-induced catalytic agent destruction.
  -Aviation RDEC - Test and measure aircraft in-flight characteristics; transition neural network based helicopter simulator software to support the Free Flight Rotorcraft Research Project and the Autonomous Scout Rotorcraft Testbed technology demonstration program.
  -Communications-Electronics RDEC - Transition antenna programs to core tech base; develop models to enhance imaging sensors capabilities; develop more efficient algorithms for Intelligence and Electronic Warfare data fusion; upgrade sensor simulation/performance models.
- 28 Revised economic assumption not available for execution.
- 146 SBIR/STTR

Total 9255

FY 1997 Planned Program:

- 9893 -Missile RDEC - Conduct research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities.
  -Armaments RDEC - Evaluate unique phenomena in weapons and munitions related research, focusing on gun/cannon barrel erosion prevention and energetic materials for various weaponry applications.
  -Tank-Automotive RDEC - Develop an improved understanding of advanced diesel engine technology through nonlinear models of compliant structures, heat transfer mechanisms for cold start engine phenomena, and non-invasive thermal imaging of engine combustion phenomena.
  -Natick RDEC - Identify innovative technologies in the areas of molecular biology, biopolymers and modeling of personnel equipment characteristics.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91A

FY 1997 Planned Program: (continued)

-Edgewood RDEC -Investigate innovative approaches to pathogen detection including development of DNA super libraries and genome sequencing of pathogens; begin development of respirator encumbrance model for the individual soldier.

-Aviation RDEC - Perform fundamental research in aeroflight dynamics, flight controls and avionics for leap-ahead rotorcraft technologies.

-Communications-Electronics RDEC - Develop antenna and sensor technologies and computer models; improve intelligence data fusion techniques; upgrade sensor simulation/performance models.

Total 9893

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	8485	9513	10078
Appropriated Amount(FY 1995)	8307		
Adjustments to FY 95	-1127		
Appropriated Amount(FY 1996)		9347	
Adjustments to FY 96		-92	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-185
Current President's Budget Submit	7180	9255	9893

Change Summary Explanation:

Funding: FY 95: Rescission within the FY 95 Supplemental Appropriation and Rescission to preserve and enhance the military readiness of the Department of Defense (261); Below threshold reprogramming to Project A91C within this PE (-866).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601101A In-House Laboratory Independent Research / PROJECT: A91C

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	4840	3817	3910	4269	4369	4480	4573		Continuing	Continuing

A. Mission Description and Budget Item Justification: Medical Research and Materiel Command: Represents allocation of funds for the six laboratories within the Medical Research and Materiel Command to conduct ILIR research.

FY 1995 Accomplishments:

- 4840 -Discovered new technology for malaria vaccine constructs (DNA vaccine); investigated mechanisms of antigen adjuvant complex processing by macrophages.
  -Discovered that NMDA antagonists can halt refractory nerve agent seizures.
  -Established an acute whole body exposure chamber for respiratory agent research.
  -Demonstrated that NMR is superb at determining nerve agent analogue sample structure.
  -Developed a more sensitive and radioisotope-free heat shock protein immunoassay useful in protection of laser eye injury.
  -Developed animal model for new plague vaccines; developed recombinant techniques to express ricin and botulinum toxin subunits and plague antigens in expression systems for use as immunogens and for use in structural biology studies.
  -Designed new diagnostic methods for identifying viral and parasitic agents in arthropod and clinical specimens; developed recombinant expression vectors for vaccines against tick-borne encephalitis, sandfly fever, hantavirus and dengue.

Total 4840

FY 1996 Planned Program:

- 3720 -Continue research in medical countermeasures against naturally occurring infectious diseases which can have significant impacts on military operations to protect the force from infection and sustain operations.
  -Continue research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness.
  -Continue research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.
- 12 -Revised economic assumption not available for execution.
- 85 -SBIR/STTR

Total 3817

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91C

FY 1997 Planned Program:

- 3910 -Continue research for medical countermeasures against naturally occurring infectious diseases which can have significant impacts on military operations to protect the force from infection and sustain operations.
  -Continue research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness.
  -Continue research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.

Total 3910

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	4102	3924	4026
Appropriated Amount(FY 1995)	4016		
Adjustments to FY 95	824		
Appropriated Amount(FY 1996)		3856	
Adjustments to FY 96		-39	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-116
Current President's Budget Submit	4840	3817	3910

Change Summary Explanation:

Funding: FY 95: Rescission within the FY 95 Supplemental Appropriation and Rescission to preserve and enhance the military readiness of the Department of Defense (-197); Below threshold reprogramming from Projects A91A, A91D, and A91E within this PE (+1021)

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: A91D

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A91D In-House Laboratory Independent Research - Corps of Engineers	695	753	768	840	860	883	901		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A91D - In-House Laboratory Independent Research (ILIR) - Corps of Engineers:** Represents allocation of funds for the four laboratories within the Army Corps of Engineers to conduct ILIR research.

FY 1995 Accomplishments:

- 695 -Developed a method using robust statistics to optimize terrain elevation data for use in distributed interaction simulation at the Topographic Engineering Center.
  -Developed a bioreactor for treatment of volatile organic compounds; analyzed dynamic responses of brittle geomaterials to high velocity projectile impact at the Waterways Experimental Station.
  -Simulated micro-mechanical position sensors for Smart Material applications at the Construction Engineering Research Laboratories.
  -Developed means to measure complex thermal and electrical conductivities of snow cover; defined macro level fracture mechanics of ice floes; and developed new approach to model river ice growth at the Cold Regions Research and Engineering Laboratory.

Total 695

FY 1996 Planned Program:

- 733 Concentrate efforts in dynamic terrain representation for simulation and computerized terrain data analysis techniques at the Topographic Engineering Center.
  Develop chemical oxidation techniques for explosive contamination on oversized solids; enhance technology for identification and quantification of lighter petroleum fraction compounds at the Waterways Experimental Station.
  Perform mathematical modeling, lab testing and computer simulation of electromagnetic phenomena in inverter-fed AC rotating machines at the Construction Engineering Research Laboratories.
  Examine the fundamental diffusion processes of organic compounds in snow and explore the relationship between snow metamorphosis and avalanche release mechanisms at the Cold Regions Research and Engineering Laboratory.
- 3 Revised economic assumption not available for execution.
- 17 SBIR/STTR

Total 753

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research
	PROJECT A91D

FY 1997 Planned Program:

- 768 -Continue research in the terrain representation process and terrain data generation by sponsoring related topics in these areas at the Topographic Engineering Center.
  -Determine in vitro molecular and cellular toxicity of TNT, RDX, and HMX explosives to establish biomarkers of exposure at the Waterways Experimental Station.
  -Develop simplified, parameter-insensitive, sensorless machine control techniques at the Construction Engineering Research Laboratories.
  -Explore physics based correlations between mechanical and electrical properties of sea ice as a basis for translation of satellite sensor data to physical behavior and examine means to characterize the diffusion of various chemical species through frozen soils and permafrost at the Cold Region Research and Engineering Laboratory.

Total 768

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	807	773	791
Appropriated Amount(FY 1995)	790		
Adjustments to FY 95	-95		
Appropriated Amount(FY 1996)		760	
Adjustments to FY 96		-7	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-23
Current President's Budget Submit	695	753	768

Change Summary Explanation:
Funding: FY 95: Rescission within the FY 95 Supplemental Appropriation and Rescission to preserve and enhance the military readiness of the Department of Defense (-24); Below threshold reprogramming to Project A91C within this PE (-71)

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: A91E

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A91E In-House Laboratory Independent Research - Army Research Institute of Behavioral and Social Sciences	111	125	130	143	147	151	154		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project A91E - In-House Laboratory Independent Research (ILIR) - Army Research Institute for Behavioral and Social Sciences: Represents allocation of funds for the Army Research Institute for Behavioral and Social Sciences to conduct ILIR research.

FY 1995 Accomplishments:

- 111 Demonstrated benefits of navigation training in virtual reality environments.

Total 111

FY 1996 Planned Program:

- 122 Investigate the role of distance estimation and configuration learning in virtual environments.
- 3 SBIR/STTR

Total 125

FY 1997 Planned Program:

- 130 Conduct research on the transfer of training from virtual to real environments.

Total 130

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	138	130	133
Appropriated Amount(FY 1995)	135		
Adjustments to FY 95	-24		
Appropriated Amount(FY 1996)		127	
Adjustments to FY 96		-2	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-3
Current President's Budget Submit	111	125	130

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91E

Change Summary Explanation:

Funding: Rescission within the FY 95 Supplemental Appropriation and Rescission to preserve and enhance the military readiness of the Department of Defense (-3); Below threshold reprogramming to Project A91C within this PE (-21).

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	192833	124742	141682	147427	153403	161571	166980		Continuing	Continuing
AF20 Advanced Propulsion Research	2216	2176	2365	2408	2448	2509	2561		Continuing	Continuing
AF22 Research in Vehicular Mobility	3132	484	521	543	567	597	628		Continuing	Continuing
BH27 Research in Munitions Science	1572	0	0	0	0	0	0		0	1572
AH40 Signals Warfare Laboratory	550	0	0	0	0	0	0		0	550
AH42 Materials and Mechanics	6258	1553	1879	2005	2167	2358	2534		Continuing	Continuing
AH43 Research in Ballistics	4967	4921	5738	5860	6006	6172	6315		Continuing	Continuing
AH44 Advanced Sensors Research	2515	1696	3385	3465	3561	3663	3761		Continuing	Continuing
AH45 Air Mobility	2108	1979	2152	2257	2361	2465	2557		Continuing	Continuing
AH47 Applied Physics Research	8064	2582	3025	3155	3322	3525	3711		Continuing	Continuing
AH48 Communications Research	1405	0	11499	12805	13019	14655	16174		Continuing	Continuing
AH49 Research in Missiles and High Energy Lasers	3318	0	0	0	0	0	0		0	3318
AH51 Combat Support	133	0	0	0	0	0	0		0	133
AH52 Equipment for the Soldier	1855	964	988	1006	1030	1056	1077		Continuing	Continuing
BH57 Scientific Problems with Military Applications	60986	54546	55707	57961	59299	62338	64087		Continuing	Continuing
AH60 Research in Armaments	1333	0	0	0	0	0	0		0	1333

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH61 Research in Close Combat Weaponry	984	0	0	0	0	0	0		0	984
AH66 Advanced Structures Research	1298	1268	1372	1391	1420	1456	1485		Continuing	Continuing
BH67 Environmental Research - Army Material Command	4959	5474	5707	5855	7009	8185	8355		Continuing	Continuing
AH68 Processes in Pollution Abatement Technology	410	389	408	444	454	466	476		Continuing	Continuing
BS04 Military Pollutants and Health Hazards	722	666	696	756	773	794	811		Continuing	Continuing
BS11 Science Base/Medical Chemical Defense	7381	0	0	0	0	0	0		0	7381
BS12 Science Base/Medical Biological Defense	14273	0	0	0	0	0	0		0	14273
BS13 Science Base/Medical research Infectious Disease	9310	9282	9815	10004	10244	10514	10736		Continuing	Continuing
BS14 Science Base/Combat Casualty Care Research	4407	4217	4459	4546	4656	4778	4878		Continuing	Continuing
BS15 Science Base/Army Operational Medicine Research	7006	6884	6591	6931	7098	7284	7438		Continuing	Continuing
BS16 Science Base/Combat Dentistry Research	528	482	545	558	572	586	598		Continuing	Continuing
BS17 Molecular Biology/Military HIV Research	894	908	932	999	1024	1049	1071		Continuing	Continuing
AT22 Soil and Rock Mechanics	1970	1946	2057	2097	2148	2205	2251		Continuing	Continuing
AT23 Basic Research/Military Construction	1708	1737	1784	1844	1889	1939	1979		Continuing	Continuing
AT24 Snow, Ice and frozen Soil	1254	1241	1313	1337	1369	1406	1437		Continuing	Continuing

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BT25 Environmental Research - Corps of Engineers	6653	3480	3652	3696	5073	5205	5314		Continuing	Continuing
A305 Automatic Target Recognition Research	1429	1045	1156	1182	1214	1254	1287		Continuing	Continuing
A31B Infrared Optics Research	2426	2083	2281	2326	2379	2447	2505		Continuing	Continuing
B52C Mapping and Remote Sensing	2470	2471	2612	2663	2726	2798	2856		Continuing	Continuing
B53A Battlefield Environment and Signature	5188	5177	3605	3678	3777	3907	4005		Continuing	Continuing
A71A Research in Chemical Warfare/Biological Warfare defense	2951	0	0	0	0	0	0		0	2951
B74A Human Engineering	2393	2388	2571	2626	2698	2779	2847		Continuing	Continuing
B74F Personnel Performance and Training	2759	2703	2867	3029	3100	3181	3246		Continuing	Continuing
B782 Biotechnology Information Facility	9048	0	0	0	0	0	0		0	9048

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

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences

milestones for the Army's key emerging technologies, and the Army Modernization Plan. The projects in this PE include basic research efforts directed toward providing fundamental knowledge for the solution of military problems and therefore are correctly placed in Budget Activity 1. The resultant science base provides the source for follow-on exploratory development (6.2) and, eventually, advanced technology development (6.3) programs.

Work in this program element is related to and fully coordinated with efforts in PE 0601104A (University/Industry Research Centers), PE 0602120A (Electronic Survivability and Fuzing Technology), PE 0602618A (Ballistics Technology), PE 0602623A (Joint Service Small Arms Program), PE 0602624A (Weapons and Munitions Technology), PE 0602720A (Environmental Quality Technology) (DA Proj 835 only), PE 0602784A (Military Engineering Technology), PE 0602786A (Logistics Technology), PE 0602787A (Medical Technology), PE 0601102A (Defense Medical Sciences), PE 0603105A (Medical Human Immunodeficiency Virus (HIV) Research), PE 0603002A (Medical Advanced Technology), PE 0603807A (Medical Systems-Advanced Development), PE 0604807A (Medical Materiel/Medical Defense Equipment-Engineering Development), PE 0605801A (Program wide Activities, Project MMO2), PE 0605898A (Management Headquarters R & D, Project MMO3), and 0601103D, University Research Initiatives; the Navy, Air Force, and other Department of Defense agencies; National Aeronautics and Space Administration; National Science Foundation; Department of the Interior; Department of Energy; National Bureau of Standards; other Government agencies; and government agencies of Allied nations sponsor related research in areas of this program.

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AF20

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AF20 Advanced Propulsion Research	2216	2176	2365	2408	2448	2509	2561		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u>: **Project AF20 - Advanced Propulsion Research:** This project is unique in the Army and DoD, as it is the only 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. The purpose of this project is to perform basic research in propulsion, as applicable to rotorcraft and tracked and wheeled vehicles. Analysis, code development, tests 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 and controls. The goal of the activity is increased performance of small airbreathing engines and power trains, to support improvements in system mobility, reliability and survivability.

FY 1995 Accomplishments:

•	2216	-Identified wear resistant, high temperature ring-liner-lubricant systems for diesel applications. -Analyzed benefit of inserting wave rotor into advanced engine cycles; designed 4-port warm cycle wave rotor experiment; validated new transmission diagnostic algorithm; and formulated turbine film cooling code. -Incorporated detailed compressor simulation modules into full numerical turboshaft engine simulation, developed surface and interface coatings for silicon carbide/reaction bonded silicon nitride (SiC/ RBSN) composites, and designed high temperature magnetic radial bearing.
Total	2216	

FY 1996 Planned Program:

•	2168	-Prepare and install large, low-speed centrifugal compressor in test facility for basic flow physics investigation. -Complete "reduced chemistry" model for advanced combustor code. -Complete model of crack propagation in thin rim gears. Complete low noise gearbox validation experiments. -Complete solid lubrication bearing performance model and design for bench test. -Complete high temperature fatigue life model, and complete ceramic matrix composite oxidation protection studies. Complete characterization of high-temperature polymer mechanical properties retention. -Include deformation effects in journal bearing code. Determine best piston ring/cylinder liner tribological pair based on rig tests.
•	8	-Revised economic assumption not available for execution.
Total	2176	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT AF20

FY 1997 Planned Program:

•	2365	-Complete diffuser flow field tests for large, low-speed centrifugal compressor. -Complete carbon deposits/radiation modeling for advanced combustor code. -Develop analytical tools for low noise face gears. Develop concepts for non-ferrous gears. Validate performance of thin-rimmed, high-speed gears. -Complete solid lubrication model development. -Characterize advanced ceramic matrix composite oxidation-resistant coatings. -Test experimental oxidation-resistant coatings for high-temperature polymers. -Complete linear stability analysis for finite (with end effects) journal bearing.
Total	2365	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2321	2236	2372
Appropriated Amount (FY 1995)	2273		
Adjustments to FY 1995	-57		
Appropriated Amount (FY 1996)		2197	
Adjustments to FY 1996		-21	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-7
Current Budget Estimate Submit	2216	2176	2365

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AF22

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AF22 Research in Vehicular Mobility	3132	484	521	543	567	597	628		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project AF22 - Research in Vehicular Mobility: 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 US 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: the University of Michigan, University of Iowa, University of Wisconsin, Wayne State University, and Howard University, while key industry partners include the three major US automotive manufacturers. In FY 96 and beyond, funding for continued Center of Excellence activity will be transferred to PE 0601104A. In addition to the described Center activity, individual tasks continue to be executed in the overall area of ground vehicle mobility. These individual tasks emphasize state-of-the-art computer simulation and laboratory based modeling of tracked and wheeled vehicles, including unique powertrain and chassis component analysis methodologies. The overall effort develops and demonstrates the theory and methodologies necessary to minimize the need for expensive and time consuming field and laboratory testing of Army ground vehicles.

FY 1995 Accomplishments:

•	3132	-Conducted university research and leveraged commercial automotive research in five thrust areas - vehicle terrain dynamics, vehicle hardware/human interface, vehicle structures, advanced propulsion, system integration - through the NAC's Center of Excellence for Automotive Research. -Performed research in symbolic and numerical methods to improve real-time vehicle modeling and simulation. -Formulated vehicle/human interface theory methodology including unique real-time feedback.
Total	3132	

FY 1996 Planned Program:

•	473	-Optimize research in symbolic numerical algorithms which permit accurate, real-time, and cost effective dynamic vehicle simulation. -Refine vehicle/human interface theory to allow accurate phenomena predictability. -Develop vehicle dynamic theory permitting real-time simulation of active control characteristics. -Develop fundamental simulative models for advanced ground vehicle powertrain components.
•	2	-Revised economic assumption not available for execution.
•	9	-SBIR/STTR
Total	484	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT AF22

FY 1997 Planned Program:

•	521	-Validate symbolic numerical algorithms within real-time vehicle dynamic scenarios. -Enhance numerical computational efficiencies of simulative models describing vehicle/human interfaces. -Demonstrate control algorithms for autonomous neural networks in support of vehicle accident avoidance. -Optimize and validate fundamental simulative models for unique ground vehicle powertrain component combinations.
Total	521	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3225	498	533
Appropriated Amount (FY 1995)	3157		
Adjustments to FY 1995	-25		
Appropriated Amount (FY 1996)		489	
Adjustments to FY 1996		-5	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-12
Current President's Budget Submit	3132	484	521

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BH27

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH27 Research in Munitions Science	1572	0	0	0	0	0	0		0	1572

A. Mission Description and Budget Item Justification: **Project BH27 - Research in Munitions Science:** Conduct basic research in the areas of explosives, propellants and warhead/penetrator materials in support of future munitions. This research will result in improved performance of chemical/kinetic energy warheads, bio-synthesis/bio-degradation of energetics, increased manufacturing safety and improved battlefield survivability. Beginning in FY 96, funds for this effort are transferred to PE 0601101A. This is consistent with BRAC 91 and the formation of ARL, where basic research funding in the RDECs will only be In-House Laboratory Independent Research (ILIR).

FY 1995 Accomplishments:

- 1572 -Tested and use computer code to identify insensitive high energy explosive.
  -Conducted synthesis studies of polynitrocubanes for new ultra high energy density explosives.
  -Characterized advanced tungsten composite kinetic energy (KE) penetrators to enhance warhead performance.
  -Fabricated a 40mm step chamber test fixture for the regenerative liquid propellant gun.

Total 1572

FY 1996 Planned Program: Project funded in PE 0601101A.

FY 1997 Planned Program: Project funded in PE 0601101A.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	1628	0	0
Appropriated Amount (FY 1995)	1593		
Adjustments to FY 1995	-21		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	1572	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences PROJECT AH40

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH40 Signals Warfare Laboratory	550	0	0	0	0	0	0		0	550

A. Mission Description and Budget Item Justification: **Project AH40 - Signals Warfare Laboratory:** This project develops the fundamental theory to manage the enormous quantity and variety of tactical intelligence data collected and passed from the Intelligence Electronic Warfare (IEW) battlefield sensors to the battlefield intelligence center. The nature of the problem has necessitated an approach that features an artificial intelligence (AI)-based research for sorting and fusing data from sensors, and signal processing techniques that promote automated sorting and interference reduction at the sensor itself. Beginning in FY 96, funds for this effort are transferred to PE 0601101A. This is consistent with BRAC 91 and the formation of ARL, where basic research funding in the RDECs is to be only In-House Laboratory Independent Research.

FY 1995 Accomplishments:

•	550	-Developed algorithms which will check for algorithm completeness and correctness. -Developed robust and efficient data base structures which support dynamic procedural language requirements. -Continued the study of optimal detection of wideband signals to extend to direct sequence spread spectrum.
Total	550	

FY 1996 Planned Program: Project funded in PE 0601101A.

FY 1997 Planned Program: Project funded in PE 0601101A.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	566	0	0
Appropriated Amount (FY 1995)	554		
Adjustments to FY 1995	-4		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	550	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH42

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH42 Materials and Mechanics	6258	1553	1879	2005	2167	2358	2534		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project AH42 - Materials and Mechanics:** This project establishes the science base for creating and producing advanced materials to achieve higher performance, lower cost, improved reliability and environmental compatibility for Army-unique system and component applications. Emphasis is on synthesis, processing and understanding fundamental aspects of chemistry and microstructure that influence the flow and failure mechanisms of materials subjected to high strain rates (armor/anti-armor); the permeation and performance characteristics of materials subjected to chemical, biological and directed energy threats; and the durability, service life and maintenance of candidate materials for ground combat vehicles, armament systems, personnel support and aircraft. Funding for research conducted at university Centers of Excellence in FY 95 will be restructured to PE/PROJ 0601104A/BH64 in FY 96.

FY 1995 Accomplishments:

- 2682 -Measured shock induced damage in armor materials under combined compression/shear shock loading.
  -Developed joined ceramic component for testing at high temperatures.
  -Developed a method to deposit diamond like coating containing silicon on steel alloys using an ion beam assisted deposition process.
  -Demonstrated computer simulation of chemical agent molecular permeation through organic barrier.
- 3576 -Established materials Center of Excellence with local universities to conduct research in: materials synthesis and processing; high strain rate behavior; and surface/interphase science.
  -For selected neural network algorithms, used mine data to evaluate effectiveness and robustness.
  -Improved NASA's aircraft tire modeling capability by adding viscoelasticity to the finite element models: predicted strength and performed quasi-static testing of thick curved laminates.

Total 6258

FY 1996 Planned Program:

- 1548 -Synthesize and characterize bulk ferroelectric composites for phased array antenna applications.
  -Determine shock induced damage in armor materials under oblique impact/shock.
  -Correlate hydrogen bonding energies with microstructural constituents in high strength steels intended for aviation and armor use.
  -Include thermal and anisotropic effects in new constitutive models for elastomer structures.
- 5 -Revised economic assumption not available for execution.

Total 1553

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
PROJECT AH42	

FY 1997 Planned Program:

•	1879	-Establish the science base for creating and producing special function electrical, magnetic, optical, chemical-biological protective, and smart-responsive materials. -Provide an enhanced knowledge base of the relationship between microstructure and mechanisms of flow and failure in materials subjected to high strain rates typical of armor/anti-armor events. -Provide an enhanced knowledge base to relate the structure and properties of metal, ceramic, polymer, composite and hybrid materials surfaces and interphases to improve performance and long-term durability. -Investigate computational difficulties associated with simulating manufacturing of composite structures made with elastomers, and develop criteria for failure and fatigue durability of thick curved laminates.
Total	1879	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	6484		1885
Appropriated Amount (FY 1995)	6348		
Adjustments to FY 1995	-90		
Appropriated Amount (FY 1996)		1569	
Adjustments to FY 1996		-16	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-6
Current Budget Estimate Submit	6258	1553	1879

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH43

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH43 Research in Ballistics	4967	4921	5738	5860	6006	6172	6315		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project AH43 - Research in Ballistics: The purpose of this project is to conduct basic research in technologies which are unique in the Army and DoD in combustion chemistry, physics and fluid dynamics, physics of explosive materials, interior ballistic reaction kinetics, computational algorithms, computer networking, and remote sensing. This basic research is critical to the U.S. in maintaining a technological edge on the battlefield.

FY 1995 Accomplishments:

- 4967 -Explored novel techniques to extend penetrators in flight and provided a shaped charge precursor for a Kinetic Energy (KE) rod.
  -Integrated multiple infrared (IR) tracker systems to perform real-time tracking and interception of threat munitions for an active protection system.
  -Identified/explored potential countermeasures to electromagnetic armor.
  -Improved the code designs obtained in FY 1994 to boost code transmission rates to channel capacity.
  -Designed a class of nearly optimal, mixed-rate multi-user codes which enables many users simultaneously to share a communication channel without error and to do so at transmission rates that are asymptotically close to the maximum theoretical values. Designed and validated a simulation of an available experimental protocol.

Total 4967

FY 1996 Planned Program:

- 3406 -Formulate liquid propellant jet breakup and combustion algorithms applicable to the high pressure regime in guns.
  -Conduct interior ballistic simulations of a granular solid propellant at high initial loading density and subjected to external (e.g., plasma) energy addition; assess its combustion stability.
  -Extend current models of non-steady rod penetration to include length/diameter (L/D) effects and demonstrate utility by comparing with penetration over a range of L/D values.
  -Incorporate infrared tracker with signal processing module in real-time range demonstration of counter-kinetic energy components.
  -Demonstrate fusion of topographic, navigational sensor and optical data to form a cohesive system for navigation.
- 1447 -Investigate collateral effects of Electromagnetic (EM) environments from pulsed power sources and EM guns and systems on host vehicles, personnel and on other nearby assets.
  -Investigate means for describing the texture and correlations of Millimeter Wave (MMW) clutter through the analysis of data collected using a multi-frequency MMW rail synthetic aperture radar.
  -Investigate applying fuzzy logic to simulation model validation.
  -Assess the performance and suitability of multihop routing algorithms.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT AH43

FY 1996 Planned Program: (continued)

•	52	-SBIR/STTR.
•	16	-Revised economic assumption not available for execution.
Total	4921	

FY 1997 Planned Program:

•	3626	-Develop submodels of the surface and subsurface physics and chemistry of nitramine composite propellants which account for oxidizer particle-size dependence on burning rate. -Develop a finite element model capable of computing the transverse loads and accelerations imparted to sensitive projectile guidance and control components inside a gun tube. -Develop a simple analytical model for ceramic armor elements, including the dwell phenomenon, using a minimum of model-based parameters. -Exploit theoretical and experimental capabilities to develop EM armor scaling relationships.
•	2112	-Investigate coherent and non-coherent super-resolution techniques in scenes with distributed clutter. -Validate simulation models whose output are highly graphical, and are more animated than quantitative representations. -Examine and devise computational, efficient algorithms for: proactive packet routing, dynamic data transformation and visualization. -Examine and advance science base in massively parallel and scalable processing architectures.
Total	5738	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	5172	5059	5836
Appropriated Amount (FY 1995)	5064		
Adjustments to FY 1995	-97		
Appropriated Amount (FY 1996)		4970	
Adjustments to FY 1996		-49	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-98
Current Budget Estimate Submit	4967	4921	5738

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH44

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH44 Advanced Sensors Research	2515	1696	3385	3465	3561	3663	3761		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u>: **Project AH44 - Advanced Sensors Research:** This project exploits new opportunities in the basic sciences underpinning the technological areas of: signal and image processing by both digital and optical techniques; radar; and smart sensors. Research involves fundamental science and engineering principles that support survivable sensor systems for target recognition. Monolithic and hybrid optoelectronic structures in gallium arsenide and lithium niobate are investigated as integrated processors for novel signal and radar processing. Diffractive optics is investigated to enhance the performance of bulk and integrated optical processors. Processing algorithms and architectures are investigated for performance of bulk and integrated optical processors. Processing algorithms and architectures are investigated for electromagnetic sensing and imaging of ultra-wideband, inverse, and conventional synthetic aperture radar (SAR) returns.

FY 1995 Accomplishments:

•	2515	-Integrated refractive, diffractive and/or integrated optical elements for performing image processing. -Investigated Vertical Cavity Surface Emitting Lasers capable of gigabit transmission. -Demonstrated prototype two-dimensional spatial light modulators for optical signal processing applications. -Demonstrated semi-insulating silicon carbide substrates by appropriate introduction of deep level impurities.
Total	2515	

FY 1996 Planned Program:

•	1685	-Design, construct and characterize optical processors for image and signal processing, incorporating refractive, diffractive and/or integrated optical elements. -Continue research on components for optical control of microwaves by combining integrated optic beam splitter with phase modulators and amplifier structures. -Develop, test and characterize wideband high-resolution, direction-finding, acoustic algorithms for tracking vehicles; research projectile shock wave characterization. -Investigate properties of SiC including electronic impurities for compensation of epitaxial layers, high resistivity substrate materials and PIN diode limiters as a basic for developing robust electronics. -Investigate the underlying physical principles for better hybridization as well as different material issues and polarization issues for designing single polarization lasers.
•	5	-SBIR/STTR.
•	6	-Revised economic assumption not available for execution.
Total	1696	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH44

FY 1997 Planned Program:

•	1099	-Incorporate on-chip processing and optical pre-processing on two dimensional photodetector arrays for improved performance and functionality. -Design photonic based integrated optic processor for optical control of microwaves and phased arrays. -Research photonic implementations of automatic target recognition (ATR) and other signal processing algorithms. -Apply the giant magnetoresistive (GMR) effect to non-volatile memory design.
•	2286	-Develop graphic approach for interpreting DIS performance. -Conduct research focused on new data/image compression techniques to offset the growing demands for additional bandwidth in the DIS environment. -Investigate techniques to automatically establish seamless connections between physical models in constructive, virtual, and live simulation. -Investigate different semiconductor structures and physical/material properties. Utilize this knowledge to design and demonstrate high density smart-pixels and other concepts and devices for 2D optical processing, image processing, and for aided target recognition.
Total	3385	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2629	1742	1897
Appropriated Amount (FY 1995)	2573		
Adjustments to FY 1995	-58		
Appropriated Amount (FY 1996)		1712	
Adjustments to FY 1996		-16	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			1488
Current Budget Estimate Submit	2515	1696	3385

Change Summary Explanation:
Funding: FY97: Funding restructured within ARL.

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH45

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH45 Air Mobility	2108	1979	2152	2257	2361	2465	2557		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project AH45 - Air Mobility:** Basic and applied research in aerodynamics and avionics as applied to rotary wing aircraft. Analysis, code development, test and evaluation are conducted on rotor unique aerodynamics, dynamics, performance, and aircraft performance and acoustics. Efforts in avionics are focused in antenna modeling and advanced display concepts.

FY 1995 Accomplishments:

- 2108 -Fabricated smart airfoil models and dynamic stall-free experimental model rotors.
  -Investigated new blade concepts for low noise and vibration characteristics; and validated computational aeroacoustic codes for blade vortex interaction.
  -Evaluated antennas embedded in composite tail section by both electromagnetic modeling and measurements.
  -Initiated interactional aerodynamics studies for isolated rotor test system (IRTS) applications.

Total 2108

FY 1996 Planned Program:

- 1929 -Test and evaluate smart airfoils and stall-free model rotors.
  -Investigate rotor active control techniques for acoustic propagation.
  -Conduct interactional aero-vibration code validation focused studies.
  -Extend antenna codes to handle multiple composite materials.
- 6 -Revised economic assumption not available for execution.
- 44 -SBIR/STTR

Total 1979

FY 1997 Planned Program:

- 2152 -Expand smart airfoil results to revolutionary envelope expansion for rotorcraft.
  -Initiate the combination of aeroacoustic theory with interactional aero computational fluid dynamics (CFD) codes.

Total 2152

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT AH45

B. Project Change Summary	FY 1995	FY 1996	FY 997
Previous President's Budget Request (FY 1996)	2195	2034	2217
Appropriated Amount (FY 1995)	2149		
Adjustments to FY 1995	-41		
Appropriated Amount (FY 1996)		1999	
Adjustments to FY 1996		-20	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-65
Current President's Budget Submit	2108	1979	2152

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH47

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH47 Applied Physics Research	8064	2582	3025	3155	3322	3525	3711		Continuing	Continuing

A. Mission Description and Justification: **Project AH47 - Applied Physics Research:** The purpose of this project is to perform research on critical optoelectronic hybrid components, power sources, fuel cells, microsensors, photonics, magnetics and experimental nanofabrication processes vital to supporting Army requirements in the areas of electronic warfare (EW), reconnaissance, surveillance, target acquisition (RSTA); and fire-and-forget munitions. This project exploits emerging technologies and develops needed device concepts for: smart tactical electronics for real-time signal/data processing in tactical scenarios; millimeter-wave technologies for mini-radars (motor vehicle collision warning devices), missile seekers (thermal heat leakage from home/factories), and secure communications (business/banking); and ultra-long-life batteries for a wide variety of man-portable equipment.

FY 1995 Accomplishments:

- 2705 -Completed design and construction of two permanent magnet solenoids and transitioned to industry.
  -Fabricated room temperature coplaner ferroelectric phase shifter and fabricated new oxide dielectrics with low permitivity for use in high temperature superconductors.
  -Designed, fabricated, and tested 4X4 array of normal incidence high contrast spatial light modulation.
  -Designed, fabricated, and tested a 1 to 16 optical waveguide Y splitter for optical control of microwaves for communication-on-the-move technology.
- 2484 -Designed 9.2 micron infrared hot-electron transistor (IHET) operating at 90 degrees K.
  -Diagnosed pervasive defects in critical semiconductor materials due to hydrogen and initiated program to control hydrogen in quartz accelerometers for missile guidance.
  -Demonstrated feasibility of 600 V class silicon carbide thyristor.
  -Formulated high-energy cathode materials for rechargeable lithium/polymer solid-state batteries.
  -Improved water retention properties of fuel cell Polymer Exchange Membrane (PEM) and improved the electrocatalytic activity of catalysts for methanol oxidation.
- 2875 -Issued BAA to establish Microelectronics Research Collaborative Program. Cooperative Agreements were awarded to Johns Hopkins University and the University of Maryland.

Total 8064

FY 1996 Planned Program:

- 2558 -Perform research on novel integrated, loss-less optical splitter/phase shifter necessary for lightweight, low cost highly functional integrated photonic devices critical to Army comm-on-the-move systems and for fiber optic gyroscopes for missile guidance and global positioning. Look at other concepts for higher functionality.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
PROJECT AH47	

FY 1996 Planned Program: (continued)

-Design and demonstrate tunable multicolor quantum well infrared photodetector (QWIP) to provide high performance, low cost and highly manufacturable technology with unique capabilities for DoD and NASA's infrared imaging requirements.
-Continue research on spatial light modulator arrays necessary to implement fast optical processing architectures for automatic target recognition applications. Investigate issues involving optimization, novel functionalities and physical limitations of such devices.
-Increase operating temperature of an infrared hot-electron transistor (IHET) beyond 77 degrees K in the 10 micron range and optimize the IHET structure capable of detecting infrared radiation in the 15 micron range.
-Design 2nd generation permanent magnet bias source for a 140 Ghz microwave tube and transmission to industry.

•	15	-SBIR/STTR.
•	9	-Revised economic assumption not available for execution.
Total	2582	

FY 1997 Planned Program:

•	2425	-Perform research on integrated photonic laser/shifter/receiver to extend capabilities of Army communications systems for battlefield digitization and fiber optic gyroscopes for missile guidance and global positioning. -Investigate novel structures and the basic properties of these devices to understand the limitations as well as the advanced functionalities to design next generation device. -Design and demonstrate fully addressable smart pixel array to provide high speed, high resolution components for implementing fast optical processing architectures for automatic target recognition applications.
•	600	-Transfer tunable quantum well infrared photodetector (QWIP) technology to DoD and NASA. -Continue research on novel magnetic circuits using 3-D finite element analysis techniques. -Optimize and transition a ferroelectric/high temperature superconducting active microwave phase shifter.
Total	3025	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	8319	2653	3043
Appropriated Amount (FY 1995)	8145		
Adjustments to FY 1995	-81		
Appropriated Amount (FY 1996)		2607	
Adjustments to FY 1996		-25	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-18
Current Budget Estimate Submit	8064	2582	3025

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH48

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH48 Communications Research	1405	0	11499	12805	13019	14655	16174		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project AH48** - This project performs basic research in three technology areas: Simulations, Intelligent Systems, and Information Survivability and Vulnerability Analysis. The project also supports the Army High Performance Computer Resource Center.

FY 1995 Accomplishments:

- 1405 -Continued development of photonic technology for optically fed/controlled phased arrays.
  -Continued research on formal techniques of protocol engineering.
  -Investigated propagation prediction techniques for tactical radio communication at frequencies in the wireless personal-communication band.
  -Continued development of advanced numerical analysis methods for printed antennas/arrays. The goal is a highly efficient user-friendly computer code.
  -Continued studies on representation of a battlefield situation that supports automated plan management and on object oriented C2 system modeling.
  -Researched AI techniques for design of distributed decision support applications for integration into Army tactical C2 systems.

Total 1405

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program:

- 11499 -Evaluate prototypical Virtual Sand Table configuration for Tacticle Operations Center (TOC) operations at the National Training Center, port Joint Tactical Simulation (JTS) to the sand table environment for viewing in three dimensions; incorporate C2 models, evaluate alternatives for vulnerbilities, determine weather and feature related masking, and provide synthetic environment to the Dismounted Infantry Battle Lab.
  -Apply software agents to specific applications, such as situational awareness, and investigate techniques and methods for language understanding and translation.
  -Developing techniques that provide secure and survivable technologies, networks, and architectures, and develop C4I vulnerability assessment methodologies that address information warfare threats.
  -Demonstrate modeling techniques for fluid-body interactions including adaptive gridding and multi-body dynamics, establish 3D modeling capability for free surface flows in waterways, and demonstrate modeling techniques for fluid flow through fractured rock for radioactive waste cleanup and hazard assessment.

Total 11499

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT AH48

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1463	0	0
Appropriated Value	1433		
Adjustments to Appropriated Value	-28		
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			+11499
Current Budget Estimate Submit for FY 1997	1405	0	11499

Change Summary Explanation:
Funding: FY97: Funds restructured from PE 0601104A projects BH53 and BH55.

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH49

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH49 Research in Missiles and High Energy Lasers	3318	0	0	0	0	0	0		0	3318

A. Mission Description and Budget Item Justification: **Project AH49 - Research in Missiles and High Energy Lasers:** This is the only Defense Research Sciences project providing basic research dedicated to the development and evaluation of evolving science knowledge critical for future superiority in Army missiles and high energy lasers. Current research emphasis is in selected key areas: integrated and guided-wave optics; optical pattern recognition; quantum optics; neural network applications; signal processing/analysis; electro-optical materials. Work in this project supports PE 0602303A and PE 0602307A at Missile Command RDEC and is fully coordinated with related activity at the Army Research Laboratory (ARL).

FY 1995 Accomplishments:

•	3318	-Exploited advantages of neural network computing techniques for aided target recognition and cueing, and conducted integrated and guided wave optics research enabling improved fabrication/packaging for sensors. -Demonstrated optical correlator technology for smart weapons applications in target recognition and cueing and missile terminal guidance. -Developed advanced integrated and opto-electronic optical components and structures enabling exploitation of photonic devices for missile target acquisition, discrimination and tracking. -Conducted research in quantum and nonlinear optics for future opto-electronic components and optical computing systems.
Total	3318	

FY 1996 Planned Program: Project funded in PE 0601101A.

FY 1997 Planned Program: Project funded in PE 0601101A.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	3462	0	0
Appropriated Amount (FY 1995)	3390		
Adjustments to FY 1995	-72		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	3318	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH51

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH51 Combat Support	133	0	0	0	0	0	0		0	133

A. Mission Description and Budget Item Justification: **Project AH51 - Combat Support:** Basic research in fuels and lubricants involving lubrication tribology investigations is performed by Army scientists collocated at Wright Laboratory (USAF) under Project Reliance. Also under this project, the Materials Directorate of the Army Research Laboratory (ARL) performs basic research in elastomers, low volatile organic compounds (VOC) Chemical Agent Resistant Coating (CARC) with low observability in the extended infra-red region. Due to BRAC actions, this project was terminated in FY 1995.

FY 1995 Accomplishments:

•	133	-Defined load-carrying capability of solid lubricant-metal combinations.
Total	133	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	139	0	0
Appropriated Amount (FY 1995)	136		
Adjustments to FY 1995	-3		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	133	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences PROJECT AH52

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH52 Equipment for the Soldier	1855	964	988	1006	1030	1056	1077		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project AH52 - Equipment for the Soldier- Basic research focused on five core technology areas critical to the Soldier System: biotechnology, polymer science/textile technology, food technology, airdrop technology, and behavior/performance science. Research is targeted toward enhancing the mission performance, survivability, and sustainability of the soldier by advancing the state of the art in defense against battlefield threats and hazards such as ballistics, chemical agents, lasers, environmental extremes, and shortfalls in the availability of nutritious, satisfying rations essential to the health and well-being of soldiers. In FY 96 and beyond, the research focuses on only the first three of these five technology areas.

FY 1995 Accomplishments:

- 821 -Produced low cost, high performance PVA fibers for application in ballistic protection.
  -Designed and built automated machine to determine fiber attributes.
  -Established fractal analysis protocol for examining fibers and films as determinant of high performance fiber/film functionality.
  -Synthesized fully rigid polycarbonate for fibers with the potential for improved ballistic resistant performance using an environmentally friendly process.
  -Expanded gradient design concept for development of multifunctional armor.
  -Developed processing systems for biomimetic ceramics.
- 1034 -Determined structure of M2 chemical marker for identifying processing variables in food/rations.
  -Developed modified liposomes and stabilized micelles as carriers for bioactive food amino acids and demonstrated functionality for delivery of performance enhancing nutrients.
  -Spun fibers from newly developed copolymer materials to be used for personnel armor; transitioned to 6.2.
  -Used enzyme based polymerization process for synthesizing optical and electronic application materials for laser eye protection.
  -Predicted behavior of parachutes changing shape as they open.
  -Determined the extent of metabolism of bioactive proteins for oral delivery of performance enhancing nutrients.

Total 1855

FY 1996 Planned Program:

- 351 -Characterize self-assembly of next-generation protein building blocks for development of new biosensors for laser eye protection.
  -Probe intestinal immune system for targeted delivery of bioactive nutrients to improve immune response.
  -Quantify constituent distribution affecting stability and texture of complex carbohydrate/protein ration components as a basis for enhancing nation shelf-life in the field.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
PROJECT AH52	

FY 1996 Planned Program: (continued)

		-Characterize nonlinear optical properties of polymer-inorganic composites for laser eye protection applications.
•	590	-Perform mathematical modeling and experimental studies on textile systems as a means of understanding complex failure mechanisms. -Improve breaking stress of PVA fibers through incremental fiber drawing for ballistic protection applications. -File patents on biosensor arrays which provide technology for development of unique advanced materials for ballistic laser eye protection, counter surveillance and conducting ceramics. -Investigate thin-film technologies to demonstrate self-assembling for controlled permeation for CB defense applications. -Determine the physical properties of newly modified polymers for ballistic applications and measure ballistic performance using mechanics testing. -Investigate mechanisms and yields of intrinsic chemical markers for assurance of improved thermal ration processes.
•	2	-Revised economic assumption not available for execution.
•	21	-SBIR/STTR
Total	964	

FY 1997 Planned Program:

•	988	-Investigate various plasticizers/moisture binders to ameliorate textural changes during storage of intermediate moisture food products. -Initiate mathematical modeling to incorporate heat generation and transfer rates and to predict lethality throughout complex foods processed by new ration applicable technologies such as ohmic heating.
•		-Incorporate self-assembly technologies into newly developed ballistic silk fibers for further refinement of properties and characteristics.
•		-Continue experimentally guided analytical work on fibers, fabrics, and fiber-resin systems for application to soldier survivability items.
Total	988	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1934	991	1018
Appropriated Amount (FY 1995)	1893		
Adjustments to FY 1995	-38		
Appropriated Amount (FY 1996)		974	
Adjustments to FY 1996		-10	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-30
Current President's Budget Submit	1855	964	988

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BH57

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH57 Scientific Problems with Military Applications	60986	54546	55707	57961	59299	62338	64087		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u>: **Project BH57 - Scientific Problems with Military Applications:** This extramural research project seeks to capture and exploit new scientific opportunities and technology breakthroughs, primarily at universities, to improve the Army's future operational capabilities. The Army Research Office maintains a strong peer-reviewed scientific research program through which technological improvements to warfighting capability can be assessed and implemented. Included are research efforts of scientific study and experimentation directed toward increasing knowledge and understanding in fields related to long-term national security needs and covering the physical sciences (physics, chemistry, biology, and mathematics) , the engineering sciences (mechanics, electronics, computer, energy conversion, aeronautics, and materials), and the environmental sciences (atmospheric and terrestrial). It covers approximately 450 grants and contracts with leading academic researchers and over 800 graduate students yearly, and supports research at over 150 universities in 41 states. Additionally, 5% of Army funding of universities research is committed to Historically Black Colleges and Universities/Minority Institutions (HBCU/MI). In FY 1996 the High Performance Computing Research Center of Excellence (COE) and the Information Sciences COE will transition to the Army Research Laboratory (ARL). Other COEs are restructured from Project BH57 into PE 0601104A, Project BH59 in FY 1996.

FY 1995 Accomplishments:

- 28276 -Exploited materials research including biomimetic synthesis of nanocrystalline materials for high energy storage devices.
  -Advanced physics research to develop tunable laser sources for target acquisition and remote sensing as well as nonlinear optical processes for sensor protection.
  -Advanced chemistry research in electrochemistry for mobile power, in kinetics and modeling for energetic materials and in polymers for the soldier system.
  -Advanced biosciences research in biologically based methods for chemical/biological threat detection and for biodegradation for military toxic wastes.
- 32710 -Advanced research in electronic materials, devices and communication coding increased the speed and frequency performance of digital and microwave systems and data throughput of combat net radios.
  -Provided computational techniques for predicting rotorcraft aerodynamics and shock-induced changes in materials for survivable resilient structures for armored ground vehicles.
  -Improved numerical simulations of boundary layer turbulence in atmospheric boundary layer and improved models for contaminant flows through porous media.
  -Advanced mathematical research in modeling, analysis and scientific computing for design of advanced materials, including composites for lightweight armor and critical structural components.

Total 60986

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 EXHIBIT)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT BH57

FY 1996 Planned Program:

•	27056	-Advance materials research on ultrahard diamond-like coatings for recoilless gun components. -Advance research in electronic and optoelectronic structures for ultrafast processing with minimum energy dissipation for command and control on the digital battlefield. -Develop techniques for coherent infrared imaging, millimeter wave imaging, multiple wavelength detectors and temporal imaging to improve visibility. -Advance biosciences research to develop microbiological and biochemical characterization of cells to break down military materiel waste.
•	26251	-Design adaptive intelligent control systems for multivariable and nonlinear systems with application to real-time implementation in embedded systems. -Conduct research in atmospheric sciences for accurate prediction of electromagnetic wave scattering cross section in the atmosphere, and terrestrial sciences advances for hydrologic runoff processes for large floods. -Develop "smart" structures concepts to suppress vibrations, reduce noise levels, and modify structural shapes of rotorcraft. -Provide fundamental information on energetic materials, ignition and combustion for ballistic models and develop elastomeric materials for lower cost, longer life, high performance plastics.
•	157	-Revised economic assumption not available for execution.
•	1082	-SBIR/STTR
Total	54546	

FY 1997 Planned Program:

•	28780	-Advance materials research in glassy metallic alloys for lightweight, ultrastrong composites with application to combat vehicle structures. -Advance research in wireless communications, signal processing and efficient RF transmit/receive modules to enhance throughput of information supporting command and control for Force XXI. -Advance research in mechanics to demonstrate a time-dependent, 3-D model of fuel injection, ignition and combustion dynamics to identify optimal ranges of engine operation. -Increase the understanding of behavior of soil and cold climate materials in response to military operations with emphasis on vehicle-terrain interactions and interaction of precipitation with the ground.
•	26927	-Advance research in chemistry to create a new synthetic route to recyclable polymers with tailored properties. -Advance computer science research to design a multi-protocol for the integration of symbolic, numeric, graphics and document processing into a single problem-solving environment for battle management. -Advance biosciences research including deriving a novel photochromic material from bacteriorhodopsin. -Explore nonlinear optical phenomena occurring in liquid crystal optical fibers for possible application for pulse compression, frequency conversion and other electro-optical applications.
Total	55707	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 EXHIBIT)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT BH57

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	63373	56084	58869
Appropriated Amount (FY 1995)	62174		
Adjustments to FY 1995	-1188		
Appropriated Amount (FY 1996)		55095	
Adjustments to FY 1996		-549	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-3162
Current President's Budget Submit	60986	54546	55707

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH60

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH60 Research in Armaments	1333	0	0	0	0	0	0		0	1333

A. Mission Description and Budget Item Justification: Project AH60 - Research in Armaments: This project provides basic research in the areas of smart projectiles, autonomous launchers, and fire control systems. Efforts focus on resolving basic technology problems required for insertion into Applied Research and Advanced Technology Development.

FY 1995 Accomplishments:

•	1333	-Evaluated and selected optimum gallium-antimonide waveguide processing device concepts and validated conceptual designs. -Completed the development and evaluation of the laboratory prototype neural-network based, voice recognition and synthesis module capable of real-time functioning in the presence of complex noise. -Developed signature and signal modeling programming for cost effective evaluation of laser radar sensor algorithms. -Investigated planar optical approaches to large processor gain correlation for high bandwidth radar. -Investigated discourse processing aspect of natural language for human-computer interface for on-the-move command and control. -Conducted research in natural language (discourse processing) in collaboration with the University of Maryland.
Total	1333	

FY 1996 Planned Program: Project not funded in FY 1996.

FY 1997 Planned Program: Project not funded in FY 1997

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1394	0	0
Appropriated Amount (FY 1995)	1365		
Adjustments to FY 1995	-32		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current President's Budget Submit	1333	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH61

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH61 Research in Close Combat Weaponry	984	0	0	0	0	0	0		0	984

A. Mission Description and Budget Item Justification: **Project AH61 - Research in Close Combat Weaponry:** This effort addresses basic physical phenomena associated with gun armament development and applies the knowledge gained to new design approaches to extend service life and improve the accuracy and life cycle cost of weapon systems. Additional efforts involve the prediction of the dynamic effects in weapon and ammunition components, deposition and high strength refractory metals and alloys and characterization of weapon system failure mechanics. Efforts focus on resolving basic technology problems required for insertion into Exploratory Development and Advanced Technology Development. This project supports Science and Technology Thrusts for Advanced Land Combat. Beginning in FY 96, funds for this effort are transferred to PE 0601101A. This is consistent with BRAC 91 and the formation of ARL, where basic research funding in the RDECs will only be ILIR.

FY 1995 Accomplishments:

•	984	- Established combined neural net multifractal method characterizing material microstructures to resolve gun material problems. - Evaluated gun materials prepared with planar magnetron and cylindrical magnetron sputtering systems for future coating applications. - Enhanced muzzle brake computer code by chemistry integrated model of propellant gases to optimize projectile obturator designs. - Established new test geometry for use in gun failure predictions in accordance with the American Society for Testing and Materials fracture toughness standards.
Total	984	

FY 1996 Planned Program: Project funded in PE 0601101A.

FY 1997 Planned Program: Project funded in PE 0601101A.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1031	0	0
Appropriated Amount (FY 1995)	1009		
Adjustments to FY 1995	-25		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current President's Budget Submit	984	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH66

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH66 Advanced Structures Research	1298	1268	1372	1391	1420	1456	1485		Continuing	Continuing

A. Mission Description and Justification: Project AH66 - Advanced Structures Research: As agreed to under Project Reliance, this is the only project for rotorcraft and ground structures basic research within the DoD. The purpose of this project is to perform basic and applied research in structures, as applied to rotorcraft and ground vehicles. No related effort is being conducted within DoD.

FY 1995 Accomplishments:

- 1298 -Tested piezoelectric elements bonded to a liner inside a composite cylinder for active control of interior noise, and validated Nearfield Acoustical Holography (NAH) techniques in a simple enclosure.
  -Conducted detailed stress analysis to isolate specimen edge effects, investigated scaling effects under complex statically applied loads, and jointly modeled the full-scale crash test of the Learfan 2100 under a U.S./German Memorandum of Understanding(MOU).
  -Completed first tests of aeroelastic tiltrotor model in the Transonic Dynamics Tunnel, and initiated refurbishment of tiltrotor model power train system to enable power-on testing.
  -Conducted tests to validate delamination criteria for rotorcraft composite hub designs being worked under Cooperative Research and Development Agreements (CRDAs) with Bell and McDonnell-Douglas Helicopter Company(MDHC).
  -Developed low velocity test methodology and standard impact test based on quasi-static test method.
  -Developed hybrid technique for processing thermal non-destructive evaluation data and incorporated into a prototype thermal instrument.

Total 1298

FY 1996 Planned Program:

- 1257 -Conduct a comprehensive test to characterize damage development in scaled composite tensile coupons at intermediate tension levels using x-ray techniques, and evaluate the use of real-time continuous x-ray methods.
  -Conduct crash tests of a Learfan 2100 fuselage with and without modified energy absorbing subfloor.
  -Complete analysis and test of tiltrotor model with composite tailored "thin" wing and active vibration control using both wing flaps and swashplate actuators.
  -Validate 3D finite element analysis (FEA) for predicting delamination onset in tapered laminates under combined tension-bending loads; document damage tolerance design criteria for low velocity impact damage; validate advanced p-version FEA.
  -Investigate artificial intelligence (AI) pre/post processing science for applications to advanced non-destructive evaluation (NDE) methods.
- 6 -SBIR/STTR.
- 5 -Revised economic assumption not available for execution.

Total 1268

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT AH66

FY 1997 Planned Program:

•	1372	-Develop an improved analytical model for predicting the size effect on strength for advanced composite materials. -Use Vlasov analysis with optimization algorithm to study how to design more efficient energy absorbing fuselage frames specifically looking at the effect of tapered beam cross sections. -Initiate fabrication of a new "low noise" tiltrotor blade system for the model in the NASA Langley Transonic Dynamic Tunnel (TDT). -Develop improved analyses for predicting onset and progression of damage in woven and braided composites; transition advanced stress analysis methods to 3D woven composite structures. -Develop advanced NDE technology to integrate sensors and AI for enhanced structural integrity monitoring. -Analyze and evaluate advanced computational science methods for error detection and adaptive mesh refinement.
Total	1372	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	1362	1302	1381
Appropriated Amount (FY 1995)	1334		
Adjustments to FY 1995	-36		
Appropriated Amount (FY 1996)		1280	
Adjustments to FY 1996		-12	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-9
Current Budget Estimate Submit	1298	1268	1372

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BH67

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH67 Environmental Research - Army Material Command	4959	5474	5707	5855	7009	8185	8355		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project BH67 - Environmental Research - Army Materiel Command:** This project focuses basic research on technologies for pollution prevention related to Army Materiel Command materiel development programs. The objectives are to: establish a technology base for pollution prevention and life cycle management of hazardous materials and wastes; develop innovative key technologies to reduce the cost and risk of the Army's environmental challenge. Program 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 coatings for metal and composite surfaces. This project is linked to the Tri-Service Environmental Quality R & D Strategic Plan and addresses environmental technology requirements addressed in that plan.

FY 1995 Accomplishments:

- 2165 -Established the feasibility of explosive composition bioconversion.
  -Initiated aqueous processing of membrane structures, optimized processing for aqueous based degreasing and explored biomimetic processes for lightweight protective ceramics application.
  -Measured photochemical properties (primary decomposition products/branching ratios) of halon alternative compounds (HACs), and thermal (non-photochemical kinetics) for HAC decomposition products.
  -Developed a new environmentally friendly trinitrotoluene (TNT) production method without redwater generation.
- 2794 -Initiated controlled plant studies and tested terrestrial microcosm sensitivity.
  -Assessed toxicity of tungsten penetration in human cell lines and compared to published values.
  -Identified enzymatic pathway for hydrolyzed mustard metabolism and cloned genes for several G-agent degrading enzymes.

Total 4959

FY 1996 Planned Program:

- 3378 -Apply genetic engineering techniques to both synthesis and bioconversion applications as a means for process optimization.
  -Complete all basic research work in aqueous based degreasing and lightweight protective ceramics and initiate transition of all programs to exploratory development.
  -Develop kinetic models for atmospheric fate of chloroflourocarbons (CFx) and other species for most promising HACs; perform quantum chemical simulations of infrared spectra for HAC decomposition products (for global warming predictions).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BH67

FY 1996 Planned Program: (continued)

		-Down-select most promising DENOx additives; measure compatibility and aging characteristics of candidate propellant formulations.
•	1964	-Conduct laboratory validations of plant studies and evaluate aquatic microcosm systems. -Use the cytosensor to monitor status of soil microbial consortia. -Optimize biodegradative systems for mustard and sarin and evaluate biosurfactant/nutrient addition treatments for remediation of APG and SAEP soils.
•	16	-Revised economic assumptions not available for execution.
•	116	-SBIR/STTR
Total	5474	

FY 1997 Planned Program:

•	3988	-Synthesize cyclic nitramine using enzymatic methods. -Complete all basic research work in aqueous processing of fibers and composites and initiate technology transfer to exploratory development. -Release final reports on halon alternative compounds research and transition to commercial sector for potential non-military applications. -Transition propellant additive results to exploratory development/advanced technology development gun propelling charge development program.
•	1719	-Complete validations and scaling comparisons and transition to site assessment and restoration programs. -Develop procedures for assessing toxic mechanisms (cellular and subcellular) of environmental pollutants. -Optimize biodegradative systems for DS2 and VX and demonstrate the removal of pollutants from water streams by means of enzymes, inorganic solvents and biomagnetic separation technology.
Total	5707	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	7587	5627	6067
Appropriated Amount (FY 1995)	7427		
Adjustments to FY 1995	-2468		
Appropriated Amount (FY 1996)		5529	
Adjustments to FY 1996		-55	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-360
Current President's Budget Submit	4959	5474	5707

Change Summary Explanation:
Funding: FY 95 funds reprogrammed for higher priority requirement.

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AH68

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH68 Processes in Pollution Abatement Technology	410	389	408	444	454	466	476		Continuing	Continuing

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

FY 1995 Accomplishments:

•	410	-Completed microbial degradation studies of explosives. -Set up laboratory and initiated experiments for RDX/HMX (explosives) biodegradation.
Total	410	

FY 1996 Planned Program:

•	380	-Initiate enzymatic studies of explosives degradation. -Identify bacterial cultures in RDX/HMX (explosives) biodegradation.
•	9	-SBIR/STTR
Total	389	

FY 1997 Planned Program:

•	408	-Complete enzymatic studies of explosives degradation. -Isolate/identify microbial genera and define pathways in nitrocellulose (NC), nitroglycerine (NG), and dinitrotoluene (DNT) degradation.
Total	408	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 EXHIBIT)	DATE: March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AH68

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	432	400	420
Appropriated Amount (FY 1995)	423		
Adjustments to FY 1995	-13		
Appropriated Amount (FY 1996)		393	
Adjustments to FY 1996		-4	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-12
Current President's Budget Submit	410	389	408

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS04

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BS04 Military Pollutants and Health Hazards	722	666	696	756	773	794	811		Continuing	Continuing

A. **Mission Description and Budget Item 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 Biomedical Research and Development Laboratory (USABRDL) and U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM).

FY 1995 Accomplishments:

•	722	-Characterized interspecies variability in selected immunotoxicity endpoints (USABRDL). -Developed improved cancer assessment model incorporating new cell proliferation assays (USABRDL). -Assessed the sensitivity of new immunotoxicity models to pollutants found at Army sites (USABRDL). -Identified specific tumor suppressor genes in non-mammalian models (USABRDL).
Total	722	

FY 1996 Planned Program:

•	649	-Explore improvements in specific environmental toxicity methods (USABRDL). -Identify sentinel biomonitoring systems (USABRDL). -Explore cross-species extrapolation of non-mammalian bioassay systems (USABRDL/CHPPM). -Identify methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL). -Conduct research on molecular biomarkers (CHPPM).
•	2	-Revised economic assumption not available for execution.
•	15	-SBIR/STTR
Total	666	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 EXHIBIT)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS04

FY 1997 Planned Program:

•	446	-Continue to explore improvements in specific environmental toxicity methods (USABRDL). -Identify additional sentinel biomonitoring systems (USABRDL). -Continue exploration of cross-species extrapolation of non-mammalian bioassay systems (USABRDL/CHPPM).
•	250	-Refine identification of methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL). -Continue research on molecular biomarkers (CHPPM).
Total	696	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	738	685	717
Appropriated Amount (FY 1995)	722		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		673	
Adjustments to FY 1996		-7	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-21
Current President's Budget Submit	722	666	696

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS11

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BS11 Science Base/Medical Chemical Defense	7381	0	0	0	0	0	0		0	7381

A. Mission Description and Budget Item Justification: Project BS11-Science Base/Medical Chemical Defense: This project emphasizes understanding of the basic mechanisms of action of nerve, blister, blood, and respiratory agents. Basic studies are performed to delineate mechanisms and site of action of identified and emerging chemical threats to generate required information for initial design and synthesis of medical countermeasures. In addition, these studies are further designed to maintain and extend a science base to prevent technologic surprises. Beginning in FY 96, funding for this project is transferred to DoD PE 0601384BP.

FY 1995 Accomplishments:

- 3547 -Detected reactivity of monoclonal antibody, fragmentation of DNA within three hours post exposure to sulfur mustard (HD)
  -Determined dose-and time-dependent expression of DNA stand breaks and dose-dependent degranulation of mast cells in HD exposure.
  -Applied microdialysis procedures to animal models to measure time course of neurochemical changes following anticonvulsant treatment.
- 3834 -Mutated human butyrylcholinesterase (HuBuChE) in such a way that it is not inhibited by nerve agents but continues to hydrolyze cholinesterase.
  -Characterized soman steroisomers by nuclear magnetic resonance (NMR) spectroscopy.
  -Evaluated animal models for screening reactive topical skin protectant (r-TSP).
  -Established model to predict pathophysiology and course of chemical agent damage to lung tissue.
  -Measured levels of amines, amino acids and inhibitory neuro transmitters in several brain regions following nerve agent seizures.

Total 7381

FY 1996 Planned Program: Project moved to DoD PE 0601384BP, project number 511.

FY 1997 Planned Program: Project moved to DoD PE 0601384BP, project number TC1.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	8087	0	0
Appropriated Amount (FY 1995)	7745		
Adjustments to FY 1995	-364		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current President's Budget Submit	7381	0	0

Change Summary Explanation:

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS12

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BS12 Science Base/Medical Biological Defense	14273	0	0	0	0	0	0		0	14273

A. Mission Description and Budget Item Justification: Project BS12-Science Base/Medical Biological Defense: This project funds exploratory research on the development of vaccines and drugs to provide an effective medical defense against validated biological threat agents including bacteria, toxins, viruses and other agents of biological origin. By employing biotechnology, medical systems will be designed to rapidly identify, diagnose, prevent, and treat disease due to exposure to biological threat agents. Beginning in FY 96, funding for this project is transferred to DoD PE 0601384BP.

FY 1995 Accomplishments:

•	14273	-Investigated genetics and physiology of threat agents; developed expression vector for a recombinant Plague vaccine. -Discovered, cloned and sequenced a membrane proteins to include those associated with Brucella that are useful for vaccines and diagnostic assays. -Studied genetic composition of threat agents; cloned, sequenced and expressed filovirus proteins and developed an infectious clone of the Western equine encephalitis virus for vaccine preparation. -Studied mechanisms of action of toxins; designed synthetic analogs for botulinum toxin assays.
Total	14273	

FY 1996 Planned Program: Project moved to DoD PE 0601384BP, project number 512.

FY 1997 Planned Program: Project moved to DoD PE 0601384BP, project number TB1.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	15149	0	0
Appropriated Amount (FY 1995)	14574		
Adjustments to FY 1995	-301		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	14273	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS13

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BS13 Science Base/Medical research Infectious Disease	9310	9282	9815	10004	10244	10514	10736		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project BS13-Science Base Medical Research Infectious Disease:** This project funds basic research on medical countermeasures for naturally occurring diseases which are militarily significant due to their potential impact on military operations. Development of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations.

FY 1995 Accomplishments:

- 5655 -Expressed nucleic acid malaria vaccine candidates and the binding domain of a malaria protein. Evaluated lead antiparasite extracts from natural products and cloned selected parasites with known drug resistance.
  -Tested improved repellents and discovered key markers in the genome of malaria vectors. Improved diagnostic tests for leishmaniasis.
  -Determined incidence rates of shigella diarrhea at potential field sites in Vietnam and Brazil. Identified immunodominant regions of virulence determinants for shigella and identified the function of a plasmid gene.
  -Cloned and sequenced the EAST-1 gene from classical enterotoxigenic E coli; determined the incidence and antibiotic susceptibility of Campylobacter diarrhea during a deployment in Thailand. Discovered novel processes for production of diarrhea vaccines.
- 3655 -Determined etiology of emerging infections affecting deployed forces. Validated laboratory models for preclinical screening candidate vaccines against meningitis, wound infections, gonorrhea, and group A streptococcus.
  -Prepared novel cDNA and killed dengue vaccine candidates and prepared field sites to test candidates. Investigated the threat of Rift Valley Fever and Hantaan Viruses.
  -Evaluated measures for the rapid diagnosis of dengue, malaria, scrub typhus, and hepatitis E. Identified a new hepatitis virus found in Peru, Egypt, and Indonesia.
  -Defined risk factors of antibiotic resistant scrub typhus and identified a new ecology including new vectors in rice fields in Thailand.

Total 9310

FY 1996 Planned Program:

- 9010 -Determine if there is natural immunity to re-infection by hepatitis E virus; identify technology to distinguish pathogenic strains of E. coli; identify means to prepare attenuated campylobacter strains as potential vaccine candidates.
  -To support CAD of antimalarial drugs: identify key malaria parasite enzymes; clone and characterize key malaria enzyme; clone and characterize resistance genes.
  -Assess clinical importance of emerging scrub typhus resistance to antibiotics.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS13

FY 1996 Planned Program: (continued)

-Identify key antigens of blood stage Plasmodium vivax capable of inducing protective immunity against relapsing malaria.
-Assess threats of high hazard viral diseases to global military operations.

- • 65 -Revised economic assumption not available for execution.
- • 207 -SBIR/STTR

Total 9282

FY 1997 Planned Program:

- • 9815 -Begin exploratory efforts for Norwalk virus gastroenteritis vaccine.
-To support structure based CAD of antimalarial drugs: express and crystallize malaria enzymes for determination of 3D molecular structure; express drug resistance genes, identify drug resistance mechanisms.
-Identify means to produce subunit (pilus, capsule or LPS conjugate) macromolecules as potential gonorrhea vaccines; identify monoclonal antibodies against wound infecting bacteria that protect animals from systemic septic shock.
-Begin exploratory efforts on a leishmania vaccine.
-Identify technology to improve site directed delivery of vaccine components; begin exploratory efforts directed at a West Nile fever vaccine.

Total 9815

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	9892	9543	10107
Appropriated Amount (FY 1995)	9531		
Adjustments to FY 1995	-221		
Appropriated Amount (FY 1996)		9376	
Adjustments to FY 1996		-94	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-292
Current President's Budget Submit	9310	9282	9815

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences PROJECT BS14

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BS14 Science Base/Combat Casualty Care Research	4407	4217	4459	4546	4656	4778	4878		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project BS14-Science Base/Combat Casualty Care:** This project supports research to understand the basic mechanisms of combat related trauma. This research identifies trauma related topic areas, develops exploratory techniques, and initiates the experimental models necessary to support in-depth trauma research studies. This research is the basis for the development of trauma treatment and surgical procedures to extend "the golden hour" following trauma injury, minimize lost duty time from minor battle and non-battle injuries and combat stress, and provide military medical capabilities for far-forward medical/surgical care of battle and non-battle injuries.

FY 1995 Accomplishments:

- 3450 -Developed models and methods to explore basic mechanisms of toxicity induced by model hemoglobin-based blood substitute compounds.
  -Demonstrated that an Army-discovered carbetapentane analog was among the most effective compounds known in protecting against focal brain injury in rats; explored mediators and potential protective measures against organ failure, including hypothermia and induction of heat shock proteins.
  -Characterized microorganisms responsible for burn wound sepsis clinically, and conducted studies to identify new treatments for emerging resistant organisms.
  -Demonstrated passive protection in animal models of sepsis with antisera from animals immunized with E. coli J5 lipopolysaccharide.
- 957 -Initiated animal studies to identify whether androgenic anabolic steroid is beneficial in improving outcome strength in muscles with partial lacerations.
  -Demonstrated feasibility of chemical fiber optic monitors for monitoring the development of lactic acidosis, as a means to identify early tissue damage following injury.
  -Explored prognostic factors to guide treatment decisions for management of smoke inhalation injury.

Total 4407

FY 1996 Planned Program:

- 2024 -Characterize physiological effects of hemoglobin in animal models.
  -Develop models for evaluation of fibrin-based hemostatic bandages to control hemorrhage.
  -Continue microbiological surveillance of burn victims and explore role of endocrine and other mediators in burn wound infection and hypermetabolism.
- 2086 -Complete development of spinal cord injury model; characterize effects of lead candidate neuroprotective compounds; evaluate protective effects of heat shock protein overexpression.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS14

FY 1996 Planned Program: (continued)

-Identify critical physiological markers following hemorrhage and trauma for non-invasive sensor development; expand inventory of "smart fiber" sensor materials to offer greater choices for minimally invasive measurements.
-Evaluate potential countermeasures to ameliorate smoke inhalation injury and improve outcome in a small animal injury model.

•	12	-Revised economic assumption not available for execution.
•	95	-SBIR/STTR
Total	4217	

FY 1997 Planned Program:

•	4459	-Identify potential countermeasures for hemoglobin toxicity. -Identify basic mechanisms of central nervous system damage occurring secondarily to trauma; explore basic mechanisms of organ failure in shock. -Explore role of endocrine and other mediators in burn wound infection and hypermetabolism; continue microbiological surveillance of burn victims. -Conduct animal testing of miniature, fiber optic, catheter based blood gas monitor for base deficit determination. -Conduct additional evaluations of potential countermeasures for smoke inhalation injury in small and large animal injury models; evaluate countermeasures for musculoskeletal injury.
Total	4459	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4495	4336	4593
Appropriated Amount (FY 1995)	4485		
Adjustments to FY 1995	-78		
Appropriated Amount (FY 1996)		4260	
Adjustments to FY 1996		-43	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-134
Current President's Budget Submit	4407	4217	4459

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: BS15

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BS15 Science Base/Army Operational Medicine Research	7006	6884	6591	6931	7098	7284	7438		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project BS15-Science Base/System Health Hazards Research:** The scientific and technical objectives for this project focus on physiological and psychological factors limiting soldiers' effectiveness, and on the characterization of health hazards generated by military systems and resulting from military operations. Research is conducted on military 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 military relevant toxic chemicals 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. Research efforts are categorized by five major thrust areas: Operational Medicine and Performance; Environmental Extremes; Directed Energy Bioeffects; Toxic Hazards Health Effects; and Biodynamic Stresses.

FY 1995 Accomplishments:

•	7006	-Identified non-invasive biological markers of stress (salivary cortisol) for determining effects of exposure to chronic stress. -Determined the effects of blast overpressure (BOP) air emboli on cardiac contractility and output. -Demonstrated that caffeine ingestion improved submaximal exercise performance at altitude. -Obtained first histologic evidence of retinal damage mechanism following picosecond duration laser exposures. -Evaluated assays for use in rapid screening of militarily relevant female reproductive toxins.
Total	7006	

FY 1996 Planned Program:

•	6711	-Identify candidate compounds to enhance the restorative values of short duration sleep periods. -Characterize gender related differences in susceptibility to heat-induced injuries. -Characterize the time-course of ocular injury from ultra short-pulse laser pulses. -Determine role of antioxidants in prevention of tissue damage from blast overpressure and toxic gas exposure. -Identify the cellular consequences of hyperthermia useful for heat stress prevention.
•	19	-Revised economic assumption not available for execution.
•	154	SBIR/STTR
Total	6884	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT BS15

FY 1997 Planned Program:

•	6591	-Identify strategies for preventing stress-induced suppression of immune function. -Identify nutritional and pharmacological strategies to reduce incidence and severity of cold-induced injuries. -Characterize the time course of injury from high-peak power, short-pulse duration microwave radiation. -Characterize health effects of combustion products from propellants from advanced weapon systems. -Investigate cochlear "toughing" as a potential means to reduce noise-induced hearing loss.
Total	6591	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	7396	6403	6788
Appropriated Amount (FY 1995)	7241		
Adjustments to FY 1995	-235		
Appropriated Amount (FY 1996)		6954	
Adjustments to FY 1996		-70	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-197
Current President's Budget Submit	7006	6884	6591

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences PROJECT BS16

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BS16 Science Base/Combat Dentistry Research	528	482	545	558	572	586	598		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project BS16 - Science Base/Combat Dental Research: This project supports biomedical research directed toward understanding basic biological mechanisms underlying repair of militarily relevant maxillofacial injuries. This research is of fundamental importance to the development of treatment which enhance survival and sustain warfighting capability following battle and non-battle injuries.

FY 1995 Accomplishments:

•	528	-Evaluated efficacy and safety of a biodegradable hemostatic agent to control osseous bleeding during maxillofacial surgery. -Prepared candidate materials for use in a biodegradable bone screw and other biodegradable bone fixation products. -Evaluated effects of microencapsulated ampicillin on immunity; produced tobramycin macrobeads providing sustained release of drug in vitro , for further evaluation as a locally applied antibiotic. -Assessed new fabrication methods in computerized powder deposition/welding and in stereo lithography pertinent to CAD/CAM of surgical prostheses.
Total	528	

FY 1996 Planned Program:

•	469	Complete strength testing of candidate materials, and fabricate and conduct mechanical testing of biodegradable bone screws. Explore conventional and exotic fabrication techniques to replicate synthetic bone repair.
•	2	-Revised economic assumption not available for execution.
•	11	-SBIR/STTR
Total	482	

FY 1997 Planned Program:

•	545	-Evaluate efficacy and safety of biodegradable bone screws in animal injury models. -Develop capability to fabricate bone replicas from 3-D in-house obtained data using CAD/CAM algorithms and in-house machine tools.
Total	545	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences PROJECT BS16

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	552	496	561
Appropriated Amount (FY 1995)	532		
Adjustments to FY 1995	-4		
Appropriated Amount (FY 1996)		487	
Adjustments to FY 1996		-5	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-16
Current President's Budget Submit	528	482	545

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT BS17

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BS17 Molecular Biology/Military HIV Research	894	908	932	999	1024	1049	1071		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project BS17-Molecular Biology/Military HIV Research: This project provides for basic research for early diagnosis and identification of technologies to design prevention and treatment of HIV. The present emphasis is on identification and comparison of HIV strains from many geographical locations, characterization of etiologic agents and definition of tests for epidemiological surveys to design a vaccine to prevent disease. Current policy prohibits OCONUS assignments of antibody positive service members. A safe and effective vaccine for prevention of infection and intervention will permit all service members to become worldwide deployable.

FY 1995 Accomplishments:

•	894	-Completed studies on an applied new technology to expand and modify human T cells in the laboratory for immune construction of military personnel. -Evaluated a second generation PCR assay to detect HIV in blood. -Studied non-progressor HIV infections and the worldwide variability of the HIV genome to select an attenuated vaccine candidate. -Completed analysis of the Army-wide HIV/AIDS survey (AWAS) of behavior.
Total	894	

FY 1996 Planned Program:

•	885	Construct recombinant vaccine candidates that use attenuated Salmonella to express HIV antigens. Expand studies of the HIV genome of worldwide strains of HIV to select vaccine candidates. Study the relationship between infections with HIV-1 and HIV-2 as a possible modifier of the progression of HIV infections.
•	3	-Revised economic assumption not available for execution.
•	20	-SBIR/STTR
Total	908	

FY 1997 Planned Program:

•	932	-Evaluate preclinically naked DNA as a vaccine candidate based upon information obtained from worldwide variability of the HIV genome. -Study transmission kinetics of newly introduced HIV types. -Determine potential for an alphavirus-vectored HIV DNA recombinant vaccine construct.
Total	932	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: BS17

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	954	933	959
Appropriated Amount (FY 1995)	934		
Adjustments to FY 1995	-40		
Appropriated Amount (FY 1996)		917	
Adjustments to FY 1996		-9	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-27
Current President's Budget Submit	894	908	932

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences	PROJECT AT22

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AT22 Soil and Rock Mechanics	1970	1946	2057	2097	2148	2205	2251		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u>: **Project AT22 - Soil and Rock Mechanics:** Basic research in this project develops the fundamental knowledge base required by the Army in the field of civil engineering. Current emphasis is on: determining and quantifying the non-linear, hysteretic response of deformable soils to transient loadings resulting from high-speed curvilinear vehicle maneuver; defining the constitutive behavior and penetration mechanics (including plastic deformation and microfracture mechanics) associated with projectile impact on complex geologic and structural materials; development of mathematical models needed for first principle analyses of explosive-induced ground shock and high-velocity projectile impact; development of analytic models and advanced construction materials for the design and construction of permanent or expedient operating surfaces both within CONUS and within a theater of operations; investigation of soil electromagnetic properties that affect in-situ obstacle discrimination and development of adaptive or responsive construction materials suitable for camouflage, concealment, and deception measures for fixed or semi-fixed assets. These technologies provide the basis for applied research to provide: analytical capabilities for mobility assessments; hardened battlefield positions, fixed facilities, and semi-fixed assets; multispectral camouflage, concealment, and deception for fixed facilities; and advanced vertical and horizontal construction materials in PE 0602784A, Project AT40.

FY 1995 Accomplishments:

•	1355	-Developed finite element code for dynamic structural analysis of deformable projectiles during penetration into geologic/concrete materials; conducted constitutive property analysis of high strength concretes for structural hardening. -Developed aggregate soil theory for evaluating soil subject to large-discontinuous soil deformations (dry and saturated soil conditions); compared aggregate soil theory with large-scale particle theory. -Verified electromagnetic propagation model via controlled field experiments.
•	615	-Performed laboratory analysis of advanced responsive/passive composite materials for potential use in fixed-facility camouflage. -Developed and implemented predictive model for response of granular pavement layers. (370)
Total	1970	

FY 1996 Planned Program:

•	1897	-Develop pavement fracture and durability mechanics models for application in predicting pavement performance. -Quantify performance parameters of advanced high-strength structural materials for anti-penetration shields/hardened structures. -Validate soil/climatological relationships for soil-moisture strength prediction in humid microthermal, undifferentiated highland, and humid esothermal climates. -Provide quantitative recommendations for designing/selecting a sensor suite for in-situ discrimination applications. -Perform quantitative evaluations and matching of selected responsive/passive materials to backgrounds.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AT22

FY 1996 Planned Program: (continued)

•	6	-Revised economic assumption not available for execution.
•	43	-SBIR/STTR
Total	1946	

FY 1997 Planned Program:

•	2057	-Develop first-principle computer code to calculate long-rod penetrator performance during normal impact against concrete targets. -Validate and document soil/climatological relationships for predicting/evaluating soil-moisture strength world wide. -Develop substrate specifications for materials to host responsive/passive concealment and camouflage deception (CCD) laminate materials. -Develop dynamic constitutive models for pavement materials and complete preliminary formulation of traffic distribution model.
Total	2057	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2046	2000	2118
Appropriated Amount (FY 1995)	2003		
Adjustments to FY 1995	-33		
Appropriated Amount (FY 1996)		1965	
Adjustments to FY 1996		-19	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-61
Current President's Budget Submit	1970	1946	2057

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences PROJECT AT23

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AT23 Basic Research/Military Construction	1708	1737	1784	1844	1889	1939	1979		Continuing	Continuing

A. **Mission Description and Budget Item 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 ambitious infrastructure cost reduction goals of the current national military strategy. This project supports exploratory development efforts in Program Element 0602784A, Projects AT41 and AT45. This project also supports related Defense Modeling and Simulation Office-funded applications, and has significant dual use application potential.

FY 1995 Accomplishments:

•	1708	-Developed machine learning methods for a task modeling environment and for merging and versioning next generation concurrent engineering models. -Constructed models and concepts for integrating molecular "tags" into composite materials to enable creation of "smart building materials" that can be remotely queried to perform condition analyses.
Total	1708	

FY 1996 Planned Program:

•	1693	-Incorporate abstract models that relate graphical display to mental models of users from different engineering disciplines. -Develop capability to integrate collaborative software systems. -Develop algorithms to predict post-elastic structural response of single degree of freedom systems under triaxial loading.
•	5	-Revised economic assumption not available for execution.
•	39	-SBIR/STTR
Total	1737	

FY 1997 Planned Program:

•	1784	-Develop models for self-responding self-repairing composites for infrastructure applications. -Develop models to predict the behavior of materials under load histories simulating earthquakes.
Total	1784	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: AT23

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1776	1785	1838
Appropriated Amount (FY 1995)	1738		
Adjustments to FY 1995	-30		
Appropriated Amount (FY 1996)		1754	
Adjustments to FY 1996		-17	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-54
Current President's Budget Submit	1708	1737	1784

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: AT24

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AT24 Snow, Ice and frozen Soil	1254	1241	1313	1337	1369	1406	1437		Continuing	Continuing

A. **Mission Description and Budget Item Justification**: Project AT24 - Snow, Ice, and Frozen Ground. 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 material, operations, and facilities. It provides the knowledge base for exploratory development 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 0602784, Project AT42, as well as specific Navy and Air Force science and technology efforts, and forms the basis for much civilian applied research in these areas. It provides the fundamental knowledge base for developing concepts and approaches to upgrade materiel and doctrine for more effective performance in these challenging conditions.

FY 1995 Accomplishments:

•	1254	-Developed millimeter wave (MMW) scattering model for multiphase media. -Modeled unsteady freezing of soils under loads for infrastructure design. -Related structural icing accumulation processes to winter storm characteristics and quantified vapor transport and solute release mechanisms in snow.
Total	1254	

FY 1996 Planned Program:

•	1210	-Develop concept for integrated millimeter wave (MMW)/infrared (IR) signature modeling for snow covered terrain. -Model freezing effects on soil chemistry and behavior. -Define effects of electrical charging on snow friction and evaluate snow as a chemical absorption agent.
•	3	-Revised economic assumption not available for execution.
•	28	-SBIR/STTR
Total	1241	

FY 1997 Planned Program:

•	1313	-Develop first principals radar scattering model for ice. -Develop 2- and 3-D models for freeze/thaw in saturated soils. -Develop analysis of atmospheric icing persistence; develop a dynamic model of ice inclusion size distribution.
Total	1313	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT AT24

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1305	1276	1352
Appropriated Amount (FY 1995)	1278		
Adjustments to FY 1995	-24		
Appropriated Amount (FY 1996)		1254	
Adjustments to FY 1996		-13	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-39
Current President's Budget Submit	1254	1241	1313

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT BT25

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BT25 Environmental Research - Corps of Engineers	6653	3480	3652	3696	5073	5205	5314		Continuing	Continuing

A. **Mission Description and Budget Item Justification**: This project provides the basic research needed to develop the technologies to address Army issues in the cleanup, compliance, conservation and pollution prevention areas. The focus in cleanup provides the basic knowledge needed to develop physical, chemical and biological technologies to clean up the Army's contaminated sites. In compliance and pollution prevention, efforts address knowledge gaps vital to maintaining compliance at non-industrial installations and fundamentals of training and test activity noise as they might be applied to reducing adverse effects on mission activities. The focus in conservation is on landform and ecological modeling and 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 exploratory development efforts in PE 062720A, Projects AF25, D048, and A896. 65% of the funds in this project are used to support extramural research via a Broad Area Announcement requesting proposed work supporting in-house laboratory efforts.

FY 1995 Accomplishments:

•	2180	-Designed benchmark set of dynamic spatial applications for modeling complex environmental phenomena.
		-Initiated dynamic, spatial ecological modeling and simulation package development using set of existing models.
•	2613	-Tested propagation of cryptogamic vegetation under field conditions.
		-Developed methodologies for determining directions of arrival of blast noise.
		-Developed criteria and application control options for vitrification.
		-Completed environmental effects studies on degradation of TNT by Cyanobacteria Mats.
•	1860	-Analyzed the dynamics of explosive residue and contaminant exchange at snow/air and water/ice interfaces.
		-Initiated investigations to determine fundamental mechanisms of chemical transport in subsurface porous media.
		-Initiated investigations to develop fundamental understanding of sensor technologies for site characterization and analysis penetrometer.
Total	6653	

FY 1996 Planned Program:

•	3394	-Develop species risk and richness models.
		-Develop fundamental understanding of impulse sound propagation.
		-Investigate fundamental mechanisms of spectral response for contaminant identification and quantification.
		-Investigate solute exclusion and contaminant transport for frozen, snow-covered and ice-covered regimes and wetlands.
		-Initiate research to understand the role of biodiversity in ecosystem integrity.
		-Continue development of geomorphological process modeling for archeological site and soil erosion predictions.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT BT25

FY 1996 Planned Program: (continued)

•	9	-Revised economic assumption not available for execution.
•	77	-SBIR/STTR
Total	3480	

FY 1997 Planned Program:

•	3652	-Develop variance models for patterns of biodiversity and evaluate remote monitoring technologies for threatened and endangered species responses to Army training. -Develop erosion control techniques using cryptograms. -Identify fundamentals of spatial data visualization and registration. -Investigate fundamental science of biosensor technology for application to site characterization. -Evaluate soil, snow, ice, and contaminant parameters necessary to provide data fusion to describe transport processes in cold regions, -Continue the research on the role of biodiversity in ecosystem integrity. -Determine transportation mechanisms in heterogeneous multiphase soil systems.
Total	3652	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4758	3579	3860
Appropriated Amount (FY 1995)	4658		
Adjustments to FY 1995	+1995		
Appropriated Amount (FY 1996)		3516	
Adjustments to FY 1996		-36	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-208
Current President's Budget Submit	6653	3480	3652

Change Summary Explanation: FY 95: Reprogrammed from PE 0601102A project BH67 to perform Corps of Engineers work under this project.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT A305

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A305 Automatic Target Recognition Research	1429	1045	1156	1182	1214	1254	1287		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A305 - Automatic Target Recognition (ATR) Research:** This project focuses on the battlefield environment with its very challenging ground clutter problem, including areas not being addressed by the other Services, such as: automatic model-based generation of automatic target recognition (ATR) search trees; ATR physically implemented on the focal plane array; model-based automatic recognition of one dimensional infrared signals (chemical detection); information-based theories applied to target signature analysis; and low depression angle, short range scene modeling for target acquisition and endgame.

FY 1995 Accomplishments:

- 1429 -Investigated image compression of SAR and FLIR images using wavelet vectoquantization.
  -Performed synthetic aperture radar (SAR) image model evaluation.
  -Increased the efficiency of high quality scene modeling towards real time scene simulation.
  -Developed an algorithm capable of generating a multisensor ATR algorithm with near optimal performance from mathematical imagery model input.

Total 1429

FY 1996 Planned Program:

- 1034 -Extend recent advances made in speech and handwriting recognition to develop a hierarchical hybrid neural model-based ATR algorithm structure for the 2-D ATR problem.
  -Investigate recent advances in the sciences of combinatoral optimization & computational geometry to approach near optimal search solutions for ATR algorithms.
  -Develop modeling techniques which allow the extension of multi-spectral scene generation (MSSG) to synthetic environment applications.
- 7 -SBIR/STTR.
- 4 -Revised economic assumption not available for execution.

Total 1045

FY 1997 Planned Program:

- 1156 -Develop hierarchical syntax/grammar for hybrid neural model based ATR algorithms to include higher level model structures.
  -Apply learning theory to the ATR problem in order to automate the feature selection process.
  -Develop techniques for extension of MSSG to real-time virtual reality environment.

Total 1156

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT A305

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	1617	1073	1169
Appropriated Amount (FY 1995)	1583		
Adjustments to FY 1995	-154		
Appropriated Amount (FY 1996)		1055	
Adjustments to FY 1996		-10	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-13
Current Budget Estimate Submit	1429	1045	1156

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: A31B

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A31B Infrared Optics Research	2426	2083	2281	2326	2379	2447	2505		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A31B - Infrared Optics Research:** This project sustains the Army's theoretical and experimental research in night vision and electro-optic technology. It generates new technologies so we can continue to "own the night," notwithstanding increased foreign competition. The research is focused upon new dual-use materials, devices and techniques relative to infrared focal plane arrays (IRFPAs), directed energy sources and protection against directed energy sources. Emphasis is placed on the development of technology for high performance smart IRFPAs and on uncooled low-cost medium performance IRFPAs based on thin film ferroelectric materials. Applications for uncooled IRFPAs include improved night navigation and surveillance for both military and civilian usage. In the directed energy arena, efforts are focused on wide bandgap laser diode arrays that emit in the blue, blue-green wavelength regions, new tunable laser sources in the visible wavelengths and development of frequency diversity techniques to obtain directed energy in the 3-5 micron region. Main Army applications are for countermeasures and remote chemical detection. There are many important civilian applications, such as: optical recording/storage, optical image processing, optical computing, display devices, and medical non-invasive imaging. 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 storage.

FY 1995 Accomplishments:

•	2426	-Optimized Si/GaAs/CdZnTe structures for mercury cadmium telluride (HgCdTe) detector growth. -Demonstrated efficient, directed energy conversion through optical parametric amplifier in the 3-5 micron region. -Processed laser diode array on Si/GaAs substrate for chip to chip communication. -Demonstrated uncooled IRPFA based on thin film ferroelectrics.
Total	2426	

FY 1996 Planned Program:

•	2075	-Fabricate blue/green laser diodes for compact, efficient, visible laser sources and demonstrate room temperature operation for high efficiency pumping of visible laser sources for optical countermeasures and non-lethal weapons. -Deliver an optimized, efficient 3-5 mm optical parametric oscillator (OPO) to provide tunable laser output in the required wavelength bands for IR countermeasures (IRCM) to Night Vision Electronics Sensors Directorate (NVESD).
•	1	-SBIR/STTR.
•	7	-Revised economic assumption not available for execution.
Total	2083	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: A31B

FY 1997 Planned Program:

•	2281	-Fabricate, demonstrate blue/green laser diode array with greater power than a single diode and which will be a compact efficient laser source alone, or capable of pumping visible emitting laser materials for greater efficiency devices for optical countermeasures and non-lethal weapons. -Demonstrate and deliver to NVESD an optimized visible emitting laser material that can be pumped with blue/green laser diode arrays for a compact, efficient, higher power laser source that emits in the visible. These components will be integrated into the advanced lightweight countermeasure system (LCMS) for the Infantry School and for biological agent detection systems.
Total	2281	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2478	2141	2288
Appropriated Amount (FY 1995)	2426		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		2103	
Adjustments to FY 1996		-20	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-7
Current Budget Estimate Submit	2426	2083	2281

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: B52C

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
B52C Mapping and Remote Sensing	2470	2471	2612	2663	2726	2798	2856		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project B52C - Mapping and Remote Sensing:** This project supports research in fundamental topographic sciences to improve the tactical commander's knowledge of the battlefield; to extract natural and man-made features from reconnaissance imagery in near-real time; to exploit terrain reasoning/artificial intelligence techniques for distributive interactive simulation (DIS) and for combat planning and operations; to support unmanned/autonomous vehicle navigation using sensor enhanced dynamic data bases; and to explore the potential of space technology to provide real-time terrain intelligence, command and control, and targeting support. The research provides the theoretical underpinnings for Program Element 0602784A, Project A855

FY 1995 Accomplishments:

•	2470	-Investigated the application of multi-sensor imagery data for support of simulation and modeling. -Developed neural net/computer algorithms for enhancing image classification accuracy and feature extraction capability from interferometric synthetic aperture radar imagery and integrated with wavelet techniques for image segmentation. -Instrumented desert test site for collecting data on change detection using hyperspectral imagery; developed algorithms for enhancing multi/hyperspectral imagery classification and feature extraction.
Total	2470	

FY 1996 Planned Program:

•	2408	-Investigate techniques to automatically upgrade the accuracy and density of standard (Defense Mapping Agency and U.S. Geological Survey) digital elevation data and design an open architecture system for processing spectral data to support terrain visualization and environmental monitoring. -Assess complex neural net architectures for feature extraction and image classification and perform 3-D image compression with wavelet transformations. -Investigate the application of multiple sensors for detecting and monitoring environmental issues; integrate hyperspectral data and imagery with geographic information systems.
•	8	-Revised economic assumption not available for execution.
•	55	-SBIR/STTR
Total	2471	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT B52C

FY 1997 Planned Program:

- 2612 -Study automated knowledge based feature extraction modules to simplify applications in basic topographic sciences.
  -Validate concept for a wavelet transform/neural network-based image data classification system operating on interferometric synthetic aperture radar data.
  -Research algorithms for enhanced data classification and feature extraction from next generation multi-sensor imagery.

Total 2612

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2598	2539	2690
Appropriated Amount (FY 1995)	2543		
Adjustments to FY 1995	-73		
Appropriated Amount (FY 1996)		2495	
Adjustments to FY 1996		-24	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-78
Current President's Budget Submit	2470	2471	2612

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences PROJECT B53A

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
B53A Battlefield Environment and Signature	5188	5177	3605	3678	3777	3907	4005		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project B53A - Battlefield Environment and Signatures:** Provides in-depth understanding of the complex atmospheric behavior associated with electro-magnetic propagation, transport and diffusion, and remote sensing, which affect Army operations and systems such as electro-optics, smoke deployment and target designators, includes research in techniques for C^2 natural language and logic based reasoning systems. Supports Project Reliance sub-areas of lower atmospheric sciences and terrestrial sciences with a lead role in boundary layer processes and interactions over terrain.

FY 1995 Accomplishments:

- 5188 -Developed high-fidelity atmospheric transport and diffusion model for calculating wind flow and nuclear, biological, chemical (NBC) agent concentration evolution through urban areas.
  -Determined and described the processes that cause the formation and dissipation of boundary layer gravity waves, and define coupling of boundary layer meteorology, radiative, and diffusion models.
  -Developed a prototype counter for detection of single airborne biological particles using laser-induced autofluorescence.
  -Developed high-fidelity visualization/simulation capability by inclusion of polarization effects in the battlefield emission and multiple scattering (BEAMS) model.
  -Developed and evaluated the Weather and Atmospheric Visualization for Environments Simulations (WAVES) suite of models that calculates and visualizes environmental effects due to natural clouds, haze, and fog.
  -Developed 3-dimensional stratified-atmosphere, acoustic propagation theory to account for earth curvature at extended ranges.

Total 5188

FY 1996 Planned Program:

- 2872 -Develop adaptive optical system for mitigation of severe atmospheric-induced phase distortions affecting optical systems.
  -Develop analytical solutions to the nonlinear stochastic Navier-Stokes equations to provide ultra-fast meteorological and turbulence predictions over complex terrain and structures of military significance on the digitized battlefield.
  -Develop a model for boundary layer coherent structures over vegetation.
  -Investigate the utility of fluorescence excitation and emission spectra for differentiating between biological and non-biological aerosol.
- 2258 -Incorporate wind effects and turbulence into 3-dimensional acoustic propagation model.
  -Develop the methodology for mitigation of atmospheric effects in visible color imagery.
  -Integrate user definable geotypical dynamic terrain into synthetic environments.
  -Develop dynamic data transformation approach to support real-time visualization of environmental effects.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: B53A

FY 1996 Planned Program: (continued)

•	30	-SBIR/STTR.
•	17	-Revised economic assumption not available for execution.
Total	5177	

FY 1997 Planned Program:

•	3605	-Perform basic research towards the development of a new generation of self-learning, self-adapting, passive all-optical systems based on neural network principals. -Develop analytical solutions to the coupled nonlinear atmospheric diffusion-advection equations, Navier-Stokes and propagation equations to provide ultra-fast solutions for obscuration, chemical and biological hazard prediction on the digitized battlefield. -Define and characterize the diurnal behavior of the atmospheric boundary layer. -Develop a laser-based method for rapid point detection of biowarfare agents. -Complete prototype 3-dimensional acoustic propagation model for inclusion into acoustic decision aid. -Develop a complete suite of models for characterization and visualizing the battlespace atmospheric environment.
Total	3605	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	5404	5321	5634
Appropriated Amount (FY 1995)	5291		
Adjustments to FY 1995	-103		
Appropriated Amount (FY 1996)		5228	
Adjustments to FY 1996		-51	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-2029
Current Budget Estimate Submit	5188	5177	3605

Change Summary Explanation:
Funding: FY 97 - Restructure of ARL funding (-2029)

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: A71A

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A71A Research in Chemical Warfare/Biological Warfare defense	2951	0	0	0	0	0	0		0	2951

A. Mission Description and Budget Item Justification: **Project A71A - Research in Chemical Warfare/Biological Warfare Defense:** The purpose of this project is to obtain, through basic research in chemistry, physics, mathematics and life sciences, fundamental information in support of: new and improved detection systems for biological agents and toxins; new and improved detection systems for chemical threat agents; advanced concepts in individual and collective protection, new concepts in decontamination and information on the chemistry and toxicology of threat agents and related compounds. Beginning in FY 96, funding for this project is transferred to DoD PE 601384BP.

FY 1995 Accomplishments:

- 2951 -Began study designed to show relationship between binding of surface proteins on pathogens and pathogenesis.
  -Transitioned five methods of agent detoxification to Alternative Technologies Program. Validated new *in situ* detoxification mechanism for VX. Initiated toxicity screen on two of three new threat materials and completed synthesis of the third.
  -Demonstrated matrix assisted laser desorption/time of flight mass spectrometry of bioparticles and documented advantages over electrospray and pyrolytic techniques. Completed construction of a single bioparticle trap coupled to a flourometer and began instrument check out.
  -Developed and evaluated inverse scattering for use in optical detection of microencapsulated particles. Documented new solution to the inversion problem and multiple angle scattering from layered particles.

Total 2951

FY 1996 Planned Program: Project funded in DoD PE 0601384BP, Project 71A.

FY 1997 Planned Program: Project funded in DoD PE 0601384BP, Project CB1.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: A71A

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	3014	0	0
Appropriated Amount (FY 1995)	2951		
Adjustments to FY 1995	0		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	2951	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: B74A

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
B74A Human Engineering	2393	2388	2571	2626	2698	2779	2847		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project B74A - Human Engineering:** This project supports research on soldier performance, including the areas of visual, auditory, cognitive, and stress-related performance. The objective is to identify, describe and manage underlying human-system interface factors critical to the design of Army weapon systems. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP), the Science and Technology Objectives (STOs), and the Army Modernization Plan. All work under this PE is part of the "Human-Systems Interfaces" Tri-Service Reliance Panel.

FY 1995 Accomplishments:

•	2393	-Expanded graphical information display research by developing correct decision aids for ground-combat personnel. -Completed study to isolate human errors due to deficiencies of visual cues caused by limited depth perception with night vision devices. -Established field-of-view and resolution requirements for remote driving. -Proposed international noise standard; demonstrated "meter" for assessing noise hazards. -Developed stress amylase procedures for field use.
Total	2393	

FY 1996 Planned Program:

•	2365	-Conduct studies addressing human ability to detect, recognize and localize sound sources at various spatial locations in both quiet and noise. -Complete a series of field studies evaluating critical design variables (e.g., field-of-view, ocular configuration, image resolution) affecting the use of night vision devices in military operations. -Conduct studies to examine the relationship between various helmet mounted display options and perceptual fatigue and workload. -Validate noise hazard model for complex waveforms with low frequency components characteristic of armored vehicles and other Army materiel. -Complete development and validation of field practical salivary amylase stress measurement technique; expand application of procedure to on-going studies of command and control vehicle operations. -Complete a human performance tradeoff analysis of the vision parameters that affect the ability to navigate and drive a teleoperated vehicle.
•	15	-SBIR/STTR.
•	8	-Revised economic assumption not available for execution.
Total	2388	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102A Defense Research Sciences
	PROJECT B74A

FY 1997 Planned Program:

- 2571 -Continue auditory performance studies addressing human ability to maintain a situation awareness of environments containing multiple sound sources and the effect of practice in detecting and localizing sound signals in noise.
  -Conduct studies to evaluate critical perceptual variables, (e.g., hyperstereopsis) and its effect on the use of night vision devices in military operations.
  -Based on previous studies, develop a model for estimating performance and workload effects of changes in selected parameters of helmet mounted display design.
  -Validate noise hazard model with hearing loss data and demonstrate with time-varying middle ear muscle system (long acting waveforms) characteristic of enclosed crew compartments.
  -Conduct studies on the effects of stress on voice recognition system efficacy.
  -Further define the vision parameters that affect performance in teleoperation, and develop human driving performance model.

Total 2571

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2509	2454	2599
Appropriated Amount (FY 1995)	2456		
Adjustments to FY 1995	-63		
Appropriated Amount (FY 1996)		2411	
Adjustments to FY 1996		-33	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-28
Current Budget Estimate Submit	2393	2388	2571

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: B74F

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
B74F Personnel Performance and Training	2759	2703	2867	3029	3100	3181	3246		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project B74F - Personnel Performance and Training:** This project conducts behavioral science research in the following areas of human performance: variables and processes determining effective group functioning, leader-group interaction, and decision-making; and principles of technology-based instructional methods that promote the learning of cognitive, perceptual-motor, and unit performance tasks by individuals and groups.

FY 1995 Accomplishments:

•	2759	-Completed chronopsychological research contributing to *owning the night*, and explorations of new methodologies for behavioral research and performance analysis. -Extended research on sociological conceptions of functional Army elements, peace operations, and attitudes underlying career choice and enlistment propensity. -Continued analysis of leader behavior as influenced by motivational variables, and revised transformational leadership theory. -Initiated training research on skills needed on the digital battlefield. -Completed research on decision making skills and development of automaticity.
Total	2759	

FY 1996 Planned Program:

•	2635	-Initiate research to improve occupational analysis techniques leading to improved selection, training and assessment of personnel. -Continue initiative on training research to improve skill retention and transfer of skills relevant to future battlefields. -Complete research on organizational commitment and continue analysis of new leader behavior. -Continue research on effects of societal issues on Army morale, cohesion, and retention.
•	8	-Revised economic assumption not available for execution.
•	60	-SBIR/STTR
Total	2703	

FY 1997 Planned Program:

•	2867	-Complete analysis of effects of Army service life course events, and analyze effects of peacekeeping on morale and cohesion. -Initiate research on psychophysiological correlates of elite performance. -Explore the potential of facet analysis and innovative multivariate methods in behavioral research. -Continue research on the improvement of soldier skill training.
Total	2867	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY: 1 - Basic Research	PE NUMBER AND TITLE: 0601102A Defense Research Sciences / PROJECT: B74F

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2872	2778	2952
Appropriated Amount (FY 1995)	2812		
Adjustments to FY 1995	-53		
Appropriated Amount (FY 1996)		2730	
Adjustments to FY 1996		-27	
Adjustment to Budget Year (FY 1997) Since FY 1996 President's Budget			-85
Current President's Budget Submit	2759	2703	2867

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102A Defense Research Sciences

PROJECT: B782

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
B782 Biotechnology Information Facility	9048	0	0	0	0	0	0		0	9048

A. Mission Description and Budget Item Justification: This is a Congressionally-directed project to fund a competitively-awarded grant for computing, data, and communications networks and associated facilities in support of engineering biotechnology facilities. The Army Research Office, Triangle Park, NC, is the responsible agency for performing award of the grant, which will be accomplished in FY 96.

FY 1995 Accomplishments:

•	9048	-Initiated competitively-awarded grant action for biotechnology facilities (to be awarded in FY 96).
Total	9048	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	9865	0	0
Appropriated Amount (FY 1995)	9658		
Adjustments to FY 1995	-610		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	9048	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

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

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	8253	48417	47288	51641	53900	56856	59998		Continuing	Continuing
BH50 Telecommunications Research	0	8472	9081	10022	10260	11464	12600		Continuing	Continuing
BH53 Advanced Distributed Interactive Simulation Research	0	0	690	617	702	635	604		Continuing	Continuing
BH54 Advanced Sensors Research	0	8935	9758	10755	11163	12301	13450		Continuing	Continuing
BH56 Advanced Displays Research	0	4815	4735	5241	5371	6018	6631		Continuing	Continuing
BH59 University Centers of Excellence	0	5807	5797	5774	5754	5732	5685		Continuing	Continuing
BH62 Electromechanics and Hypervelocity Physics	8253	9734	8443	10397	11753	11750	12049		Continuing	Continuing
BH64 Materials Center of Excellence	0	2903	2899	2886	2877	2865	2842		Continuing	Continuing
BH65 Microelectronics Center of Excellence	0	2903	2899	2886	2877	2865	2842		Continuing	Continuing
BH73 National Automotive Center of Excellence	0	4848	2986	3063	3143	3226	3295		Continuing	Continuing

Mission Description and Budget Item Justification: The Army's initiative to create an open, federated laboratory system is an innovative and forward thinking approach focusing the talents of industry and academia on critical technology needs of the Army. The federated laboratory is a partnership between the Army Research Laboratory (ARL) and the private sector involving cooperative agreements, integrated management and staff rotation, education and communication. The basic construct of a federated laboratory is to continue strong in-house involvement to meet Army-unique requirements where there is little external expertise in the technologies; but to forge direct associations with industry/university consortia with recognized competencies in specific technology areas where the centers of expertise are definitely outside of the Government (i.e. telecommunications). Under federated laboratory, ARL will form partnerships with consortia consisting of at least one each of an industrial company, a major university, and a Historically Black College or University/Minority Institution (HBCU/MI). Long-term cooperative agreements (5 years) will be established in three key areas, and these consortia will become "virtual labs" within ARL and function like any other ARL division. Work will be jointly planned and executed and Army scientists and engineers will be intermingled through long term assignments with the consortia. The federated laboratory approach for ARL is in accordance with the 1991

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601104A University and Industry Research Centers**

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

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH50

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH50 Telecommunications Research	0	8472	9081	10022	10260	11464	12600		Continuing	Continuing

A. Mission Description and Justification Project BH50 - Telecommunications Research: This project establishes long term collaboration between the Army Research Laboratory and competitively selected industry/university consortia 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 that will be addressed under this project are: Wireless Battlefield Digital Communications; Tactical/Strategic Interoperability; Information Distribution; Multi-media Concepts.

FY 1995 Accomplishments:
Project not funded. A Broad Agency Announcement (BAA) was issued in December 1994 to solicit proposals for this Center. Award was 16 January 1996

FY 1996 Planned Program:

•	8222	Research in wireless battlefield digital communications, tactical/strategic interoperability, information distribution and multimedia concepts will be initiated by the Army/industry/university team.
•	189	SBIR/STTR
•	61	Revised economic assumption not available for execution.
Total	8472	

FY 1997 Planned Program:

•	9081	Continue research in wireless battlefield digital communications, tactical/strategic interoperability, information distribution and multimedia concepts.
Total	9081	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers
	PROJECT BH50

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	10150	10050
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		8558	
Adjustment to FY 1996		-86	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-969
Current President's Budget Submit	0	8472	9081

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH53

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH53 Advanced Distributed Interactive Simulation Research	0	0	690	617	702	635	604		Continuing	Continuing

A. Mission Description and Justification: Project BH53 - Information Sciences Research: Army Center of Excellence in Information Sciences (ACEIS) will perform basic (6.1) research in information science within its designated research areas. The research focuses on the mid to far term needs of information systems for the Army. The program addresses enabling and applied technologies to use new and emerging technologies to meet the needs of a digital force in the 21st Century. It performs research in information science with emphasis in the following areas: interactive and intelligent systems; database and information systems; and distributed and parallel systems. Current research activities align with the Digitization and Communication Sciences Research Program in the Software and Intelligent Systems and the Information Distribution areas. The ACEIS at Clark Atlanta University has completed its third year of operation under the auspices of ARO and has begun its fourth year under ARL. Work was restructured to this project to ensure program visibility and separability from BH50 budgeting.

FY 1995 Accomplishments: Work conducted under PE/Project 0601102A/ BH57.

FY 1996 Planned Program: Work conducted under PE/Project 0601104A/ BH50.

FY 1997 Planned Program:

•	690	Continue research in information sciences at Clark Atlanta University.
Total	690	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	6965	6965
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		0	
Adjustment to FY 1996			
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-6275
Current President's Budget Submit	0	0	690

Change Summary Explanation: FY97: Funds restructured to PE 0601120A, project AH48.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH54

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH54 Advanced Sensors Research	0	8935	9758	10755	11163	12301	13450		Continuing	Continuing

A. Mission Description and Justification: Project BH54 - Advanced Sensors Research: This project establishes long term collaboration between the Army Research Laboratory and a competitively selected industry/university consortia headed by Lockheed Sanders 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 that will be addressed under this project are: Multidomain Smart Sensors to include multispectral infrared focal plane arrays; Multisensor Fusion Automatic Target Recognition Algorithms to include synthesis of sensor modeling; Radar Sensors to include atmospheric and terrain effects on propagation; and Signal Processing capitalizing on commercially available hardware.

FY 1995 Accomplishments:
Project not funded. A Broad Agency Announcement (BAA) was issued in December 1994 to solicit proposals for this Center. Award was 16 January 1996.

FY 1996 Planned Program:

•	8711	Develop integrated program plan with detailed short-term and long-term (3-5 years) goals; develop ARL/Consortium work structures supporting workpackages and scientific coordination process; and initiate design based on device application analysis, as well as fabrication of components for Multi-Quantum Well (MQW) detector structure.
•	200	SBIR/STTR.
•	24	Revised economic assumption not available for execution.
Total	8935	

FY 1997 Planned Program:

•	4878	- Complete design of multispectral MQW device; investigate laser radar (LADAR) active imaging concepts, identifying means for integrating laser/detector structures; and determine practical limits of single active/passive imaging system with regard to the extent of spectral bands. - Deliver baseline Forward Looking Infrared/Synthetic Aperture Radar algorithm and three sensor signature/scene modeling environments.
•	4880	- Evaluate the effectiveness of various target discrimination features for a foliage penetration radar; develop techniques to synthesize clutter data by extrapolating/interpolating from existing millimeter wave clutter data bases. - Demonstrate signal processing for Multi-Domain Smart Sensors (MDSS) using off chip hardware and selected algorithms. - Define performance of enhanced performance low-light-level imager (e.g., extended low-wave cut off, and design low-power integrated processing).
Total	9758	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH54

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	9971	10049
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		9026	
Adjustment to FY 1996		-91	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-291
Current President's Budget Submit	0	8935	9758

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH56

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH56 Advanced Displays Research	0	4815	4735	5241	5371	6018	6631		Continuing	Continuing

A. <u>Mission Description and Justification</u>: **Project BH56 - Advanced Displays Research:**. This effort establishes a competitively selected university/industry consortia to provide solutions for the many requirements for information assimilation on the battlefield. Displays and control constructs are the interface between human users and computers. This center will develop display subsystem architecture which can provide access to all information of practical use, provide data visualization in an efficient manner and use the advanced hardware and software technologies to address the human sensory modality without overloading the user and degrading performance. Work in this project differs from ARPA's program, which aims to establish a domestic capability for display development. 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 1995 Accomplishments:
Project not funded. A Broad Agency Announcement (BAA) was issued in December 1994 to solicit proposals for this center. Award was 16 January 1996.

FY 1996 Planned Program:

•	4695	Initiate research in human-computer interface in an information rich environment; initiate research in display configuration. Conduct research involving real time visualization, architecture and information presentation.
•	107	SBIR/STTR.
•	13	Revised economic assumption not available for execution.
Total	4815	

FY 1997 Planned Program:

•	4735	Continue research in: human-computer interface in an information rich environment; display configuration; real time visualization; architecture; and information presentation.
Total	4735	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH56

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	5373	4876
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		4864	
Adjustment to FY 1996		-49	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-141
Current President's Budget Submit	0	4815	4735

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH59

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH59 University Centers of Excellence	0	5807	5797	5774	5754	5732	5685		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u>: **Project BH59 - Centers of Excellence:** Work in this project was previously conducted in PE 0601102A. Army Centers of Excellence are active in the fields of rotary-wing technology, the mathematical sciences, fuel cell technology, the foundations of image science, and training. The Army's Centers have significant collaborative participation by Historically Black Colleges and Universities/Minority Institutions (HBCU/MIs) and all future Army Centers will be formed in partnership with an HBCU. In addition, industry will be encouraged to "buy into" future Army Centers of Excellence to leverage and synergize the investment in these collaborative efforts.

FY 1995 Accomplishments: Work conducted in PE 0601102A, Project BH57.

FY 1996 Planned Program:

•	2510	- Recompete up to three rotorcraft Centers of Excellence and consolidate these into the newly established National Rotorcraft Technology Center (NRTC). - Conclude research by the Mathematical Sciences Institute focusing on computational algebra, stochastic analysis and nonlinear wave high resolution simulation.
•	3160	- Develop the scientific foundations of object recognition at Washington University and establish metrics for background clutter, image complexity and algorithm performance. - Advance training technology at Morris Brown College through research in computer simulation training in cooperation and team performance, and critical decision making. - Establish a Center of Excellence for Science, Mathematics, and Engineering (SME) Education at Contra Costa College to strengthen academic programs in SME and attract underrepresented minority students to these programs.
•	130	-SBIR/STTR.
•	7	-Revised economic assumption not available for execution.
Total	5807	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH59

FY 1997 Planned Program:

•	3880	- Conduct interdisciplinary investigations on topics of specific relevance to the Army's rotorcraft science and technology base in conjunction with the NRTC. - Advance image analysis research through investigations of object recognition at Washington University and establish metrics for background clutter, image complexity and algorithm performance.
•	1917	-Advance fuel cell and advanced battery research at the Illinois Institute of Technology with emphasis on lithium-ion/metal oxide and nickel/hydride batteries and direct oxidation methanol fuel cells. -Conclude training technology research at Morris Brown College focused on computer simulation training in cooperation and team performance, and critical decision making. -Support SME Education at Contra Costa College to strengthen academic programs in SME and attract underrepresented minority students to these programs..
Total	5797	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	5970	5970
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		5865	
Adjustment to FY 1996		-58	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-173
Current President's Budget Submit	0	5807	5797

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH62

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH62 Electromechanics and Hypervelocity Physics	8253	9734	8443	10397	11753	11750	12049		Continuing	Continuing

A. Mission Description and Justification: **Project BH62 - Electromechanics and Hypervelocity Physics:** Tactical demands on the future battlefield will require more mobile and lethal weapons systems having greater range and lethality, and reduced logistical demands to speed deployability and support. Combat vehicles, weapons and other tactical systems must utilize technologies beyond the current state-of-the-art in propellants, materials and electromechanical devices to achieve major technical and operational breakthroughs for future generations of military systems. This project funds the Army Federated Laboratory at the Institute for Advanced Technology (IAT). Electromechanics and hypervelocity physics support critical Army research relating to electromechanical systems (EM launchers and power supplies) for application to electromagnetic (EM) and electrothermal-chemical (ETC) guns. Additionally, this project provides for research, testing and computer modeling of advanced hypervelocity (HY) projectiles. In keeping with the restructure of the Electric Armaments Program, an increased emphasis has been placed on basic research at IAT in pulsed power technology. The sum of these focused efforts serves as a catalyst for technological innovation and provides crucial support to the Army technology base for advanced weapons systems development with potential applications for anti-armor, artillery and air defense.

FY 1995 Accomplishments:

- 8253 - Conducted limited breadboard testing of integrated energy storage and transfer (IEST) concept; conducted limited testing of materials for advanced armatures, rails, and solid state for IEST; performed post-test analyses of bores of all 90 mm EM guns operated at multi-megajoule energy levels; and performed experiments to improve directed energy efficiency through use of energy injections at larger number of launcher feedpoints .
  - Conducted experiments to examine mechanics of oblique plates and reactive targets as a function of velocity; continued research and development of most promising novel penetrators for enhanced penetration; developed data to support improved dynamic constitutive models for hardened alloys and ceramics .
  - Conducted two technical workshops in Hypervelocity Physics/Electromechanics (HV/EM) for Army electric armaments engineers; upgraded and expanded the technical information center to increase electronic accessibility; facilitated development and coordination of graduate degree programs in related areas for Army Acquisition Corps; and continued the intern apprenticeship and summer programs associated with HV/EM.
  - Implemented Army direction to increase focus on pulsed power by establishing a new effort solely dedicated to pulsed power research with focus on addressing the most critical issues.

Total 8253

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH62

FY 1996 Planned Program:

•	9539	- Conduct focused experiments on the effects of rail gouging during EM launch; conduct studies of high performance materials in an attempt to identify optimum performance of armature/rail pairs and high dielectric strength insulators; conduct experiments focused on improving launch efficiency; validate EMAP3D code and initiate expansion to include sliding electrical contact interface model; conduct studies to identify and develop improved diagnostics for in-barrel and on-board EM/HV launchers. - Conduct focused experiments to address the issue of HV utility in the anti-armor role; conduct experiments in HV penetration mechanics and lethality in conjunction with ARL sponsor and Defense Research Agency (UK); conduct studies of HV novel penetrator designs; validate advanced computational codes for modeling HV penetrator structural and aerophysical behavior. - Plan and conduct the 8th International Electromagnetic Launch Symposium and a Pulsed Power Short Course (expanded and updated) for Army scientists and engineers; continue operating technical information center; host high school interns and West Point cadets for summer EM/HV research projects. - Conduct studies to identify fundamental issues facing pulsed power development and to determine possible solutions; conduct assessments of technological alternatives to rotating machines including integrated pulse forming networks and linear magnetic flux compressors; evaluate high energy density dielectrics for capacitors; evaluate IEST concept and relevant pulsed power component technologies.
•	166	- SBIR/STTR.
•	29	- Revised economic assumption not available for execution.
Total	9734	

FY 1997 Planned Program:

•	8443	- Conduct studies and provide critical information on gouging, armature/rail interface interactions, performance of hybrid armatures, high performance materials for EM applications and improved railgun efficiency; conduct integrated launch pack modeling and feasibility tests; perform medium scale testing for solid armature designs; validate updated version of EMAP3D. - Conduct experiments to demonstrate mass-velocity tradeoff studies of advanced penetrators against reactive targets. Select and perform feasibility demonstrations for most promising novel penetrator designs. - Plan and conduct Electric Gun Theory Short Course (updated and expanded) and HV Physics II Short Course; continue operating technical information center; continue summer intern and West Point cadet summer research programs. - Conduct assessments of critical pulsed power components and systems with emphasis on fatigue and cyclic performance; work with industry and other research organizations to foster development of the most promising concepts; assess potential of new high temperature super conducting materials for magnetic energy storage in pulsed power applications.
Total	8443	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH62

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	8617	10007	10024
Appropriated Amount (FY 1995)	8487		
Adjustments to FY 1995	-234		
Appropriated Amount (FY 1996)		9832	
Adjustment to FY 1996		-98	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-1581
Current President's Budget Submit	8253	9734	8443

Change Summary Explanation:

Funding: FY97: Funds (-1581) reprogrammed for higher priority requirements.

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH64

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH64 Materials Center of Excellence	0	2903	2899	2886	2877	2865	2842		Continuing	Continuing

A. Mission Description and Justification: **Project BH64 - Materials Center of Excellence:** This project establishes long term collaboration between ARL Materials Directorate and universities for the purpose of conducting world-class materials collaborative research relevant to Army needs. Basic research will be conducted to establish the scientific basis for creating and producing advanced materials to achieve higher performance, lower cost and improved reliability in Army unique system and component applications. A Broad Agency Announcement (BAA) was issued to solicit proposals under this effort. Specific efforts and funding cannot be provided at this time. The technical areas that will be addressed under this project are: degradation, reactivity and protection of materials; mechanical behavior of materials; synthesis and processing of materials; physical behavior of materials; high rate loading phenomena in materials. Funding for this effort is a restructure from PE/PROJ 0601102A/AH42.

FY 1995 Accomplishments: Work conducted in Project AH42, PE 0601102A (Defense Research Sciences).

FY 1996 Planned Program:

•	2818	- Conduct research in corrosion effects and protection of alloys. - Develop interface and high temperature property measurements in metal matrix composites. - Develop non-destructive characterization of polymer matrix composite materials.
•	65	- SBIR/STTR.
•	20	- Revised economic assumption not available for execution.
Total	2903	

FY 1997 Planned Program:

•	2899	- Continue research in corrosion effects and protection of alloys. - Continue development of interface and high temperature property measurements in metal matrix composites. - Continue to develop non-destructive characterization of polymer matrix composite materials.
Total	2899	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH64

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	2985	2985
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		2933	
Adjustment to FY 1996		-30	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-86
Current President's Budget Submit	0	2903	2899

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

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

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

PROJECT: BH65

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH65 Microelectronics Center of Excellence	0	2903	2899	2886	2877	2865	2842		Continuing	Continuing

A. Mission Description and Justification: Project BH65 - Microelectronics Center of Excellence: The Microelectronics Research Collaborative Program (MCRP) will establish a long term collaboration between ARL Physical Sciences Directorate and universities to ensure a seamless, synergistic cooperative work environment to provide the Army the key technologies and analytical support necessary to assure supremacy in future land warfare. The goals of this effort are to conduct innovative research and exploit new concepts in solid-state physics, electronics engineering and chemical/electrochemical engineering, and provide mutual exchange of public and private sector researchers working at each other's institutions in an "open lab" environment. The Cooperative Agreement process under the authority of 10 United States Code (USC) 2358, Research Projects, is currently underway and specific efforts and funding cannot be provided. The technical areas being addressed under this project are: Nanoelectronics/Optoelectronics; Electrochemistry/Energy Science; Biological/Chemical Detection; High Frequency and Quasi-optical Electronics; Piezoelectronics; Microelectromechanics.

FY 1995 Accomplishments: Work conducted in Project AH47, PE 0601102A (Defense Research Sciences).

FY 1996 Planned Program:

•	2830	- Perform research and development of membranes for methanol fuel cells and investigation of molecular transport mechanisms. Study the synthesis and process of carbon electrodes for charged storage applications. - Determine selected physical properties of piezoelectric materials to support manufacturing science in acoustic microtechnology. Research and develop quartz microsensor arrays. - Perform research related to the synthesis and deposition of electroluminescent polymers for high resolution, flat panel display applications. - Study new concepts and recent advances in microelectromechanical devices, ultra-miniature sensors, actuators, transducers, and microresonators. - Research materials, optical sources, detectors, waveguides and optoelectronic integrated circuits for optical signal processing and optoelectronic component technology to advance the state of the art in communications and aided-target recognition.
•	65	- SBIR/STTR.
•	8	- Revised economic assumption not available for execution.
Total	2903	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers
	PROJECT BH65

FY 1997 Planned Program:

•	2899	- Continue research and development of membranes for methanol fuel cells and investigation of molecular transport mechanisms. Study the synthesis and process of carbon electrodes for charged storage applications. - Continue research to determine selected physical properties of piezoelectric materials to support manufacturing science in acoustic microtechnology. Research and develop quartz microsensor arrays. - Perform research related to the synthesis and deposition of electroluminescent polymers for high resolution, flat panel display applications. - Exploit new concepts and advances in microelectromechanical devices, ultra-miniature sensors, actuators, transducers, and microresonators for smart, lightweight, inexpensive battlefield sensors. - Research materials, optical sources, detectors, waveguides and optoelectronic integrated circuits for optical signal processing and optoelectronic component technology to advance the state-of-the-art in communications and aided-target recognition.
Total	2899	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	2985	2985
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		2933	
Adjustment to FY 1996		-30	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-86
Current President's Budget Submit	0	2903	2899

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH73

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
BH73 National Automotive Center of Excellence	0	4848	2986	3063	3143	3226	3295		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project BH73 - Automotive Center of Excellence:** The Center of Excellence for Automotive Research, established in 1994, is a key element of the basic research module of the National Automotive Center (NAC), located at the U.S. Army Tank-Automotive Research, Development, and Engineering Center (TARDEC). The Center of Excellence for Automotive Research is an innovative university/industry/government consortium leveraging commercial dual use technology for the Army through on-going and new programs in automotive research, allowing significant cost savings while maximizing technological productivity. The selected university partners include: University of Michigan, University of Iowa, University of Wisconsin, Wayne State University, and Howard University, while key industry partners include the "Big Three" U.S. automotive manufacturers.

FY 1995 Accomplishments: Work conducted in Project AF22, PE 0601102A (Defense Research Sciences).

FY 1996 Planned Program:

•	4725	Conduct university research and leverage commercial automotive research in five thrust areas - vehicle terrain dynamics, vehicle hardware/human interface, vehicle structures, advanced propulsion, system integration - through the National Automotive Center of Excellence for Automotive Research.
•	109	SBIR/STTR.
•	14	Revised economic assumption not available for execution.
Total	4848	

FY 1997 Planned Program:

•	2986	Conduct university research and leverage commercial automotive research in five thrust areas - vehicle terrain dynamics, vehicle hardware/human interface, vehicle structures, advanced propulsion, system integration - through the National Automotive Center of Excellence for Automotive Research.
Total	2986	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601104A University and Industry Research Centers PROJECT BH73

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	2985	3075
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		4897	
Adjustment to FY 1996		-49	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-89
Current President's Budget Submit	0	4848	2986

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602105A Materials Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	19768	9901	10841	11582	12101	11549	11830		Continuing	Continuing
AH69 Cast Ductile Iron	5000	0	0	0	0	0	0		0	7000
AH84 Materials	14768	9901	10841	11582	12101	11549	11830		Continuing	Continuing

Mission Description and Budget Item Justification: This program element provides the technical foundation for materials technology in metals, ceramics, polymers, and composites essential for the optimum use of these materials in all future Army systems. It also provides the technology base required for solving materials-related problems in existing fielded systems. The project addresses Army specific technologies to increase and sustain survivability and lethality of current and future Army unique systems in aircraft, missiles, armaments, ground and combat vehicles, combat service, and personnel support equipment for the soldier system. Development efforts are focused in Armor/Anti-armor 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. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602105A Materials Technology — PROJECT AH69

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH69 Cast Ductile Iron	5000	0	0	0	0	0	0		0	7000

A. Mission Description and Justification: Project AH69 - Cast Ductile Iron: This project is a Congressionally directed program for ductile iron technology research to reduce component costs and weight.

FY 1995 Accomplishments:

- 5000 -Perform qualification test program for Austempered Ductile Iron (ADI) Bradley track with current contractors to include screen testing followed by full production qualification testing (To be accomplished in FY 96).
  -Demonstrate ADI for heavier track vehicle applications through both new and existing contractual efforts; examine track performance under critical vehicle environments and applications (To be accomplished in FY 96).

Total 5000

FY 1996 Planned Program: Project not funded

FY 1997 Planned Program: Project not funded

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	9865	0	0
Appropriated Amount (FY 1995)	9658		
Adjustment to FY 1995	-4658		
Appropriated Amount (FY 1996)			
Adjustment to FY 1996			
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current President's Budget Submit	5000	0	0

Change Summary Explanation:

Funding: Rescission within the FY 95 Supplemental Appropriation and Rescissions to preserve and enhance the military readiness of the Department of Defense (-4658).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602105A Materials Technology — PROJECT AH84

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH84 Materials	14768	9901	10841	11582	12101	11549	11830		Continuing	Continuing

A. Mission Description and Justification: Project AH84 - Materials: This project provides the technical foundation for providing necessary materials technology in metals, ceramics, polymers, and composites for Army systems. The efforts address technologies required to meet increased performance, reliability and survivability demands of current and future systems in aircraft, armaments, missiles, ground vehicles, combat support and personnel support equipment. Cost reduction is addressed through materials manufacturing/processing developments. Congressional increases to this project in FY 1994 and FY 1995 have financed the development of composite structures to be used on high performance missile systems.

FY 1995 Accomplishments:

- 4440 -Conducted model scale ballistic testing of tungsten-based material candidates to replace depleted uranium.
  -Provided a new military specification on low cost titanium alloys for armor applications.
  -Fabricated thin film alumina barium strontium titanate composites for phase shifter applications in radar antenna; developed laser barrier and signature reflective coatings for goggles and windshields.
- 6328 -Provided technical support to the Composite Armored Vehicle (CAV) demonstration; developed and evaluated novel composite materials for ground vehicles.
  -Optimized dry ion beam treatments as environmentally acceptable alternatives to specific cadmium/chromium electroplating applications; developed multi-functional protective coatings.
  -Demonstrated potential of SMART weave sensor grid for real time monitoring of composite parts during service.
  -Performed tests and analyses on thick composite structures to support integrated stress-strength-inspection technology for composite structures.
  -Developed prototype Mission Intensity Counter system for demonstration on a ground vehicle.
- 4000 -Completed fabrication, initial testing, and characterization of quartz phenolic and carbon-carbon missile nosetips.

Total 14768

FY 1996 Planned Program:

- 3600 -Determine dynamic response(constitutive relationships) of ceramic and polymer composite materials for application in ultra lightweight personnel protection.
  -Determine dynamic responses and residual strength properties for emerging composite armor materials applicable to combat and helicopter systems.
  -Correlate dynamic finite element analysis and modal testing data of undamaged and damaged materials (e.g. helicopter tail booms).
- 4886 -Develop analytical tools (modeling, hardware and design data base) for life prediction and deterioration control of polymers in plastics, rubbers, coatings and composite/hybrid materials leading to significant O&S cost reduction.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602105A Materials Technology / PROJECT AH84

FY 1996 Planned Program: (continued)

-Develop intelligent imaging systems for non-destructive evaluation (NDE) of materials used in electronic components.
-Establish criteria for prevention and mediation of the deleterious effects of advanced propellants (e.g. liquid, plasma) on current and future gun systems.

- 730 -Demonstrate performance of thick film low loss, phase shifter materials for high performance low cost radar antenna applications.
-Characterization of near optimal tungsten materials for replacement of depleted uranium in KE penetrators.
- 652 -Evaluate stress-strength-inspection test and analysis results for thick compose structures to define integrated structural design criteria.
-Extend Mission Intensity Counter prototype to air vehicle systems and demonstrate ground vehicle prototype.
- 33 -Revised economic assumption not available for execution.

Total 9901

FY 1997 Planned Program:

- 4214 -Develop material systems based on a combination of ceramics, intermetallics, composites, and metal hybrids for use in advanced armor systems; investigate alternative warhead materials to replace heavy metal penetrators.
-Correlate lightweight materials dynamic properties to improvements in ballistic sponse for application in ultralightweight personnel protection.
-Investigate novel approaches to combining low cost titanium and other lightweight materials for incorporation into future armor and army systems.
- 5931 -Demonstrate improved protective coatings, including chemical agent resistant coating, meeting all military requirements for armament, ammunition, ground support equipment and aircraft.
-Demonstrate gun tube life enhancement by using protection schemes developed to reduce the attack of advanced propellant systems on conventional and improved gun systems.
-Combine sensor based manufacturing techniques and on-board life monitoring for use in manufacture of composite components with greater logistic supportability for future armored vehicles.
-Demonstrate performance of thick film low loss phase shifter materials for applications at 25 Ghz extremely low cost lightweight radar antenna.
- 696 -Demonstrate Mission Intensity Counter for Army rotorcraft vehicles and transfer technology to developers.
-Validate integrated structural integrity design criteria for thick composites and transition results to the ground vehicle industry.

Total 10841

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE March 1996
2 - Applied Research	0602105A Materials Technology	PROJECT AH84

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	15048	10176	10872
Appropriated Amount (FY 1995)	15048		
Adjustment to FY 1995	-280		
Appropriated Amount (FY 1996)		9998	
Adjustment to FY 1996		-97	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-31
Current President's Budget Submit	14768	9901	10841

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

DATE: March 1996

2 - Applied Research | **0602120A Sensors and Electronic Survivability**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	25877	26952	23608	25271	26910	27822	29322		Continuing	Continuing
AH15 Ground Combat Identification Technology	3939	3369	3686	3718	3802	3778	3854		Continuing	Continuing
AH16 Sensor Technology	11386	16635	12455	12950	14223	15271	16506		Continuing	Continuing
AH25 Nuclear Effects Survivability and Fuzing Technology	5012	4452	4816	5821	5908	5808	5934		Continuing	Continuing
A140 High Power Microwave (HPM) Technology	5540	2496	2651	2782	2977	2965	3028		Continuing	Continuing

Mission Description and Budget Item Justification: The objectives of this program are: first, to provide sensor, signal and information processing technology for advanced Reconnaissance, Intelligence, Surveillance, and Target Acquisition (RISTA), ground to ground and air to ground Combat Identification (ID), and fire control systems as well as the fuzing and guidance integrated fuzing functions in future munitions and, second, to determine and reduce the susceptibility and vulnerability of Army equipment and systems to nuclear and Radio Frequency (RF)/High Power Microwave (HPM) environments. Four critical technologies are addressed to increase the combat effectiveness of tactical Army Forces: (1) High Power Microwave (HPM) technology; (2) Combat Identification technology; (3) Sensors, Signatures, Signal and Information Processing (S3I) technology; (4) Nuclear Effects Survivability technology. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Force Modernization Plan and Project Reliance. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT AH15

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH15 Ground Combat Identification Technology	3939	3369	3686	3718	3802	3778	3854		Continuing	Continuing

A. **Mission Description and Budget Item Justification:** This program provides the enabling technology necessary to demonstrate advanced Combat Identification (CI) concepts and systems for all aspects of ground combat. The hardware and software improvements and modeling and simulation advances provided by this project are essential to ensure needed advancements in point-of-engagement target ID and accurate, timely situational awareness (SA). The operational impact is not only reduced fratricide but also a significant increase in combat effectiveness. CI is also strongly related to the Army's larger objective of Battlefield Digitization and synergistically supplements that effort by feeding friendly and hostile positional information from the platform level into the command and control network.

FY 1995 Accomplishments:

- 3939 - Completed construction of laser/RF and millimeter wave target ID equipment for the dismounted soldier and supported Dismounted Battlespace Battle Lab (DBBL) Warfighting Experiments with the hardware.
  - Completed system performance modeling of alternative combat ID concepts for the Ground-to-Ground platform application and preliminary modeling of candidate Air-to-Ground concepts, and initiated development of constructive modeling tools for dismounted soldier CI.
  - Initiated development of capability for virtual simulation of Battlefield Combat ID System (BCIS) to provide highly accurate SA information at platform level and link into digitized C3 system.
  - Developed initial design for conceptual millimeter wave Air-to-Ground CI approach.

Total 3939

FY 1996 Planned Program:

- 3291 - Develop improved conceptual prototype hardware for soldier-to-soldier, vehicle-to-soldier and soldier-to-vehicle target ID applications, support operational field experimentation by DBBL, and provide assistance to requirements definition.
  - Complete initial force-on-force modeling of candidate Air-to-Ground combat ID systems for the dismounted soldier.
  - Complete virtual simulation of BCIS Digital Data Link and initial simulation of Air-to-Ground CI alternatives, and begin development of simulation tools for dismounted soldier.
- 69 -SBIR/STTR
- 9 -Revised Economic assumption not available for execution.

Total 3369

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT AH15

FY 1997 Planned Program:

•	3686	- Complete constructive modeling and virtual simulations of Air-to-Ground CI systems and initial simulations of dismounted soldier CI system. - Initiate field experiments with advanced technologies for enhanced target ID using augmented target acquisition sensors and perform initial data collection and analysis of ID performance referenced to target acquisition performance.
Total	3686	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4085	3615	3783
Appropriated Amount (FY 1995)	4003		
Adjustment to FY 1995	-64		
Appropriated Amount (FY 1996)		3403	
Adjustment to FY 1996		-34	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-97
Current President's Budget Submit	3939	3369	3686

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT AH16

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH16 Sensor Technology	11386	16635	12455	12950	14223	15271	16506		Continuing	Continuing

A. Mission Description and Justification: Project AH16 - Sensor Technology: This project provides for the synergistic development of sensors, signal processors, and Automatic Target Recognition (ATR) technology for RISTA, fire control, smart munitions and fuzing systems. In the RISTA and fire control area, the project will develop and demonstrate: (1) advanced Ultra Wide Band (UWB) radar technology for adverse weather, wide-area detection, location and recognition of tactical ground targets concealed in foliage, and buried mines; (2) innovative algorithms for the detection, discrimination, and classification of stationary targets from a low flying helicopter; (3) ATR algorithms that synergistically use outputs of Forward Looking Infrared (FLIR), Millimeter Wave (MMW) Radar and Laser Radar (LADAR) sensors to identify combat vehicles and perform signature predictions in many bands (infrared, visible, MMW, and LADAR) from targets and backgrounds at specified times, weather conditions and locations; (4) affordable, lightweight target acquisition radar technology for man-portable and battlefield platform applications: (5) advanced optical processing techniques to automatically process, at the sensor, the received signals into target information of sufficiently narrow bandwidth to be compatible with Army communication systems; (6) concept validation of the Passive MMW Camera. Project goals in the smart munitions and fuzing sensor area include development of advanced microwave, millimeter wave (MMW), acoustic, electrostatic, and LADAR technologies and reliably sense low-cross section targets in high countermeasures and clutter environments. These technologies support the Force XXI modernization efforts, the Army Battlefield Digitization effort, ATD's/ACTD's such as: Intelligent Minefield; Target Acquisition; Remote Sentry; Rapid Force Project Initiatives; and systems such as: Longbow; advanced submunitions, standoff fuzing for anti-armor munitions, proximity fuzing, range finding for bursting munitions, smart mines, Multi-Option Fuze for Artillery; guided and unguided tank, mortar and artillery ammunition; and anti-aircraft applications including projectile and missile fuzing.

FY 1995 Accomplishments:

- 5653 - Characterized targets and clutter using UWB Synthetic Aperture Radar data and used to develop target/clutter discriminants; completed transportable testbed to characterize sub-surface targets such as mines.
  - Demonstrated digital pulse compression, investigated digital inphase/quadrate phase demodulation and demonstrated digital phase control of direct digital synthesizer to compensate for transceiver phase errors for the detection of moving and stationary targets.
  - Developed neural-net based stationary target/clutter discriminator and tested on existing radar database. Identified alternate target clutter algorithm architectures.
  - Integrated a range doppler processor into the Missile Command (MICOM) Multi-Role Survivable Radar (MRSR) testbed and began performance testing, and developed algorithms and implementation architectures for interfacing wide band optical correlation processors to radar signal processing for the Communications-Electronics Command (CECOM) Electronic Support Measures (ESM) testbed.
- 3084 - Demonstrated improved multi-sensor ATR algorithms to expand the ATR operation envelope, and increased performance by further emphasizing target signature differences.
  - Developed enhanced target engagement sensor technologies, including microwave, electrostatic, and Global Positioning Systems for future Army systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT AH16

FY 1995 Accomplishments: (continued)

- Developed MMW and electro-optic breadboards and modeling technologies needed for the development of improved target acquisition, tracking, and endgame engagement techniques.

• 2649 - Incorporated acoustic, seismic and other sensor capabilities in the smart mines and integrated soldier testbeds; developed and evaluated sensing and recognition algorithms for vehicle, unattended and soldier platforms.
- Designed terrain and environmental spatial database and tactical event detection/synchronization software to autonomously correlate sensor detections and to detect significant battlefield events.
- Developed improved subsystem elements for Passive Millimeter Camera (PMC); began extensive field testing of PMC to demonstrate performance; Made initial measurements with millimeter wave raster-scanned radiometer; Continued development of enabling technologies for MMW sensors.

Total 11386

FY 1996 Planned Program:

• 5759 - Develop refined automatic detection capability for concealed targets using UWB SAR data by exploiting unique phenomenology; conduct measurements program on near surface metal and plastic mines using transportable testbed.
- Perform efficient multi-mode waveform processing, using direct digital synthesis and open architecture signal processing; quantify cost savings for future systems.
- Develop advanced target/clutter separation techniques for RISTA and fire control radar applications based on use of neural net and genetic training techniques; evaluate concepts for self-regulating algorithm to sense cluttered background.
- Test and characterize the ambiguity optical processor and develop algorithms and architecture for the MRSR testbed.

• 4472 - Add MMW radar data as the second sensor for ATR algorithms; develop new 10 class model based multi-sensor recognition algorithms; and investigate the performance and data requirement issues related to a SAR/thermal image multi-sensor ATR.
- Develop low cost, enhanced target engagement sensor technologies, including microwave, electrostatic and GPS for future Army systems; develop design of GPS receiver suitable for projectile firing (very high gravity environment).
- Develop a testbed to quickly analyze acoustic data and facilitate generation of acoustic algorithms and demonstrate real time tracking and identification of targets for application to vehicle, unattended and soldier platforms.
- Investigate techniques for providing near-field target signature by purely analytical means; evaluate MMW radar tracking algorithms for armored targets at extended ranges.

• 6241 - Conduct experiments with Battle Labs to validate the utility of integrating the terrain and environmental reasoning spatial database and tactical event detection and synchronization software.
- Complete development and field test of 1st & 2nd generation modular, concept validation passive MMW camera.

• 109 - SBIR/STTR

• 54 - Revised Economic assumption not available for execution.

Total 16635

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT AH16

FY 1997 Planned Program:

- 6147 - Provide initial transition of foliage penetration (FOPEN) technology to receiving Research, Development, and Engineering Center (RDEC) by supplying point design for FOPEN radar with supporting algorithms; perform characterization of sub-surface mine signatures.
  - Implement advanced waveform processing in software and benchmark; evaluate adding advanced Moving Target Indication (MTI) and Stationary Target Indication (STI) algorithms to processor suite.
  - Test advanced real beam radar target/clutter separation techniques in end-to-end algorithm evaluation facility and provide report; apply data compression techniques to signature storage to enhance vehicle classification capability; test self-regulation concepts on diverse clutter data.
  - Develop algorithms and architectures for image processing and demonstrate two-dimensional optical processors with high throughput.
- 4127 - Extend performance envelope of the FLIR/MMW model-based algorithm to more difficult scenarios: 10-20 class, moderate to heavy clutter, up to 40% occlusion; initiate development of multi-sensor SAR/thermal images ATR.
  - Demonstrate GPS performance for projectiles and missiles. Develop LADAR for smart munition applications.
  - Expand acoustic real time tracking and identification to include a broader base of ground and air targets.
- 2181 - Develop an initial version of a target signature generator which will accept as user inputs sensor parameters, target description and sensor-to-target geometrics; extend MMW radar track accuracy measurements to armored targets in defilade.
  - Prototype and evaluate mutli-level situational awareness agents that will operate over a distributed computing environment.

Total 12455

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	11988	11162	12491
Appropriated Amount (FY 1995)	11736		
Adjustment to FY 1995	-350		
Appropriated Amount (FY 1996)		16799	
Adjustment to FY 1996		-164	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-36
Current President's Budget Submit	11386	16635	12455

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT AH25

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH25 Nuclear Effects Survivability and Fuzing Technology	5012	4452	4816	5821	5908	5808	5934		Continuing	Continuing

A. Mission Description and Justification: **Project AH25 - Nuclear Effects Survivability Technology:** This project develops and provides nuclear weapons effects survivability technology for designing, producing, and fielding tactical systems and equipment for the Army and other military services in accordance with the Tri-Service Reliance Agreements on Nuclear Weapons Effects. The goals are to understand new weapons phenomena and the response of new emerging technologies to nuclear weapons effects, to develop new techniques for mitigating the response of new emerging technologies to nuclear weapons effects, and to develop new methods for analyzing and simulating the effects in order to reduce the costs for achieving nuclear survivability. This project will provide cost effective solutions for the rapidly growing threat of nuclear weapons technology proliferation in the Third World. This project has been coordinated with the Defense Nuclear Agency and other military services in the DoD Nuclear Technology Area Plan to avoid duplication of effort and maximize return on investment.

FY 1995 Accomplishments:

- 5012 - Calculated nuclear radiation protection and electromagnetic shielding effectiveness of a composite armored vehicle.
  - Identified state-of-the-art commercial electronic components that can be used to meet nuclear survivability requirements and develop guidelines for designing radiation hardened integrated circuits.
  - Evaluated the electromagnetic shielding characteristics of candidate composite materials and a prototype composite electronic equipment shelter.
  - Demonstrated the ability to simulate the non-ideal nuclear airblast and test the effects on Army vehicles.
  - Improved algorithms to insert chemical, biological, and nuclear impact into conventional weapon effects models.

Total 5012

FY 1996 Planned Program:

- 3168 - Develop test methodologies for radiation survivability of advanced commercial integrated circuits, new Static Random Access Memories (SRAMs) and, using the Scale Model ElectroMagnetic Facility, for composite structures.
  - Examine non-linear materials as potential smart composite shield materials and demonstrate composite shielding concept.
  - Calculate radiation shielding effectiveness for a composite armored vehicle and calculate internal blast on Massively Parallel Processing (MPP) computers.
  - Determine non-ideal blast parameters for use in nuclear survivability criteria and specify techniques that will mitigate non-ideal blast effects on personnel and equipment.
- 1275 - Update working version of nuclear blast codes from experiments and computer analysis design tools.
- 58 - SBIR/STTR

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT AH25

FY 1996 Planned Program: (continued)

•	14	- Revised Economic assumption not available for execution.
Total	4452	

FY 1997 Planned Program:

•	4816	- Perform computations to evaluate radiation shielding design of the CRUSADER system and to develop new criteria for ElectroMagnetic Pulses on Army systems. - Develop guidance for designing radiation resistant control systems for infantry vehicle upgrades, EMP hardened composite shelters, and innovative technologies for preventing vehicle overturn in nuclear weapons environments. - Evaluate advanced materials for survivability enhancement, including light, low fatigue electromagnetic shielding materials and magnetoresistive non-volatile memories. - Perform drag coefficient mitigation studies to reduce vulnerability of tactical vehicles to non-ideal blast drag loading.
•		- Complete integration of nuclear effects model coding into three-dimension geometry model (Ballistics Research Laboratory-Computer Aided Design) of Army Systems.
Total	4816	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5121	4576	4903
Appropriated Amount (FY 1995)	5121		
Adjustment to FY 1995	-109		
Appropriated Amount (FY 1996)		4496	
Adjustment to FY 1996		-44	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-87
Current President's Budget Submit	5012	4452	4816

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT A140

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A140 High Power Microwave (HPM) Technology	5540	2496	2651	2782	2977	2965	3028		Continuing	Continuing

A. Mission Description and Justification: Project A140 - High Power Microwave (HPM) Technology: The objective of this project is to develop the tools, techniques and methodology to assess the susceptibility and vulnerability of Army equipment and systems to various types of Radio Frequency (RF)/High Power Microwave (HPM) environments, and to identify and evaluate the technology required to protect and harden U.S. equipment. This program is coordinated and when appropriate leveraged with HPM programs in the Air Force, Navy, Defense Nuclear Agency, National Labs, University consortia and relevant industry and foreign partners.

FY 1995 Accomplishments:

•	5540	- Conducted HPM susceptibility assessments (through testing and analysis) of foreign and US Army assets including munitions, communications equipment and avionics to supported Advanced Technology Demonstrations and Advanced Concepts and Technology Demonstrations. - Conducted HPM hardening technology development and demonstrations centering on 21st Century Land Warrior helmet and the GPS system. - Developed HPM tools (sources/components) for indoor/outdoor experimentation including antennas and pulsed power amplifiers with a focus on the interference modulator for laboratory use in FY 95, completed final testing of the BandWidth Oscillators for transition to Test and Evaluation Command and begin development of a wideband Klystron amplifier for use in the out years.
Total	5540	

FY 1996 Planned Program:

•	2433	- Conduct limited HPM susceptibility assessments (through testing and analysis) of foreign and US Army assets including munitions, communications equipment and avionics to support ATDs and ACTDs. - Conduct HPM hardening technology development and demonstrations centering on completion of Microwave/Millimeter Integrated Circuit on-chip limiters for U.S. Army Space and Strategic Defense Command and for selected systems. - Develop HPM tools (sources/components) for indoor/outdoor experimentation including antennas and pulsed power amplifiers with a focus on development of the wideband Klystron amplifier. Deliverables will be progress report and journal publication. - Develop a more rigorous physical foundation for modeling the effects of RF radiation on radar and RF sensor systems.
•	55	- SBIR/STTR
•	6	- Revised Economic assumption not available for execution.
Total	2496	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602120A Sensors and Electronic Survivability — PROJECT A140

FY 1997 Planned Program:

•	2651	- Model physical phenomena and incorporate into electronic warfare analysis simulation tools for radar and RF sensors. - Develop electromagnetic susceptibility assessment tools and methods and conduct HPM susceptibility assessments (through experimentation and analyses) of foreign and US Army assets including munitions, communications equipment and avionics to support ATDs and ACTDs. - Conduct HPM hardening technology development and demonstrations centering on technology to protect US assets on the digital battlefield. Focus will be on silicon carbide (SiC) technology and electro-optics and millimeter wave limiters. - Develop HPM tools (sources/components) for indoor/outdoor experimentation including antennas and pulsed power amplifiers with a focus on the completion of design for a wideband klystron amplifier for laboratory use. Deliverables will be progress report and journal publication.
Total	2651	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5779	2565	2702
Appropriated Amount (FY 1995)	5657		
Adjustment to FY 1995	-117		
Appropriated Amount (FY 1996)		2520	
Adjustment to FY 1996		-24	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-51
Current President's Budget Submit	5540	2496	2651

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602211A Aviation Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	19501	17970	24683	27875	30396	29735	32454		Continuing	Continuing
A47A Aeronautical and Aircraft Weapons Technology	16358	15393	21940	24994	27305	26643	29084		Continuing	Continuing
A47B Vehicle Propulsion and Structures Technology	3143	2577	2743	2881	3091	3092	3370		Continuing	Continuing

Mission Description and Budget Item Justification: The objective of this program element (PE) is to develop aeronautical technology for new and/or upgrades to DoD/Army Vertical Take-off and Landing (VTOL) airmobile systems. Helicopter rotors provide low disc loading as compared to the tilt rotor's intermediate disc loading and vertical lift jet engine's high disc loading. Low disc loading VTOL aircraft offer a practical solution to many of the DoD/Army's operational needs. Such aircraft, with their ability to operate below tree top level for Nap-of-the-Earth (NOE) missions, present significantly different analysis and design challenges from traditional fixed wing aircraft which fly at higher altitudes. The Army Aviation Science and Technology program's functional organization, with assistance from National Aeronautics and Space Administration (NASA) at three co-located activities, are the focal points for US efforts in rotorcraft technology. Technical areas include aeromechanics, aerodynamics, aeroacoustics, structures, propulsion, reliability and maintainability, safety and survivability, mission support equipment, aircraft system synthesis, aircraft subsystems, advanced helicopter analysis, flight simulation, aircrew-aircraft integration, and aircraft weapons. These technologies are continuously being researched for applications to improve and correct deficiencies in current DoD/Army VTOL aircraft systems, to improve the capabilities and affordability of future rotorcraft, and reduce operation and support cost of current systems. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and DoD Project Reliance agreements. Beginning in FY 1996, this PE also funds technology development in cooperation with industry and academia through the establishment of a National Rotorcraft Technology Center (NRTC). The NRTC will be a cooperative, joint Army, NASA, Navy, FAA, academia, and industry effort for cooperative R&D on technologies critical to U.S. rotorcraft military supremacy and economic competitiveness, and addresses the full spectrum of rotary wing vehicle technologies and concepts for dual-use applications. Projects in this PE include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

Work in this PE is performed by contractors including McDonnell Douglas Helicopter Systems, Mesa, AZ; Boeing Helicopter Company, Philadelphia, PA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Northrop Grumman Corp., Bethage, NY; General Electric, Lynn, MA; Allied Signal - Lycoming Engines Div., Stratford, CT; Allied Signal Engines, Phoenix, AZ; Sikorsky, Stratford, CT; Allison Gas Turbine, Indianapolis, IN; Rolls Royce, Atlanta, GA; Kaman Aerospace Corp., Bloomfield, CT; Piasecki Aircraft Corp., Essington, PA; Technology Integration Inc., Bedford, MA; Structural Integrity Associates, San Jose, CA., Simula, Phoenix, AZ.; Georgia Tech Research Institute, Atlanta, GA; Navajo, San Jose, CA; Institute of Medical Cybernetics Inc., Potomac, MD; SRI/David Sarnoff Research Center, Princeton, NJ; BDM International, Albuquerque, NM; MITRE, McLean, VA; Intermetrics, Wall Township, NJ; and Charles Stark Draper Laboratory, Cambridge, MA.

Primary in-house developers include Aviation and Troop Command (ATCOM), St. Louis, MO; Aeroflightdynamics Directorate/ATCOM, NASA Ames Research Center, Moffett Field, CA; Aviation Applied Technology Directorate/ATCOM, Ft Eustis, VA; Vehicle Structures Directorate/Army Research Laboratory (ARL), NASA

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602211A Aviation Technology

Langley Research Center, Hampton, VA; and Vehicle Propulsion Directorate/ARL, NASA Lewis Research Center, Cleveland, OH. Related activities are performed by the National Aeronautics and Space Administration.

This program adheres to Tri-Service Reliance Agreements on Aeropropulsion and Air Vehicles (Rotary) with oversight and coordination provided by the Joint Directors of Laboratories. Related technology demonstrations are conducted under PE 0603003A (Aviation Advanced Technology). Work in this Program Element contains no unwarranted duplication of effort among the Military Departments. Joint coordination of efforts, where applicable, is conducted with the National Aeronautics and Space Administration (NASA) Low Speed Aircraft Research and Technology; PE 0602122N, Aircraft Technology; and PE 0602201F, Aerospace Flight Dynamics. Coordination to eliminate unnecessary duplication is accomplished by joint program reviews, exchange of program data sheets, research and technology resumes, technical reports; inter-service liaison; attendance at scientific meetings and conferences; joint participation in 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 and provide risk reduction for Demonstration/Validation and Engineering Development programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). Some efforts also transition to the field through PE 0203752A (Aircraft Engine Component Improvement Program). In addition, this PE's deliverables provide technical support to PE 0604223A (RAH-66 Comanche), PE 0604816A (Longbow), and PE 0203744A (Aircraft Modifications/Product Improvement). Active joint Service programs supported: Tri-Service Multi-mode Navigation/Communication Microstrip Antenna and Covert Communications program; the Tri-Service Integrated High Performance Turbine Engine Technology program. International Cooperative Agreements include Information Exchange on Engine Environmental Protection under the Master Information Exchange Agreement IEA-A-94-UK-1425 titled Advanced Tactical Helicopters and Associated Technology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602211A Aviation Technology — PROJECT A47A

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A47A Aeronautical and Aircraft Weapons Technology	16358	15393	21940	24994	27305	26643	29084		Continuing	Continuing

A. **Mission Description and Budget Item Justification:** The purpose of this project is to conduct exploratory development of technologies for DoD/Army VTOL airmobile systems improvements in operational effectiveness and combat mission capability including air-to-air combat, higher tactical mobility, increased strategic mobility, improved fire power, use of special weapons and increased combat sustainability. Work in this project maintains world excellence in rotorcraft technology through the study of advanced technologies and their applications to rotorcraft. Areas of investigation and research consist of the following: fluid mechanics, dynamics, aerodynamics, advanced flight control technology; handling qualities, aircraft and weapons interaction; acoustics and signature reduction, weight reduction; advanced materials applications; internal/external loads; militarization of propulsion/structures technology, engine specific component technologies in support of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) initiative goal demonstrators, advanced smart materials applications; flight simulation; improved soldier machine integration and pilot-vehicle interface, improvements in reliability and maintainability, combat damage repair of new materials, survivability/vulnerability to new threats, crashworthiness, and logistics. These technologies are being developed for application to current as well as future DoD/Army rotorcraft systems. Beginning in FY 1996, this project funds technology development in cooperation with industry and academia through the establishment of a National Rotorcraft Technology Center (NRTC). The NRTC will be a cooperative joint Army, NASA, Navy, FAA, academia, and industry effort for cooperative R&D on technologies critical to U.S. rotorcraft military supremacy and economic competitiveness and to address the full spectrum of rotary wing vehicle technologies and concepts for dual-use applications.

FY 1995 Accomplishments:

- 3298 -Evaluated rotorcraft integration concepts for TACAWS, Low Cost Precision Kill (LCPK) rocket and emerging Non-Lethal Weapons (NLW).
  -Developed flight test maneuvers and initiated cargo/slung load handling qualities (HQ) development; evaluated visual and aural cueing techniques; developed control laws for in-flight simulation.
  -Prepared the solicitation, evaluated proposals, and awarded contract to develop hardware/software for integration of flight, fuel, and fire control (IFFC) systems.
- 5997 -Developed advanced rotor blade technologies supporting acoustic and vibration control techniques; coupled computational fluid dynamics (CFD) and acoustic prediction into aeromechanics analysis.
  -Completed fabrication and testing of a resin mold wing spar and demonstrated a 35% labor reduction . Completed fabrication of thermoplastic horizontal stabilizers and conducted tool proof, lightning, static, and fatigue testing; fabricated frames and longerons for four (4) damage tolerant thermoplastic tailbooms..
  -Fabricated low inertia turbine; tested organic matrix composite engine inlet housing; completed flight-weight magnetic bearing controls development, adaptive lube system analysis, innovative inlet protection system analysis and non-intrusive ignition demonstration.
- 2985 -Completed assembly and testing to validate the reprogrammable smart integrated microsensor system.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602211A Aviation Technology / PROJECT A47A

FY 1995 Accomplishments: (continued)

-Developed modeling and simulation plan for structural crash dynamics; completed design, fabrication and drop test of crashworthy thermoplastic subfloor; completed design, fabrication and field evaluation of multiple crashworthy aviator seatback cushions.
-Continued development of simulation and analyses for potential "Dual Use" concepts including Joint Transport Rotorcraft (JTR), manned/unmanned vehicle integration, and low cost, reconfigurable mission equipment package architectures.

• 4078 -Initiated flight test of low observable (LO) kitted OH-58D to assess RAM/RAS durability; completed methodology for advanced visual/electro-optical VISEO detection model.
-Demonstrated Man-Machine Design and Analysis System (MIDAS) code and transferred results to Boeing Helicopter under CRDA; applied MIDAS to Army Air Warrior Program.
-Support provided by Defense Finance and Accounting System (DFAS).

Total 16358

FY 1996 Planned Program:

• 9943 -Initiate rotorcraft integration analysis of TACAWS and LCPK; update simulations/models for NLW.
-Complete IFFC design for hardware/ pilot-in-the-loop simulation/ flight test demonstrations; continue slung load cargo handling qualities development; apply control limiting for cueing to achieve carefree maneuvering; initiate demonstration of full IFFC in ground based systems integration facility; initiate integration/ checkout of RASCAL research flight control system; combine innovative rotor technologies and integrated aeromechanics analysis; merge interdisciplinary tools to set design direction for Helicopter Active Control Technology (HACT) demonstration (supports Joint Transport Rotorcraft (JTR) Program).
-Under the auspices of the NRTC, cooperate with US rotorcraft industry, NASA, Navy, FAA, and academia to reduce manufacturing and operating costs, and evolve critical technologies for exploitation of dual-use rotary-wing applications.
-Initiate system to measure and control the cure state of a composite laminate; initiate advanced joining technology for fabrication of large, complex structural assemblies in a single cure/ bond cycle; initiate crash dynamics modeling and simulation effort jointly with ARL/VSD; complete two dynamic impact (drop) tests of crashworthy thermoplastic subfloor sections; complete field evaluation of crashworthy aviator seatback cushions.

• 5397 -Conduct spin test of Low Inertia Turbine to IHPTET Phase II conditions; complete design of Army/Air Force centrifugal compressor; test Army/ Air Force non-intrusive ignition system, and test organic matrix composite engine inlet housing; conduct reliability and maintainability sensitivity assessments to identify high priority reliability, maintainability and cost drivers.
-Complete program to assess LO material durability; validate VISEO; initiate a program to develop a multi-spectral database of VISEO terrain backgrounds.
-Complete program to assess LO material durability; validate VISEO; initiate a program to develop a multi-spectral database of VISEO terrain backgrounds.
-Complete program to assess LO material durability; validate VISEO; initiate a program to develop a multi-spectral database of VISEO terrain backgrounds.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602211A Aviation Technology / PROJECT A47A

FY 1996 Planned Program: (continued)

-Complete program to assess LO material durability; validate VISEO; initiate a program to develop a multi-spectral database of VISEO terrain backgrounds.
-Continue analysis and concept development of advanced manned and unmanned VTOL systems, working as teams.
-Add model of auditory communications to MIDAS, and implement new user interface and single language simulation.
-Provide payment for services from the DFAS.

•	53	-Revised economic assumption not available for execution.
Total	15393	

FY 1997 Planned Program:

•	12348	-Continue TACAWS integration studies, LCPK integration concept and NLW for rotorcraft studies. -Provide handling qualities criteria for cargo class rotorcraft slung load night operations; demonstrate carefree maneuvering using control limiting/cueing/applying neural nets; conduct hardware/ software design validation for IFFC; complete RASCAL research flight control system checkout and initiate flight simulations; develop critical aeromechanics models for low-cost rotor/fuselage systems. -Complete fabrication of damage tolerant hub flexures; determine residual strength of ballistically damaged composite flexbeam; demonstrate close-loop composite cure process control; refine crashworthiness simulation codes for Army helicopter application and conduct component-level validation tests. -Conduct engine test of Low Inertia Turbine; fabricate and build-up of Army/Air Force high pressure ratio centrifugal compressor; demonstrate Army/Air Force non-intrusive ignition system; initiate high performance, light weight turbine module program; initiate efforts in acoustic fault detection and testing of inductive oil monitoring sensors.
•	9592	-Perform an analytical study of advanced visual/EO camouflage effectiveness; initiate program to develop RF transparent rotor blade leading edge erosion protection system; initiate program to develop advanced, light weight, low cost thermal insulation. -Begin comprehensive formal workstation evaluation of MIDAS. -Under the auspices of the NRTC, cooperate with US rotorcraft industry, NASA, Navy, FAA, and academia to reduce manufacturing and operating costs, and evolve critical technologies to enable exploitation of dual-use for rotary-wing applications. -Provide payment for services from the DFAS.
Total	21940	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602211A Aviation Technology — PROJECT A47A

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	16672	17732	23294
Appropriated Amount (FY 1995)	16672		
Adjustments to FY 1995	-314		
Appropriated Amount (FY 1996)		15544	
Adjustments to FY 1996		-151	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-1354
Current President's Budget Submit	16358	15393	21940

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602211A Aviation Technology / PROJECT A47A

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A47B Vehicle Propulsion and Structures Technology	3143	2577	2743	2881	3091	3092	3370		Continuing	Continuing

A. Mission Description and Budget Item Justification: The purpose of this project is to conduct exploratory development of generic propulsion and structures technology in support of DoD/Army VTOL airmobile systems improvements. Areas of investigation and research include concepts of: small airflow gas turbines; high temperature materials; mechanical drive systems; integrated composites structural integrity; low cost manufacturing concepts; aerodynamic loads; aeroelastic interactions; and environmental control systems. The propulsion technology in this project supports the Army Aviation Research, Development and Engineering Center (RDEC) focus on the goals of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) Program. The goal of IHPTET is to demonstrate technology which would double propulsion system capability for a wide range of potential future aircraft and missile applications.

FY 1995 Accomplishments:

- 1935 -Developed and tested carburized ground face gears; Demonstrated health/usage monitoring developed for a OH-58D/like transmission.
  -Designed and analyzed Ceramic Matrix Composite (CMC) turbine nozzle.
  -Evaluated stability enhancement for turbine engines.
  -Developed waverotor-cycle design with combustion.
- 1208 -Modified hardware and fuselage to eliminate interference problems with Advanced Rotor Experimental System (ARES) II, evaluated control algorithms, and conducted wind tunnel tests in the Langley Transonic Dynamics Tunnel (TDT).
  -Published results on skin/stringer disbonding of composite panels; incorporated advanced models for evaluating progressive failure in laminated composites; and developed finite element model for elastically coupled composite tilt-rotor blades.
  -Developed prototype thermal Non-Destructive Evaluation (NDE) hardware for composites field inspection and manufacturing quality assurance; validated bending-torsion stiffness design technique; incorporated advanced fabrication concepts for net-shape woven preforms; and designed optimized efficient energy absorbing fuselage frames.

Total 3143

FY 1996 Planned Program:

- 1398 -Perform durability test of advanced fuel injector and compliant-backed ceramic liner.
  -Complete testing of splittered rotor demonstrating ultra-high pressure ratio (greater than 3:1) from single axial compressor stage.
  -Couple test rig waverotor unit with combustor to simulate engine configuration which is expected to achieve significant increases in power and reductions in fuel consumption.
  -Complete test rig demonstration of high temperature magnetic bearing.
- 1115 -Conduct first tests of ARES II and the "low cost" basic research rotor in the Langley TDT.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
2 - Applied Research	0602211A Aviation Technology — PROJECT A47A

FY 1996 Planned Program: (continued)

-Test and evaluate advanced damage constitutive models for delamination failure and validate composites reliability-based fatigue methodology.
-Demonstrate advanced concepts for fabricating net-shape woven preforms; evaluate prototype thermal NDE system on composite structures; and test near-field acoustical holography as a global measurement technique in actual aircraft-type structure.

- 18 -Revised economic assumption not available for execution.
- 46 -Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.

Total 2577

FY 1997 Planned Program:

- 1366 -Complete waverotor warm cycle experimental program and waverotor/gas turbine engine integration analysis.
  -Complete ceramic matrix composite turbine nozzle hardware fabrication and component testing for IHPTET III.
  -Complete advanced compressor program for Joint Turbine Advanced Gas Generator (JTAGG) II.
  -Complete face gear transmission component level experimental and analytical evaluation.
- 1377 -Validate engine dynamic model and concepts for active compressor stability enhancement.
  -Conduct wind tunnel tests in the Langley TDT to investigate passive tailoring concepts to reduce rotor system vibrations.
  -Validate stress and strain failure analysis and incorporate with NDE methods to demonstrate a full integrated stress-strength-inspection methodology.
  -Develop automated and non-contacting NDE methods for large area structural inspection and analytically model the response and failure of graphite-epoxy (GR-EP) composite frames for crashworthy aircraft design.

Total 2743

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3290	2649	2751
Appropriated Amount (FY 1995)	3221		
Adjustments to FY 1995	-78		
Appropriated Amount (FY 1996)		2603	
Adjustments to FY 1996		-26	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-8
Current President's Budget Submit	3143	2577	2743

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602270A Electronic Warfare (EW) Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	17794	14786	15845	16253	18036	19117	19523		Continuing	Continuing
A442 Tactical Electronic Warfare Technology	9918	9023	8783	9078	9498	10089	10312		Continuing	Continuing
A906 Tactical Electronic Warfare Techniques	7876	5763	7062	7175	8538	9028	9211		Continuing	Continuing

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

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602270A Electronic Warfare (EW) Technology — PROJECT A442

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A442 Tactical Electronic Warfare Technology	9918	9023	8783	9078	9498	10089	10312		Continuing	Continuing

A. Mission Description and Budget Item Justification Project A442 - Tactical Electronic Warfare Technology: This project develops electronic warfare sensor and countermeasure (CM) technologies for self protection of air and ground platforms, area protection against radar directed weapons (i.e., jamming of enemy counter mortar/counter battery radars), and combat surveillance and target acquisition. The following technology areas are investigated:

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

FY 1995 Accomplishments:

•	3498	-Demonstrated jamming techniques against single and multi-spectral top attack smart munitions; conducted field test of high accuracy direction finding (DF) antennas for aircraft and ground vehicle warning receivers; and initiated development of electronic attack (EA) modulation test bed vs. ultra high frequency (UHF) through millimeter wave sensors and radars; completed field testing of millimeter wave jammer, and completed construction of millimeter wave jammer for ground vehicles.
•	4038	-Demonstrated beam coupler for Advanced Research Projects Agency (ARPA) laser/anti-tank IRCM point/track; implemented head missile warning and beam steering technology and advanced jamming techniques for multi-spectral technology demonstration; evaluated IRCM techniques for top attack threats to ground vehicles.
•	920	-Designed an omni-directional, high gain, multiband antenna which provides the technology to replace current spinning dish antennas for the intelligence electronic warfare common sensor (IEWCS).
•	792	-Initiated the design of an ES/super high frequency (SHF) receiver to complement the omni-directional antenna in order to increase the ability of the IEWCS to exploit modern radar signals.
•	198	-Implemented programs for advanced countermeasures against imaging radar systems.
•	217	-Continued WARLOCK X radar deception program and field test.
•	255	-Implemented program to target non-conventional sensors for deception and non-communication jamming purposes.
Total	9918	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602270A Electronic Warfare (EW) Technology — PROJECT A442

FY 1996 Planned Program:

•	3053	-Demonstrate radio frequency (RF) sensor and EA modulator with capability to locate, deceive and jam monopulse and phased array radars from UHF through millimeter wave; initiate development of low cost finger-printing for signal sorting and combat identification (ID) assistance. -Conduct experiments to pass threat data derived from EW self-protection systems to ground vehicles and command posts.
•	3601	-Demonstrate missile warning sensor for low observable (LO) platforms; develop gimbal-less beam steering; develop CM to advanced electro-optic-infrared (EOIR) missiles using imaging seekers.
•	2256	-Complete the design of the ES/SHF receiver and demonstrate the advantages over current antennas. -Initiate the design of an ES signal processor to provide optimal exploitation of radar signals of interest. -Initiate fabrication of the omni-directional, high gain, multi-band antenna. -Continue program for advanced countermeasures against imaging radar systems. -Continue efforts to target non-conventional sensors to develop "surgical" countermeasures techniques.
•	84	- SBIR/STTR.
•	29	-Revised economic assumption not available for execution.
Total	9023	

FY 1997 Planned Program:

•	3072	-Continue development of low cost finger-printing signal sorting, jamming and combat ID assistance; initiate EA testing against bistatic, impulse and low probability of intercept radars; initiate RF countermeasures vs. advanced multi-function munitions/weapons that attack both air and ground vehicles. -Develop fiber optic components to remote aircraft and ground vehicle RF antennas and jamming modules as potential upgrades to current EW systems. Goal is to increase warning receiver sensitivity, increase jamming signal to noise ratios, improve reliability, and decrease weigh. Conduct test against advanced phase array radar.
•	3466	-Exploit advanced EOIR CM against advanced threat missiles (surface-to-air missiles (SAMs) and anti-tank missiles); techniques will be demonstrated in multi-spectral technology demonstration (PE 0603270A, project DK16).
•	2245	-Complete the design of the ES signal processor and demonstrate its performance improvements over currently used processors. -Demonstrate the omni-directional, high-gain, multiband antenna with the next generation ES/SHF receiver. -Implement initiative to develop countermeasures to exploit digital radars. -Continue program for advanced countermeasures against imaging radar systems. -Continue efforts to target non-conventional sensors to develop "surgical" countermeasures techniques.
Total	8783	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602270A Electronic Warfare (EW) Technology — PROJECT A442

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	10023	9274	8887
Appropriated Value (FY 1995)	10023		
Adjustments to FY 1995	-105		
Appropriated Value (FY 1996)		9112	
Adjustments to FY 1996		-89	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-104
Current President's Budget	9918	9023	8783

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602270A Electronic Warfare (EW) Technology — PROJECT A906

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A906 Tactical Electronic Warfare Techniques	7876	5763	7062	7175	8538	9028	9211		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project A906 - Tactical Electronic Warfare Techniques:** This applied research program involves technologies that provide the capability to intercept, direction find (DF) and locate current and emerging threat communications emitters for targeting, tactical situation awareness, and disruption/destruction of enemy command, control and communications (C3) systems. It specifically develops essential electronic attack (EA) components and techniques for advanced jammers and smaller, low power, lightweight, common modules for advanced systems to counter communications associated with modern threat C3 systems. In addition, it will provide the capability to update through remote means the intelligence and electronic warfare common sensor system (IEWCS) with EA algorithms that allow the system to disrupt, deny or destroy threat communication signals. This effort establishes friendly force ownership of the electromagnetic spectrum. This program also involves fusion (automated assimilation and synthesis) of battlefield intelligence data. It specifically involves development and demonstration of fusion technology to automate manpower intensive command and control information from battlefield sensors, enabling friendly commanders to operate inside of the enemy decision cycle. Resultant enhancements will support joint C3 warfare, by denying threat forces access to their own C3 systems and operating within the decision cycle of threat C3 systems that survive.

FY 1995 Accomplishments:

•	1116	-Fabricated high frequency (HF) antenna technology demonstrator and transformer utilizing high temperature super conducting (HTSC) materials and tested functionality.
•	800	-Analyzed diverse antenna applications against platform requirements for optimization purposes.
•	1480	-Examined vulnerability of mobile cellular radio systems with type 2 and type 3 signals for purpose of developing exploitation strategies.
•	300	-Acquired, analyzed and began exploitation of modern tactical communications systems to develop EA strategies and update IEWCS threat system database.
•	1380	-Fabricated and tested application specific integrated circuit (ASIC) utilizing quadratic residue number system (QRNS) logic results for efficient wideband receiver developments.
•	800	-Continued development of correlation and templating, automated tracking, cross-cueing and situation display tools and techniques.
•	400	-Initiated development of airborne IEW asset management techniques for tactical applications.
•	600	-Completed electronic support (ES) asset effectiveness and planning tools.
•	500	-Completed terrain/map reasoning for automated overlays and terrain features and battlefield damage assessment techniques and tools. Technology will be demonstrated in PE 0603270A/DK15.
•	500	-Initiated efforts to provide tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms.
Total	7876	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602270A Electronic Warfare (EW) Technology — PROJECT A906

FY 1996 Planned Program:

•	2650	-Continue fabrication of HF antenna technology demonstrator and transformer utilizing HTSC materials and test functionality . -Continue analysis of diverse antenna applications against platform requirements for optimization purposes prior to design of optimal antenna for demonstration in PE 0603270A/DK15. -Complete vulnerability assessment of mobile cellular radio systems with type 2 and type 3 signals. Technologies will be demonstrated in PE 0603270A/DK15. -Acquire, analyze and exploit modern tactical communications systems to develop EA strategies and update IEWCS threat system database.
•	3094	-Complete development of the efficient wideband receiver with the final breadboard configuration of the fast Fourier Transform (FFT) ASIC utilizing QRNS. Technologies will be integrated and demonstrated in PE 0603270A/DK15. -Continue development of correlation and templating, automated tracking, cross-cueing and situation display tools and techniques. -Continue development of techniques for airborne asset management in tactical IEW applications. -Continue efforts to provide tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms.
•	19	Revised economic assumption not available for execution.
Total	5763	

FY 1997 Planned Program:

•	4300	-Complete testing of HF antenna technology demonstrator and transformer prior to demonstration in PE 0603270A/DK15 -Acquire, analyze and exploit modern tactical communications systems to develop EA strategies and update IEWCS threat system database -Continue development of airborne asset management techniques for enemy and friendly situation visualization, enhanced targeting and situation assessment/development -Initiate examination of exploitation techniques for personal communication networks
•	2762	-Complete development of correlation and templating, automated tracking, cross-queuing and situation display tools and techniques and provide technologies to PE 0603270A/DK15 for demonstration and field testing -Continue efforts to provide tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms -Investigate advanced communications jamming techniques to be utilized against evolving threat communications systems
Total	7062	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602270A Electronic Warfare (EW) Technology — PROJECT A906

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	8099	6037	6083
Appropriated Value (FY 1995)	7932		
Adjustments to FY 1995	-56		
Appropriated Value (FY 1996)		5820	
Adjustments to FY 1996		-57	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			979
Current President's Budget	7876	5763	7062

Change Summary Explanation:

Funding: FY97: Increase supports advanced jamming techniques targeted at evolving threat communications systems.

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602303A Missile Technology

PROJECT: A214

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A214 Missile Technology	23327	17500	20295	23320	25025	25219	25847		Continuing	Continuing

A. Mission Description and Budget Item Justification: This exploratory development program is designed to provide the Army with missile, rocket, and unmanned vehicle technology ready for insertion into operational systems and next generation weapon systems. Its overall objective is to provide a continental U.S. (CONUS)-based, post-cold-war Army with weapon systems enabling immediate world-wide deployment of forces with the capability to initially contain and ultimately achieve decisive victory against hostile forces equipped with modern weapons. The program is driven by U. S. Army Training and Doctrine Command (TRADOC) battlefield dynamics Battle Labs and mission area analyses of deficiencies in the areas of close combat, fire support, air defense, intelligence/electronic warfare, and the Army Science and Technology Master Plan. The program is focused on technologies which enhance weapon system deployability, flexibility, lethality, survivability, and affordability. Work within the program is conducted through system simulation, virtual prototyping, concept synthesis, hardware development, and focused technology demonstrations. The work in this program element is consistent with the resource constrained Army Science and Technology Master Plan, the Army Modernization Plan and Project Reliance. Project A214, the only project in this program element, is focused on missile and rocket technologies that support high fire power/logistic support weight ratio concepts for the early entry forces, to address system concepts that enhance the survivability of launch systems, to provide greater effectiveness under adverse battlefield conditions, to increase kill probabilities against hard targets, and to provide powerful new simulation and virtual prototyping analysis tools. This project encompasses seven major areas: missile guidance systems; air defense target acquisition systems; multi-spectral missile seekers; high fidelity system level simulations; missile aerodynamics and structure; smart, stealthy, smokeless missile propulsion; and focused technology integration/demonstrations. As efforts in these technology areas mature, work is transitioned to PE 0603313A (Missile & Rocket Advanced Technology) to support demonstrations of capabilities for early entry forces in the Rapid Force Projection Initiative (RFPI), Future Missile Technology Integration (FMTI), and 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 Technology Demonstration) and PE 0602782A (C^3 Technology) in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. This project includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology
	PROJECT A214

FY 1995 Accomplishments:

- 8525 - Missile guidance systems - demonstrated lower weight/cost warm gas missile fin actuator; Unmanned Ground Vehicle (UGV) semi-automated road-following/obstacle avoidance software to enhance soldier survivability; improved multi-sensor fusion system for increased weapons lethality and decreased fratricide; developed hardware-independent definition technology to reduce life cycle obsolescence costs; designed digital secure datalink testbed for Future Missile Technology Integration (FMTI), other missiles, and Unmanned Aerial Vehicle (UAV)/UGV guidance; developed autotracker subsystems for improved low signature target tracking in high clutter for improved missile lethality; designed a data acquisition package, tested and characterized airfoil for high altitude precision guided airdrop for increased survivability and force sustainment; demonstrated fiber optic gyroscope for decreased size and cost and increased missile reliability and lethality; demonstrated horizontal technology application of Real Time Executive for Missile Systems (RTEMS) real-time software executive on Avenger, other triservice systems, and international applications for decreased software development and life-cycle maintenance costs.
  - Air defense target acquisition systems - developed and tested integrated air defense/close combat missile target acquisition/fire control system using acoustic sensor cueing and handoff to laser radar effluent detection sensor; designed and bench-tested improved high-range resolution target ID algorithms to reduce fratricide for Patriot, U.S. Air Force (USAF), and other systems; developed high-speed optical processing system to support advanced ID algorithms using smaller, lighter, cheaper computers.
  - Multi-spectral missile seekers - evaluated Cromwell detector technology for improved, lower cost Infrared (IR) focal plane array seekers. Analyzed seeker performance in tower and captive carry flight tests. Began development of signal processing software for next-generation IR seekers; demonstrated improved target ID/classifier algorithm for imaging missile seekers for decreased fratricide and improved aimpoint selection/lethality; designed and field tested Scatterider seeker and low cost guidance link for improved missile performance.
  - High fidelity system level simulations - optimized low-cost, commercial off-the-shelf scene generation techniques for next generation tactical missile simulations; integrated technology into system simulations for operational and developing systems such as PATRIOT and JAVELIN, Follow-On-To-TOW, Advanced STINGER, and BAT.
- 14802 - Missile aerodynamics and structure - developed hardware for cooperative Army/USAF wind tunnel evaluation of missile systems. Validated aero/structural models and developed visualization techniques applicable to tactical missile design; bench tested candidate advanced materials and transitioned to upgrades of fielded systems and new missile concepts such as FMTI; assessed multistate Kalman filters for guidance fuzing for increased lethality for USAF and Patriot Advanced Capability (PAC-III) anti-air missiles; designed improved fiber payout drum for extending the range of fiber optic guided missiles; assessed impact/deformation properties of composite materials for application to reduced weight missiles.
  - Smart, stealthy, smokeless missile propulsion - demonstrated smart adaptable propulsion; demonstrated small turbo rocket; demonstrated environmentally benign propulsion and radar absorbing materials for specific civilian and military applications; developed vortex injector bi-gel engine.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602303A Missile Technology
PROJECT: A214	

FY 1995 Accomplishments: (continued)

- Focused technology integration/demonstrations - completed system trade study for the adaptive missile demonstration; analyzed advanced hypervelocity missile flight test results and performed second flight test; demonstrated heavywall ducted rocket for Japan Cooperative Program; demonstrated robust automatic, very high-speed target recognition with prototype optical correlator; completed Preliminary Design Review (PDR) and turbojet/other subsystem testing and 1995 Joint Precision Strike Demonstration (JPSD) exercise support for the Multi-mode Airframe Technology (MAT) demonstration.

Total 23327

FY 1996 Planned Program:

- 6157 - Missile guidance systems - develop low cost, low weight/volume Guidance and Control (G&C) package for insertion into DOD missile systems; develop alternative guidance techniques; develop missile and fire control software for next generation G&C subsystems.
  - Air defense target acquisition systems - develop integrated air defense fire control target acquisition algorithms and multi-sensor suites. Develop active/passive target recognition algorithms.
  - Multi-spectral missile seekers - develop missile seeker wide field-of-regard search and hand off techniques compatible with autonomous target acquisition; test seeker hardware.
  - High fidelity system level simulations - develop and demonstrate improved techniques for target signature for hardware-in-the-loop simulation; apply commercial technology to simulation processors and scene generators for low cost solutions.
- 11343 - Missile aerodynamics and structure - validate rotary wing aero-propulsion model; evaluate and select advanced materials for structural modeling development; develop warhead guidance fusing techniques to increase capabilities of air defense systems; validate current air target penetration equations for Countering Armor Protection Systems (CAPS) problems.
  - Smart, stealthy, smokeless missile propulsion - continue development of smart propulsion componentry technology for application to adaptable, multimission, light weight, survivable systems.
  - Focused technology integration/demonstrations - integrate MAT components into a multi-mode airframe for hardware in the loop test; convert and demonstrate advanced optical correlator for use in the infrared (IR) spectrum; develop flightweight ducted rocket engine for Japan Cooperative Program.
  - Revised Economic Assumption not available for execution.
  - Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.

Total 17500

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology
	PROJECT A214

FY 1997 Planned Program:

- 9628 - Missile guidance systems - demonstrate low cost, low weight/volume guidance and control package for insertion into DOD missile systems; demonstrate software for advanced operating system and develop software reuse approaches
  - Air defense target acquisition systems - demonstrate advanced integrated air defense fire control target acquisition algorithms and multi-sensor suites; test active/passive target recognition algorithms in operational scenarios; evaluate automatic target recognition algorithms for integrated missile systems.
  - Multi-spectral missile seekers - demonstrate missile seeker search and hand-off techniques applicable to autonomous target acquisition.
  - High fidelity system level simulations - develop improved radio frequency signal modulators; upgrade target signature and scene generator control software to accommodate improved generation techniques; evaluate infrared scene projectors.
  - Missile aerodynamics and structure - implement modeling codes for aerodynamic, structural, warhead fusing, and missile concept evaluation; complete integration of CAPS long standoff warheads into missile testbed and test; test advanced composites.
- 10667 - Smart, stealthy, smokeless missile propulsion - demonstrate and test advanced propulsion concepts such as ducted rocket engines, air turbo rockets, advanced solid propulsion, gel motors, and hybrid concepts.
  - Focused technology integration/demonstrations - execute MAT flight demonstration; conduct ground testing of flightweight ducted rocket engine demonstration for Japan Cooperative Program.

Total 20295

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	23520	17985	22607
Appropriated Amount (FY 1995)	23520		
Adjustments to FY 1995	-193		
Appropriated Amount (FY 1996)		17671	
Adjustments to FY 1996		-171	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-2312
Current President's Budget Submit	23327	17500	20295

Change Summary Explanation: FY 1997 funds (-2312) reprogrammed for higher priority requirements.

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

DATE March 1996

2 - Applied Research | **0602308A Modeling and Simulation Technology**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	51371	19967	21134	29557	34526	34525	35568		Continuing	Continuing
AC90 Distributed Interactive Simulation (DIS) Technology	12940	7859	9516	10121	10416	10343	10540		Continuing	Continuing
AC99 Modeling and Simulation Technology	38431	12108	11618	19436	24110	24182	25028		Continuing	Continuing

Mission Description and Budget Item Justification: Work in this program element (PE) advances development and use of modeling and simulation, including Distributed Interactive Simulation (DIS), related to Army-specific experiments/demonstrations and industry participation at the U. S. Army Training and Doctrine Command (TRADOC) Battle Labs and Army's Louisiana Maneuvers (LAM). It develops standards, architecture and interfaces essential to realizing the DoD/Army vision of creating a verified, validated and accredited synthetic "electronic battlefield" environment. The electronic battlefield is used to investigate and demonstrate new warfighting concepts including development of tactics, doctrine, training techniques, soldier support, systems and system upgrades. It directs and stimulates advances in those technologies required for real time interactive linking within and among constructive, virtual and live simulations. Work also supports planning and execution of the Advanced Concepts and Technology (ACT) II program, which evaluates new concepts. ACT II focuses on providing a timely, low overhead mechanism for industry and academia to participate in the Army's LAM and TRADOC Battle Labs warfighting demonstrations and experiments. Work is consistent with the Army Science and Technology Master Plan and the Army Modernization Plan. Efforts include non-system specific development efforts pointed toward specific military needs appropriate to Budget Activity 2.

Work is performed by the broadest range of the nation's industrial and academic communities. Contractors include: Loral Western Development Laboratories, San Jose, CA; Pathfinder, Littleton, CO; University of Central Florida, Institute for Simulation and Training, Orlando, FL; Georgia Tech Research Institute, Atlanta, GA; Veda Incorporated, Orlando, FL; University of Alabama, Tuscaloosa, AL; Perceptronics, Inc., Woodland Hills, CA; Lockheed Sanders, Nashua, NH; Lockheed Martin, Orlando, FL; Evans & Sutherland, Salt Lake City, UT. Simulation, Training and Instrumentation Command (STRICOM), Orlando, FL. is responsible for Project AC90 and Army Research Office, Raleigh, NC is responsible for Project AC99. Efforts for ACT II are being performed by the following contractors: Advanced Communication Systems, Faifax, VA; Alliant Technosystems, Inc., Hopkins, MN; Atlantic Research Marketing, W. Bridgewater, MA; Computer Sciences Corp., Huntsville, AL; Foster Miller, Inc., Waltham, MA; Hughes Aircraft Co., El Segundo, CA; Illinois Institute of Technology, Chicago, IL; Intelligent Investments, Greensboro, NC; Lockheed Sanders, Nashua, NH; Loral Electro-Optical Systems, Pomona, CA; Loral Vought Systems, Dallas, TX, McQ Associates, Inc., Fredericksburg, VA; Mystech Associates, Inc., Falls Church, VA; OptiMetrics, Inc., Ann Arbor, MI; Quick Reaction Corp., Gilroy, CA; Racal Communications, Inc., Rockville, MD; Research Triangle Institute, Research Triangle Park, NC; SPARTA, Inc., Huntsville, AL; Simulation Technologies, Inc., Dayton, OH; Syracuse Research Corp., Syracuse, NY; Texas Instruments, Inc., Plano, TX.

Future efforts will be performed by a broad range of contractors selected in response to the Broad Agency Announcement (BAA) process. This program is fully coordinated with the other Army exploratory development programs, Advanced Research Projects Agency (ARPA), 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 this Program Element

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602308A Modeling and Simulation Technology

is related to and fully coordinated with efforts PE 0604715A (Non-System Training Devices - Engineering Development). There is no duplication of effort within the Army or Department of Defense.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602308A Modeling and Simulation Technology — PROJECT AC90

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AC90 Distributed Interactive Simulation (DIS) Technology	12940	7859	9516	10121	10416	10343	10540		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project AC90 - Distributed Interactive Simulations (DIS) Technology**: This program provides and demonstrates enabling technologies for advancing Distributed Interactive Simulation (DIS) in the synthetic environment and the representation of the battlefield needed to support the use of Modeling and Simulation as an acquisition tool and training in the era of reduced funding. Efforts in this project support the Battlefield Distributed Simulation-Developmental (BDS-D) program. BDS-D will provide virtual representation of a lethal combined arms environment with the warfighter-in-the-loop that closed-form analysis cannot provide. The environment permits new system concepts, tactics and doctrine and test requirements to be evaluated with a warfighter-in-the-loop in a combined arms battlefield throughout the acquisition life cycle at a reduced cost and time than the traditional approach. The research being conducted includes Computer Generated Forces (CGF), simulation interface and linkage technologies, and complex data modeling and interchange. Arrival of this sophisticated technology, equipment and complex interactions with each other, makes this effort critical to the overall success of Army acquisition and training requirements.

FY 1995 Accomplishments:

- 5327 Defined requirements and conducted experiments to demonstrate linkage of constructive (analytical and training wargame models) and virtual (simulators and computer generated forces) simulations in DIS environments.
  Completed Battlefield Distributed Simulation-Developmental Advanced Technology Demonstration (BDS-D ATD).
  Demonstrated dynamic terrain capability for DIS and investigated architectural changes to be integrated into the DIS.
  Upgraded hardware, software, and interfaces for the Land Warrior Test Bed to facilitate infantry systems participation in virtual prototyping, advanced concepts, advanced technology demonstrations and DIS exercises.
- 6673 Expanded the architecture to accommodate increased Battlefield Operating System (BOS) functionality and capability supporting division level DIS experiments and mission rehearsals to include command, control and communications and countermeasure DIS environments.
  Enhanced standard for terrain databases to assure correlation and interpretability among simulators, semi-automated forces, and constructive simulations.
  Continued development of standards for interfacing of Command, Control, Communications and Intelligence and Electronic Warfare (C3IEW) and initial (real) tactical communication systems and simulations to distributed combat/wargame simulations for digitizing the battlefield.
- 940 Provided simulation support for Joint Precision Strike Demonstration (JSPD).

Total 12940

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602308A Modeling and Simulation Technology / PROJECT AC90

FY 1996 Planned Program:

•	3345	High Level Architecture Prototype Demonstrations of emerging "object model templates" and simulation support tools for pre, post and run time. Continue to develop authoritative computer generated forces representations of humans and human behavior for individuals and groups including Verification, Validation & Accreditation (VV&A).
•	2321	Establish a multi-site, distributed laboratory of networked virtual reality devices for integration of individual warriors into synthetic environments.
•	1985	Define methods and approaches for determining multi-cast grouping strategies for distributed systems required for linking interactively among all classes of simulation.
•	175	SBIR/STTR reduction not available for execution.
•	33	Revised economic assumption not available for execution.
Total	7859	

FY 1997 Planned Program:

•	4216	Continue development of High Level Architecture object model templates and simulation support tools for pre, post and run time, and linkages of C4I simulations and systems. Continue to develop High Level Architecture data exchange interfaces, data correlation methods and concept models of mission space for ground portion of computer generated forces with emphasis on C3IEW systems and C3IEW simulations.
•	3800	Continue to develop authoritative computer generated forces representations of humans and human behavior for individuals and groups. Continue integration of individual warrior into synthetic environment using the multi-site, distributed laboratory of networked virtual reality devices.
•	1500	Demonstrate capability to link interactively among constructive virtual and live classes of simulations. Demonstrate and evaluate multi-cast grouping strategies identified in earlier studies.
Total	9516	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	13397	11323	10800
Appropriated Amount (FY 1995)	12940		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		7938	
Adjustments to FY 1996		-79	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-1284
Current President's Budget Submit	12940	7859	9516

Change Summary Explanation:
Funding: FY97: Funds reprogrammed (-1000) for high priority requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602308A Modeling and Simulation Technology / PROJECT AC99

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AC99 Modeling and Simulation Technology	38431	12108	11618	19436	24110	24182	25028		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project AC99 - Modeling and Simulation Technology:** This project supports the Advanced Concepts and Technology (ACT) II Program. ACT II provides a timely, low-overhead mechanism, with a yearly Broad Agency Announcement (BAA) for industry and academia, to demonstrate mature technologies, prototypes, software and/or systems for assessment by the TRADOC Battle Labs and Louisiana Maneuvers Task Force. It supports new concepts evaluations through modeling and simulation in real time, soldier-in-the-loop, virtual and constructive, electronic battlefield demonstrations and field tests. Specific areas of interest include: battlespace management and battlefield synchronization; depth and simultaneous attack capabilities; early entry operations, lethality, survivability and mobility; command, control, communications and computers (to include interoperability); force sustainment; and doctrine and leader development.

FY 1995 Accomplishments:

- 38431 Conducted demonstrations and experiments in support of the Battle Labs and LAM.
  This effort included the following activities:
  (1) Released BAA to solicit Battle Lab and LAM related concepts and technologies from the nation's industrial and academic communities.
  (2) Initiated two step proposal; two page pre-proposal followed by invitation for full proposals.
  (3) Selected, within resource constraints, high payoff and innovative efforts for demonstration of new warfighting capabilities.
  (4) Analyzed and evaluated the results of FY 1994 efforts; identified candidates for streamlined acquisitions.
  (5) Approved BAA topics for new ACT II projects to satisfy future Army and DoD needs not being addressed by existing programs.
  (6) Awarded 35 projects which are in various stages of completion/transition to concept exploration or product development.

Total 38431

FY 1996 Planned Program:

- 11804 Conduct demonstrations and experiments in support of Battle Labs.
  This effort includes the following activities:
  (1) Release BAA to solicit Battle Lab and LAM related concepts and technologies from the nation's industrial and academic communities.
  (2) Select, within resource constraints, high payoff and innovative efforts for demonstration of warfighting capabilities.
  (3) Analyze and evaluate the results of FY 1995 efforts; identify candidates for streamlined acquisitions.
- 270 (4) SBIR/STTR reduction not available for execution.
- 34 (5) Revised economic assumption not available for execution.

Total 12108

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602308A Modeling and Simulation Technology — PROJECT AC99

FY 1997 Planned Program:

- 11618 Conduct demonstrations and Experiments in support of Battle Labs.
  This effort includes the following activities:
  (1) Release BAA to solicit Battle Lab and LAM related concepts and technologies from the nation's industrial and academic communities.
  (2) Select, within resource constraints, high payoff and innovative efforts for demonstration of warfighting capabilities.
  (3) Analyze and evaluate the results of FY 1995 efforts; identify candidates for streamlined acquisitions.
  (4) Approve BAA topics for new ACT II projects to satisfy future Army and DoD needs not being addressed by existing programs.

Total 11618

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	39900	12447	18464
Appropriated Amount (FY 1995)	38931		
Adjustments to FY 1995	-500		
Appropriated Amount (FY 1996)		12230	
Adjustments to FY 1996		-122	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-6846
Current President's Budget Submit	38431	12108	11618

Change Summary Explanation:
Funding: FY97: Funds reprogrammed (-6500) for high priority requirements.

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

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

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	32243	38128	34834	36690	38565	37583	39164		Continuing	Continuing
DC05 Armor Exploratory Development	6640	3882	6314	6280	6819	7158	7298		Continuing	Continuing
DC83 Tractor Card	0	2036	0	0	0	0	0		0	2036
AH74 Simulation Laboratory	5429	0	0	0	0	0	0		0	5429
AH77 Advanced Automotive Technology	5060	12085	11131	12830	14480	14776	15092		Continuing	Continuing
AH82 Non-Ozone Depleting Substance Technology	0	5323	3262	2420	1342	0	0		0	12727
AH91 Tank & Automotive Technology	15114	14802	14127	15160	15924	15649	16774		Continuing	Continuing

Mission Description and Budget Item Justification: This Program Element (PE) advances the state of technologies leading to development of advanced ground combat and tactical vehicles and components that improve the Army's ability to project force and fight, survive against, and defeat future battlefield threats. Increased emphasis is placed on technologies needed for upgrades to fielded ground vehicles leading to more mobile, affordable, digitized, lightweight, versatile and highly survivable ground combat systems essential for the post Cold War era. New technology is integrated into innovative vehicle concepts aimed at achieving more deployable advanced armored vehicles that reflect the Army's need to lighten the force while retaining the ability to survive in diverse, worldwide, flexible battlefield environments. These technologies will provide an intra-vehicular digitization compatibility with horizontal battlefield communication requirements. This PE provides critical new technologies to improve vehicle survivability against advanced anti-armor weapons. This PE evaluates non-ozone depleting fire suppressant alternatives to Halon 1301 for armored combat vehicles. This PE funds the National Automotive Center (NAC) which leverages commercial industry's large investment in automotive technology research and development and initiates shared technology programs that are directly focused on benefiting military ground vehicle systems. Work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The PE is managed by 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. There is no unnecessary duplication of effort within the Army or DoD. Furthermore, the project is coordinated with the Marine Corps office within the Naval Surface Warfare Center and ground vehicle developers within the Departments of Energy, Commerce and Transportation, and the Advanced Research Projects Agency (ARPA). Projects in this PE include non-system specific development efforts directed toward specific military needs, and therefore are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT DC05

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DC05 Armor Exploratory Development	6640	3882	6314	6280	6819	7158	7298		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project DC05 - Armor Exploratory Development:** This project lays the technical foundation to solve critical armor deficiencies and improve the survivability of ground combat vehicles against increasingly lethal anti-armor weapons and mines. Supporting the ultimate objective of lighter, more deployable, more survivable vehicles, the emphasis is on armor technologies that will be compatible with armors suitable for upgrade of current and emerging combat systems (e.g., Abrams, Bradley, Crusader), and light weight structural technologies for advanced combat systems. The project also develops low-burden solutions to the protection of tactical vehicles in war and operations other than war. This project focuses on armor technologies to complement innovative non-armor survivability techniques such as those described in project AH91 in this PE. Within the broader field of armor development, this project focuses technology on problems unique to the ground combat systems: protection of combat and tactical vehicles against such threats as kinetic energy projectiles, explosively formed penetrators and chemical energy warheads. This project draws upon products from Army programs (e.g., PE/Project 0602618A/AH81 and 0602618A/AH80), as well as innovative armors from industry, facilitating the transfer of armor products from those programs to Army systems applications. In addition to development of specific armor concepts, the project includes supporting work in armor materials, bringing together the collective expertise of the Department of Defense, the Department of Energy, and industrial and academic sources. Supporting work also includes development and refinement of armor performance models to assess armor configurations against different threats with sufficiently high fidelity. Other Government Agencies include: Jet Propulsion Lab, Pasadena, CA; National Institute of Standards and Technology (NIST), Gaithersburg, MD.

FY 1995 Accomplishments:

- 5639 - Developed energetic armors utilizing self-limiting energetic materials and other techniques to improve vehicle tolerance to effects of high performance armors.
  - Demonstrated roof armor systems for protection against advanced overhead threats (e.g., explosively formed penetrators).
  - Demonstrated armors that upgrade existing medium class vehicles to the level of the advanced medium cannon threat.
- 1001 - Initiated proof of principle demonstration of special steel armor material identified in the Joint Armor Anti-armor program.
  - Developed design methodology for armors suitable to composite combat vehicles.
  - Demonstrated armor technology for enhancing crew survivability in tactical vehicles used in operations other than war.

Total 6640

FY 1996 Planned Program:

- 3798 - Demonstrate passive and energetic roof armor technologies which can defeat overhead threats.
  - Enhance medium vehicle upgrade armors to defeat medium caliber cannon.
  - Demonstrate advanced test analysis and armor design methods for reduction of armor development and production cost.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT DC05

FY 1996 Planned Program: (continued)

		- Develop second generation protection kit for ballistic and mine protection of medium tactical trucks.
•	72	- Funds reprogrammed for SBIR/STTR in accordance with Small Business Innovative Research Program Reauthorization Act of 1992.
•	12	- Revised economic assumption not available for execution.
Total	3882	

FY 1997 Planned Program:

•	4400	- Demonstrate second generation protection kit for ballistic and mine protection of medium trucks.
		- Demonstrate advanced non-energetic reactive armor technology in armor configurations for medium combat vehicles.
		- Demonstrate advanced armor configurations compatible with signature management techniques for combat vehicles.
	1914	- Develop analytical methods for design of ceramic armors with maximum energy dissipation for defeat of KE threats.
		- Develop and validate armor penetration mechanics model enhanced to include effects of energetic armors.
Total	6314	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	6898	4002	6481
Appropriated Amount (FY 1995)	6753		
Adjustment to FY 1995	-113		
Appropriated Amount (FY 1996)		3921	
Adjustment to FY 1996		-39	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-167
Current President's Budget Submit	6640	3882	6314

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH74

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH74 Simulation Laboratory	5429	0	0	0	0	0	0		0	5429

A. Mission Description and Budget Item Justification: **Project AH74 Simulation Laboratory:** This project was established in response to Congressional direction and funding to implement an upgrade to the Physical Simulation Laboratory at the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC). The upgrades will include increased power supply, newer digital control systems, and improved visual displays, in order to make the laboratory more efficient and effective. Simulations are currently limited by the flow capability of the current circa 1970 Hydraulic Power Supply (HPS). Replacement of the vintage 1986 computer control system of the Crew Station/Turret Motion Base Simulator (CS/TMBS), which has limited capabilities compared to the current state-of-the-art computer controllers, will upgrade and increase the CS/TMBS responsiveness capabilities by incorporating computer technology critical for obtaining higher bandwidths. Installing a computer generated imagery (CGI) system for the CS/TMBS will facilitate full participation of the CS/TMBS in wargaming exercises on the Defense Simulation Internet with other crew-stations on the network. This effort will include integrating state of the art technology to enhance the simulation capability of the laboratory. These efforts will enhance the Army's modeling and simulation capabilities for combat and tactical vehicle research.

FY 1995 Accomplishments:

•	2429	- Award contract to modify the hydraulic power supply to increase the maximum flow rate and provide a larger oil supply. (to be accomplished in FY 96). - Award contract to procure a computer generated imagery system to connect to the Army Distributed Interactive Simulation (DIS) Network. (to be accomplished in FY 96). - Award contract to procure an audio system for the CS/TMBS and the RMS (to be accomplished in FY 96).
•	3000	- Award contract to upgrade the controller on the CS/TMBS to provide more responsiveness and a higher bandwidth (to be accomplished in FY 96). - Award contract to upgrade the RMS to provide a six degree-of-freedom simulator with higher responsiveness (to be accomplished in FY 96).
Total	5429	

FY 1996 Planned Program: Project not funded

FY 1997 Planned Program: Project not funded

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH74

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5919	0	0
Appropriated Amount (FY 1995)	5795		
Adjustment to FY 1995	-366		
Appropriated Amount (FY 1996)			
Adjustment to FY 1996		0	0
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current President's Budget Submit	5429	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

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

PROJECT: AH77

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH77 Advanced Automotive Technology	5060	12085	11131	12830	14480	14776	15092		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project AH77 - Advanced Automotive Technology: This project funds the National Automotive Center (NAC) which leverages commercial industry's large investment in automotive technology research and development and initiates shared technology programs that are focused on benefiting military ground vehicle systems. The NAC, located at the Tank-Automotive and Armaments Command (TACOM) is part of the Tank-Automotive Research, Development and Engineering Center (TARDEC). The NAC serves as the catalyst linking industry, academia and government agencies as a clearinghouse for the development and exchange of automotive technologies. The NAC executes collaborative research and development (R&D) contracts and other initiatives to capitalize on commercial industry's investment in well-defined, high return-on-investment areas tied to key Army science and technology objectives related to advanced land combat. The NAC focuses collaborative R&D contracts on key military automotive technology thrust areas to include: mobility, electronics, logistics, safety and environmental protection with the goal of (a) improving the performance and endurance of ground vehicle fleets, and (b) reducing ground vehicle design, manufacturing, production, and operating and sustainment costs. Two-way industry/government technology transfer is pursued under Cooperative Research and Development Agreements (CRADAs). The activities of the NAC are supported by other Government agencies via a linkage created under Memoranda of Agreement. These linkages permit the NAC to consolidate the collective expertise of federal government departments such as Energy, Transportation and Commerce and other DoD agencies. Major contractors include: Environmental Institute of Michigan, Ann Arbor, MI; Science Applications International Corporation, Warren, MI; Radian Inc., Alexandria, VA; Michigan Technological University, Houghton, MI; Picotronix, Ann Arbor, MI; University of Michigan, Ann Arbor, MI; VSE, Alexandria, VA; Oakland University, Rochester, MI; TASC, Reading, MA; Ford, Dearborn, MI; Chrysler, Auburn Heights, MI; General Motors, Warren, MI (Cooperative Agreement); Optimetrics, Ann Arbor, MI; Wayne State University, Detroit, MI; Pinnacle Research, Los Gatos, CA; Southwest Research, San Antonio, TX; Westinghouse Electric, Pittsburgh, PA; Textron-Lycoming, Stratford, CT; Failure Analysis, Redmond, WA; University of Detroit-Mercy, Detroit, MI; Barnes & Reinicke, Troy, MI.

FY 1995 Accomplishments:

- 5060 - Implemented Phase III efforts for three collaborative R&D contracts begun in FY 93 to exploit commercially developed technologies for application to military ground vehicles.
  - Integrated and evaluated the following commercially developed technologies into military ground vehicle platforms: vehicle headway control, collision avoidance sensors, ultracapacitors, advanced traction control, and electric hybrid vehicle components.
  - Planned/initiated agile manufacturing pilot programs with the automotive industry supply base and integrated advanced commercial machine tool controller technology into the military prototype environment.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH77

FY 1995 Accomplishments: (continued)

- Analyzed mature and quickly maturing commercial advanced automotive technologies, to include, squeeze cast aluminum process with silicon carbide whiskers, ultracapacitors to supplement or replace vehicle batteries, nickel metal hydride batteries and smart cruise control for rapid technology insertion into current military ground vehicle fleets.

Total 5060

FY 1996 Planned Program:

- 6000 - Award competitive contracts to acquire innovative and advanced commercial automotive technologies in the key military technology thrust areas of electronics, safety, environment, mobility and logistics.
  - Initiate a joint military/commercial technology demonstration program to produce a technology demonstrator vehicle developed from advanced commercial technologies and modified to conform to Army needs.
  - Initiate a program to improve (reduce weight, increase efficiency and reduce emissions) the HMMWV 6.2/6.5 liter engine for enhanced military performance and continued commercial demand by exploiting NAC funded commercial Silicon Carbide Whisker implantation to produce stronger and more efficient engine parts.
- 5804 - Initiate a cooperative agreement for advancing the state-of-the-art for four-stroke direct injection (4SDI) diesel with specific focus on high-temperature materials, exhaust after-treatments and low-heat rejection designs directed toward improvement of military propulsion systems.
  - Evaluate and continue to integrate maturing technologies from FY 1994 and FY 1995 collaborative R&D contracts into existing and new military demonstration platforms.
  - Initiate "Smart Truck" technology integration demonstration program that adapts commercial digital multiplexed databus technology into tactical wheeled vehicles.
- 247 - Funds reprogrammed for SBIR/STTR in accordance with Small Business Innovative Research Program Reauthorization Act of 1992.
- 34 - Revised economic assumption not available for execution.

Total 12085

FY 1997 Planned Program:

- 6131 - Evaluate on-going collaborative R&D contracts (from FY 1996) to award additional funding increments for high return-on-investment technologies.
  - Award competitive collaborative R&D contracts to acquire innovative and advanced commercial automotive technologies in the key military technology thrust areas of electronics, safety, environment, mobility and logistics.
  - Continue "Smart Truck" technology integration demonstration program that adapts commercial digital multiplexed databus technology into tactical wheeled vehicles.
- 5000 - Continue the cooperative agreement for advancing the state-of-the-art for four-stroke direct injection (4SDI) diesel with specific focus on high-temperature materials, exhaust after-treatments and low-heat rejection designs directed toward improvement of military propulsion systems.

FY 1997 Planned Program: (continued)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH77

- - Initiate a medium weight class combat vehicle chassis testbed program to evaluate advanced commercial hybrid electric drive components in cooperation with ARPA.
- - Continue the program to improve (reduce weight, increase efficiency and reduce emissions) the HMMWV diesel engine for enhanced military performance and continued commercial demand by exploiting NAC funded commercial Silicon Carbide Whisker implantation to produce stronger and more efficient engine parts.

Total 11131

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5274	12424	13442
Appropriated Amount (FY 1995)	5164		
Adjustment to FY 1995	-104		
Appropriated Amount (FY 1996)		12207	
Adjustment to FY 1996		-122	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-2311
Current President's Budget Submit	5060	12085	11131

Change Summary Explanation:

Funding: FY97: Funds reprogrammed (-2311) for higher priority requirements.

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

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

PROJECT: AH82

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH82 Non-Ozone Depleting Substance Technology	0	5323	3262	2420	1342	0	0		0	12727

A. Mission Description and Budget Item Justification: **Project AH82 - Non-Ozone Depleting Substance Technology:** This project demonstrates environmentally and toxicological acceptable replacements for Halon 1301 in fire suppression systems in crew occupied compartments of ground combat vehicles. Due to the ozone depleting potential of Halon 1301, the Clean Air Act of 1990 and DoD Directive 6050.9, alternate extinguishing agents are needed to maintain current crew and vehicle survivability and supportability. Testing will be performed to meet Tier 1-3 Army Surgeon General and Environmental Protection Agency Requirements. Funds in this project, as well as related funds for FY 1995 in PE 0603005A, identify and evaluate non-ozone depleting substances for application to military vehicles. The FY 1995 funds were placed in PE 0603005A. Starting in FY 1996, the program has been restructured under applied research to more correctly reflect the nature of the planned work. Due to the potential for dual-use applications, this program is administered by the National Automotive Center (NAC). Purchasing alternative agents from Duping Inc., Deepwater, NJ and Great Lakes Chemical, Lafayette, IN.

FY 1995 Accomplishments: Project not funded (See PE 0603005A Project D221).

FY 1996 Planned Program:

•	5189	- Complete performance testing of two initial agents, FM-200 (Heptafluorophane) and FE-13 (Trifluoromethane). - Review Tier 1 (short term single exposure) acute toxicity results and perform Tier 2 (longer term (14-90 Day) multiple exposure) subchronic toxicity testing. - Conduct performance and toxicology review to downselect agent for vehicle testing . - Select two to three alternative agents to enter into testing, pending unsatisfactory review of initial agents.
•	119	- Funds reprogrammed for SBIR/STTR in accordance with Small Business Innovative Research Program Reauthorization Act of 1992.
•	15	- Revised economic assumption not available for execution.
Total	5323	

FY 1997 Planned Program:

•	3262	- Conduct performance testing on alternative agents. - Complete Tier 2 (longer term (14-90 Day) multiple exposure) subchronic toxicity studies of alternative agents. - Perform Tier 3 (long term (1 year) multiple exposure) chronic toxicity studies, based on Tier 2 results. - Develop system design guidelines for initial agents.
Total	3262	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH82

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	0	5473	3682
Appropriated Amount (FY 1995)	0		
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		5377	
Adjustment to FY 1996	0	-54	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-420
Current President's Budget Submit	0	5323	3262

Change Summary Explanation:

Funding: FY97: Funds reprogrammed (-420) for higher priority requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology PROJECT AH91

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH91 Tank & Automotive Technology	15114	14802	14127	15160	15924	15649	16774		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project AH91 - Tank and Automotive Technology: This project provides innovative vehicle concepts and component technologies leading to product improvements to fielded equipment and to the development of advanced systems that will enable the Army to maintain superiority to fight and survive against diverse threats. Conceptual designs, virtual prototyping, and performance analyses and battlefield wargaming of ground vehicle systems identify promising emerging technologies and quantify benefits, burdens and trade-offs related to ground vehicle applications. The current M1 Abrams Tank and Bradley Fighting Vehicles have benefited from activities performed in this project. The AH91 project is comprised of six topics: (1) vehicle concepts and technology integration; (2) mobility; (3) integrated survivability; (4) vehicle electronics (VETRONICS) and digitization; (5) advanced vehicle structures; and (6) simulation/analysis. Technology initiatives are being pursued to address advanced mobility, survivability and lethality requirements of lighter, digitized, more deployable vehicles. Activities are closely coordinated through the Army Training and Doctrine Command's Mounted & Dismounted Battlespace Battle Labs; Program Executive Offices for Armored Systems Modernization, Combat Support & Field Artillery Systems; and the Army Research Laboratory (ARL)/ TACOM Advanced Armored Vehicle Technology focus program. This increases opportunities for transition of ARL corporate research into ground vehicles. The Tank and Automotive Virtual Prototyping provides seamless sharing of databases/engineering models, allowing more rapid and efficient integration, assessment and transfer of DoD and commercial vehicle technologies. Vehicle electronics will be based on adapting commercial electronic standards and architectures for combat vehicle battlefield unique requirements. The survivability technologies, which include non-armor approaches such as signature reduction, countermeasures, and damage reduction, complement, but do not duplicate, the work performed under the armor exploratory development project (DC05) in this PE. Under a restructuring of projects, the military fuels and lubricants technology and water purification technologies being conducted under PE 0602786A, Project AH20 through FY 1995 are included under this project beginning in FY 1996. This project is the Army's ground vehicle applied research program to provide the basic assessment of new and innovative technologies for current vehicle product improvements and new vehicle designs. Other Government Agencies include: Advanced Research Projects Agency, Arlington, VA; Oakridge National Laboratory, Oakridge, TN; Red River Army Depot, Texarkana, TX. Major contractors include: Cadillac Gage Textron, New Orleans LA; Quimpex, Montreal, 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; McDonnell Douglas, St. Louis, MO; University of Dayton Research Center, Dayton, OH; Monterey Technologies Inc., Monterey, CA; DCS Corp, Alexandria, VA.; Texas Instruments, Dallas, TX

FY 1995 Accomplishments:

- 7314 - Conducted advanced combat vehicle concept studies, through computer-aided solid modeling and battlefield effectiveness analysis, for M1A3 Tank improvements, lightweight vehicle and electric combat system concepts including assessment of battlefield impact and force effectiveness of the projected systems and individual technologies.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH91

FY 1995 Accomplishments: (continued)

- Demonstrated battery powered electric drive systems on the M113 testbed in coordination with DARPA (critical for assessing the stealth capability of electric drives in vehicles).
- Evaluated band track for noise reduction on M113 testbed; tested and evaluated HMMWV with active suspension fuzzy logic controller; conducted laboratory demonstration of semi-active external suspension components.

• 3564
- Developed high power density diesel engine technology; including low heat rejection and high temperature synthetic lubricants.
- Through multiple contractors, developed materials and designs for laser protected vision devices for combat vehicles.
- Developed and implemented concepts for signature integration to improved ballistic grill system for ground combat vehicle systems to defeat top attack weapon systems; demonstrated radar signature treated Forward Looking Infrared (FLIR) window system for ground vehicle systems.

• 4236
- Conducted Soldier Machine Interface (SMI) concept studies and evaluations through virtual prototype Soldier-in-the-Loop simulations in support of Bradley (M2A3) system modernization, Crewman's Associate ATD, and Anti Armor ATD programs.
- Conducted Soldier Machine Interface (SMI) concept studies and evaluations through virtual prototype Soldier-in-the-Loop simulations in support of Bradley (M2A3) system modernization, Crewman's Associate ATD, and Anti Armor ATD programs.
- Completed real-time dynamic software performance improvements to allow the motion base simulator interactively to the Distributed Interactive Simulation (DIS); Completed real time immersive environments in manufacturing simulator.

Total 15114

FY 1996 Planned Program:

• 8318
- Develop advanced combat vehicle concepts, via the virtual prototyping process, solid modeling and battlefield effectiveness analysis tank, scout, and other combat vehicle concepts and assess the battlefield impact and affordability of the projected systems and individual technologies.
- Demonstrate advanced hybrid electric drive systems in tracked and wheeled vehicles in coordination with ARPA to determine the mission expansion capability of military vehicles with hybrid electric drives.
- Develop band track and active suspension for light combat vehicle class combat vehicle testbed to increase mobility and stealth; develop electric active suspension concepts to increase mobility and move toward all-electric vehicle; determine optimal preview sensor/data for application to preview active suspension.
- Demonstrate high temperature diesel head material and synthetic lubricants.

• 1227
- Complete transmission evaluations on candidate environmentally-compliant tactical engine oils; complete field demonstration with candidate environmentally-compliant tactical engine oils and transition to DLA; complete chromatographic analytical procedure evaluations and initiate correlation program.
- Investigate emerging technologies such as aerogels, polyimide and polyphosphazene membranes, and polyphosphazene membrane coatings to improve water production capability.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH91

FY 1996 Planned Program: (continued)

- Award incremental contract work directives to continue research into combinations of non-linear absorbing materials for laser protection and development of focusing geometry to enhance dynamic range of vision device laser protection.

•	5092	- Demonstrate and test improved ballistic grill system on a combat vehicle system; demonstrate validated TARDEC visual signature virtual prototyping model; develop concepts for integrated signature armor technologies. - Initiate development of VETRONICS Systems Integration Lab (VSIL) and validate VETRONICS Open Systems Architecture (VOSA) Application Programmers Guide in support of approved STO program. - Complete initial design of baseline virtual prototyping architecture to facilitate the transfer of design & performance information/data between distributed DoD and industry research and development groups; implement Janus model at TARDEC to perform operational effectiveness analyses.
•	117	- Funds reprogrammed for SBIR/STTR in accordance with Small Business Innovative Research Program Reauthorization Act of 1992.
•	48	- Revised economic assumption not available for execution.
Total	14802	

FY 1997 Planned Program:

•	6517	- Perform advanced vehicle concept studies through virtual prototyping, solid modeling and battlefield effectiveness analysis to implement planning for the Scout Vehicle technology demonstrator. - Demonstrate active suspension and band track components on light vehicle class combat vehicle testbed; develop noncausal active suspension algorithms using preview sensor data; demonstrate electric suspension in the laboratory. - Integrate hybrid electric drive system components into a 40-ton mobility platform to evaluate its technical feasibility. - Demonstrate high power density diesel engine technologies (e.g., high pressure staged injection and low heat rejection components) on single cylinder research engine.
•	1444	- Complete correlation program with chromatographic analytical procedure for predicting fuel performance from compositional measurements; develop software package for data integration and transition chromatographic analytical procedure and model to Petroleum Quality Analysis System. - Optimize operating property requirements of selected water purification technologies and conduct bench scale analysis of leading candidates which will meet or exceed reverse osmosis membranes. - Continue development of vision system designs incorporating non-linearly absorbing materials and the construction of brassboard vision demonstrators.
•	6166	- Initiate signature/armor virtual prototyping development tool for simultaneously optimizing design to meet combat vehicle signature and armor requirements; evaluate reduced signature armor to validate new signature concepts and modeling tools. - Complete development and integration of VSIL hardware/software into laboratory environment.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A Combat Vehicle and Automotive Technology
	PROJECT AH91

FY 1997 Planned Program: (continued)

- Complete detailed design of baseline virtual prototyping architecture which will demonstrate system/component level configuration management to enable distributed/concurrent ground vehicle technology development; demonstrate remote access of DoD virtual prototype models at selected locations; perform and report operational effectiveness analysis of advanced vehicle concepts using the Janus model.

Total 14127

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	15415	15214	14683
Appropriated Value (FY 1995)	15361		
Adjustment to FY 1995	-247		
Appropriated Amount (FY 1996)		14948	
Adjustment to FY 1996		-146	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-556
Current President's Budget Submit	15114	14802	14127

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602618A Ballistics Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	25304	33045	31166	33450	38605	36163	36805	0	Continuing	Continuing
AH75 Electric Gun Technology	0	7781	5407	6346	7427	6274	6240	0	Continuing	Continuing
AH80 Ballistics Technology	22509	20520	21262	22260	25333	24081	24596	——	Continuing	Continuing
AH81 Armor/Anti-Armor Technology	2795	4744	4497	4844	5845	5808	5969	——	Continuing	Continuing

Mission Description and Budget Item Justification: This program element (PE) provides ballistic technologies required for defensive (armor) and offensive (anti-armor) weapons systems to counter changing threats. Project AH80 is focused on anti-armor warhead mechanics, penetrator mechanics, munition-target interactions, terminal effects, propulsion dynamics, launch and flight dynamics, remote sensing, and computational physics. It also includes work in hypervelocity penetrators and electro thermal chemical (ETC) technology that will greatly increase anti-armor capabilities. Corresponding emphasis is placed on advanced armor technology and vulnerability, lethality and survivability analyses and efforts to optimize effectiveness and survivability of armored combat vehicles. Beginning in FY 96, funding for electric gun and ETC technologies was moved from AH80 to a separate project - AH75. Project AH75 focuses on pulsed power technologies for electric armaments which offer the potential to field leap ahead capability in providing a hypervelocity and hyperenergy launch well above the ability of the conventional cannon. Project AH81 taps the innovation of industry and pursues the most promising and affordable approaches to developing armor/anti-armor technologies. This program element has been coordinated with the other military services through the Tri-Service Reliance and the Conventional 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 PE 0603795N and PE 0603217N and Defense Nuclear Agency PE 0602715H for ETC technology demonstrations. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602618A Ballistics Technology / PROJECT AH75

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH75 Electric Gun Technology	0	7781	5407	6346	7427	6274	6240	0	Continuing	Continuing

A. Mission Description and Justification AH75 Electric Gun Technology: This project represents a restructuring of funds from AH80 to provide improved oversight and accountability for the Army Electric Armaments technology program which transferred from the Armaments Research Development and Engineering Center to the Army Research Laboratory (ARL) in FY 95. Future armored combat vehicles will require more lethal, yet compact main armament systems capable of defeating protection levels greatly in excess of currently experienced values. Electric armaments offer the potential to field a leap ahead capability by providing hypervelocity and hyperenergy launch greatly above the ability of the conventional cannon. Electric armaments can potentially 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 funds a contractual effort to develop an efficient pulsed power system which is coupled to an electromagnetic launcher. Additionally, the pulsed power system will be capable of driving electrothermal chemical propulsion systems which are being separately developed under a joint Army/Defense Nuclear Agency program. Either a pulsed disc alternator or a compensated pulsed alternator will be selected to go forward for further development. The goal is to provide a pulsed power supply, compatible with electromagnetic and electrothermal chemical launchers, having an energy density of five Joules per gram.

FY 1995 Accomplishments: Work accomplished in Project AH80 within this PE.

FY 1996 Planned Program:

•	2661	- Develop and evaluate three candidate ETC concepts for 120mm.
		- Rebuild subscale compulsator rotor.
		- Test compulsator into a static load.
		- Integrate compulsator with 45mm railgun and test into a dynamic load.
•	4924	- Develop switching and rectifiers for self-excitation.
		- Design and begin fabrication of fully compensated machine.
		- Design and test high performance armature/launch packages.
•	174	- SBIR/STTR
•	22	- Revised economic assumption not available for execution.
Total	7781	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602618A Ballistics Technology — PROJECT AH75

FY 1997 Planned Program:

•	5407	- Complete the build of a subscale machine with fully configured power technology and demonstrate full dynamic performance, consisting of developing full machine rotational rates and proving design structural integrity. Power generation will not be shown until the following year. - Design and commence fabrication of switching and power conditioning electronics. - Design and commence fabrication of electromagnetic launcher to which pulsed power system will be mated. - Design launch packages for electromagnetic launcher.
Total	5407	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	0	0	0
Appropriated Amount (FY 1995)			
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		7860	
Adjustment to FY 1996		-79	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			5407
Current President's Budget Submit	0	7781	5407

Change Summary Explanation:

Funding: FY 96: Congressional language added funding in FY 96 for electric gun and electro-thermal chemical gun propulsion technology; FY97: Project restructured from Project AH80.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE March 1996
2 - Applied Research	0602618A Ballistics Technology	PROJECT AH80

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH80 Ballistics Technology	22509	20520	21262	22260	25333	24081	24596		Continuing	Continuing

A. Mission Description and Justification: **Project AH80 - Ballistics Technology:** This project produces key technologies required for armaments and armor materiel to allow U.S. dominance in future conflicts across a full spectrum of threats in a global context. This project supports ballistic technology advances in vehicle survivability, direct fire armament capabilities, indirect fire support, and weapon effectiveness evaluation in order to be able to design the most effective weapon capabilities and optimally protect against the most dangerous threats. Emphasis is placed on advancement of simulation and modeling technologies to foster the exploitation of the Army's supercomputer network. This project continues to support extensive experimental programs to advance the state-of-the-art of ballistics technologies.

FY 1995 Accomplishments:

- 13361 - Finalized designs for a weaponizable reverse annular piston liquid propellant gun and demonstrated muzzle velocity enhancement for solid propellant electro thermal chemical (ETC) concepts.
  - For indirect fire, demonstrated an all-composite High Capacity Artillery Projectile (HICAP) prototype with equivalent payload mass; for direct fire, designed an advanced sabot for long rod penetrators.
  - Evaluated ability of ceramic/composite armor concepts to defeat novel Kinetic Energy penetrators.
- 9148 - Evaluated performance of a moving inertial reticle system against moving targets; evaluated preliminary north finding technologies with 0.5 degree accuracy and make down selection.
  - Developed next generation vulnerability, lethality and survivability methodologies for analyzing conventional ballistics using the modular unix-based vulnerability estimation suite (MUVES) environment.
  - Developed resin transfer molding composite technology to the point where ARL simulations are now included on the Comanche helicopter program. Established a laboratory/test bed for 21 CLW compliant with Distributed Interactive Simulations (DIS).

Total 22509

FY 1996 Planned Program:

- 11314 - Investigate diode laser technology for the direct ignition of solid/liquid propellants and model inbore and free flight projectile stability, surface heating and ablation of hypervelocity projectiles.
  - Demonstrate an armor capable of defeating projectiles over a wide velocity spectrum.
  - Integrate ETC tank cartridge (plasma generator, bullets, propellant), and demonstrate improved electrical enhancement factors while maintaining enhanced performance.
  - For spinning projectiles or submunitions, develop a rotation-compensated warhead concept; for long rod penetrators, demonstrate a micro-rocket motor to reduce drag.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602618A Ballistics Technology / PROJECT AH80

FY 1996 Planned Program: (continued)

•	9136	- Integrate target acquisition, image stabilization and target cueing with the inertial reticle system fire control for secondary armament. - Implement ballistic shock and secondary spall algorithms in the stochastic vulnerability/lethality analysis code in support of live-fire test and evaluation of U.S. Army systems, to be first exercised on the armored gun system. - Simulate the resin transfer molding processes used by United Defense for manufacturing Composite Armored Vehicle components. Improve DIS compliant smoke/obscurants models and insert into Synthetic Environments.
•	70	- Revised economic assumption not available for execution.
Total	20520	

FY 1997 Planned Program:

•	10815	- Develop enabling technologies for lightweight weapons and focused warhead effects for the light and special operations forces which improve their effectiveness in remote locations and in operations other than war. - Test artillery projectile technologies which provide gliding flight and enhanced accuracy for extended range. - Provide technology to enhance weapon lethality in long standoff, counter active protection and theater missile defense applications. - Demonstrate technologies to allow lightweight protection of armored systems to advanced threats such as kinetic energy weapons and top attack weapons.
•	10447	- Develop unique armor and armaments technologies which will provide synergy with battlefield digitization to enhance both lethality and survivability. - Conduct theoretical and experimental studies of novel gun propulsion concepts for laboratory and weapon system applications to provide the energy required to defeat evolving threats. - Implement missile-to-missile impact and hypervelocity penetration models for Theater Missile Defense programs to assess target structural damage and lethal agent destruction/negation caused by interceptor. - Develop thick composite technology using resin transfer molding process. Demonstrate integration of the multi-user prototype synthetic environment with computer generated individual combatants. Develop mission planning and rehearsal tools simulating the battlefield to quickly adjust mission plans to changing battlefield situations.
Total	21262	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE March 1996
2 - Applied Research	0602618A Ballistics Technology	PROJECT AH80

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	22755	23249	26875
Appropriated Amount (FY 1995)	22755		
Adjustment to FY 1995	-246		
Appropriated Amount (FY 1996)		20721	
Adjustment to FY 1996		-201	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-5613
Current President's Budget Submit	22509	20520	21262

Change Summary Explanation:

Funding: FY97 change: Restructure of funds to Project AH75 (-5568).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE March 1996
2 - Applied Research	0602618A Ballistics Technology	PROJECT AH81

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH81 Armor/Anti-Armor Technology	2795	4744	4497	4844	5845	5808	5969		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project AH81 - Armor/Anti-Armor Technology** - The overall objective of this project is to provide significantly increased levels of protection and survivability to existing and future combat systems, and to provide significantly increased lethality and effectiveness to existing and future anti-armor munitions by seeking novel and innovative solutions from industry. This project began as a joint program among the U.S. Army, Defense Advanced Research Projects Agency (DARPA), and the U.S. Marine Corps to enhance the national capability in armor/anti-armor (A3) technologies, and has now transitioned to the Army. Major contractors include: Dow Chemical Co., Midland, MI; Kaman Sciences, Colorado Springs, CO; Simula Inc., Phoenix, AZ; GDLS, Warren, MI.

FY 1995 Accomplishments:

•	786	-Examined and baselined selected warhead concepts for defeat of a new class of armor protection. -Proved out gun launch of KE precursor concepts for defeat of reactive range targets.
•	1105	-Initiated top attack armor technology development with two competing contractor teams. -Extended industry demonstration of integral smart armor system for defeat of medium and heavy kinetic energy threats.
•	904	-Initiated second phase of demonstration of advanced armor attachment system for tactical and medium combat vehicles. -Continued development of neural network methodology for armor test data analysis. -Produced advanced ceramic armor material and initiated further study of analytic methods for ceramic armor design.
Total	2795	

FY 1996 Planned Program:

•	4629	-Develop warheads and penetrators capable of defeating explosive reactive armor. -Perform live fire tests to defeat explosive reactive appliqué target with gun launched KE projectiles incorporating KE precursor concepts. -Select and demonstrate the best technical approach for two overhead armors, one for heavy combat vehicles, such as Crusader, one for light vehicles. -Initiate development of fuze for Active Protection System (APS) defeat
•	101	-Funds reprogrammed for SBIR/STTR in accordance with the Small Business Innovation Research Program Reauthorization of 1992.
•	14	-Revised economic assumption not available for execution.
Total	4744	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602618A Ballistics Technology / PROJECT AH81

FY 1997 Planned Program:

•	4497	-Select and develop KE precursor concepts for defeat of explosive reactive armor appliqués -Complete development of overhead protection armors and transition to system managers as appropriate. -Continue development of fuze for APS defeat.
Total	4497	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2955	4877	7120
Appropriated Amount (FY 1995)	2893		
Adjustment to FY 1995	-98		
Appropriated Amount (FY 1996)		4792	
Adjustment to FY 1996		-48	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-2623
Current President's Budget Submit	2795	4744	4497

Change Summary Explanation: Funding in FY97: Funds(-2623) reprogrammed for higher priority requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602622A Chemical, Smoke and Equipment Defeating Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	30697	1760	2343	2954	3696	4164	4233		Continuing	Continuing
A552 Smoke/Novel Effects Munitions	1954	1760	2343	2954	3696	4164	4233		Continuing	Continuing
A553 Chemical/Biological (CB) Defense & General Investigations	28743	0	0	0	0	0	0		0	28743

Mission Description and Budget Item Justification: This program element provides exploratory development of technologies to increase survivability with enhanced smoke and obscurant capabilities, and solve critical light force deficiencies to defeat enemy targets (i.e., non-lethal and flame/incendiary devices). Project A552 provides exploratory development of several capabilities essential to counter enemy weapons systems and to provide the overall capability of degrading or defeating the mission of the enemy. Improved multispectral smokes/obscurants will be explored to enhance survivability by providing effective, affordable and efficient screening of deployed forces from threat force surveillance sensors and effective defeat of target acquisition devices, missile guidance, and directed energy weapons, all of which can operate anywhere within the visible through the microwave region of the electromagnetic spectrum. These systems will be designed to be safe and environmentally acceptable. Also under Project A552, 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 resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. Efforts under this PE transition and provide risk reduction for Demonstration/Validation and Engineering Development programs. Public Law 103-160 realigns funding for chemical/biological defense from the Services and consolidates it at the DoD level beginning in FY 1996 (PE 0602384BP). Efforts in this Program Element include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602622A Chemical, Smoke and Equipment Defeating Technology / PROJECT A552

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A552 Smoke/Novel Effects Munitions	1954	1760	2343	2954	3696	4164	4233		Continuing	Continuing

A. Mission Description and Budget Item Justification: This project provides exploratory development of technologies to increase survivability with enhanced smoke and obscurant capabilities and solve critical light force deficiencies to defeat enemy targets (i.e., non-lethal and flame/incendiary devices). Project A552 provides exploratory development of several capabilities essential to countermeasure enemy weapons systems and to provide the overall capability of degrading or defeating the mission of the enemy. Improved multispectral smokes/obscurants will be explored to enhance survivability by providing effective 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 within the visible through the microwave region of the electromagnetic spectrum. These systems will be designed to be safe and environmentally acceptable. Also under Project A552, flame and incendiary payloads will be investigated to defeat a variety of targets ranging from personnel to bunkers and light armored vehicles. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. Efforts under this PE transition and provide risk reduction for Demonstration/Validation and Engineering Development programs. Efforts in this Program Element include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

FY 1995 Accomplishments:

- 1589 -Evaluated feasibility of degradable millimeter wave (MMW) materials; initiated modeling and simulation studies of MMW defeat of smart sensors.
  -Evaluated novel smoke/obscurant/marking materials.
- 100 -Conducted technical watch level of effort on flame and non-lethal technologies.
- 265 -Investigated novel methods to defeat or prevent aerosolization of CB agents when production facilities and storage areas are attacked with conventional high explosive munitions.
  -Evaluated inhalation toxicology for pepper mace.

Total 1954

FY 1996 Planned Program:

- 1437 -Evaluate degradable and environmentally safe millimeter wave (MMW) screening obscurant candidates; conduct modeling and simulation of MMW screening defeat mechanism; initiate packaging and dissemination studies of candidate degradable MMW material; address affordability issues.
  -Evaluate novel smoke/obscurant/marking materials.
- 291 -Investigate novel methods to defeat or prevent aerosolization of Chem/Bio agents when production facilities and storage areas are attacked with conventional high explosive munitions.
  -Conduct technical watch level of effort on flame and non-lethal technology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602622A Chemical, Smoke and Equipment Defeating Technology — PROJECT A552

FY 1996 Planned Program: (continued)

•	5	-Revised Economic Assumption not available for execution.
•	27	-SBIR/STTR.
Total	1760	

FY 1997 Planned Program:

•	2088	-Evaluate degradable and environmentally safe MMW screening obscurant candidates and conduct field trails; conduct packaging and dissemination studies; continue to investigate affordability issues. -Evaluate rapid obscuration concepts for combat vehicles.
•	155	-Investigate novel methods to defeat or prevent aerosolization of CB agents when production facilities and storage areas are attacked with conventional high explosive munitions.
•	100	-Conduct technical watch level of effort on flame and non-lethal technology.
Total	2343	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2032	1891	1990
Appropriated Amount (FY 1995)	1989		
Adjustments to FY 1995	-35		
Appropriated Amount (FY 1996)		1778	
Adjustment to FY 1996		-18	
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			353
Current President's Budget Submit	1954	1760	2343

Change Summary Explanation: FY97: Funds reprogrammed into this project for smoke support for armored vehicles.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602622A Chemical, Smoke and Equipment Defeating Technology — PROJECT A553

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A553 Chemical/Biological (CB) Defense & General Investigations	28743	0	0	0	0	0	0		0	28743

A. Mission Description and Budget Item Justification- This project addresses the urgent need to provide all services with defensive materiel to protect individuals and groups from threat chemical-biological agents in the areas of detection, identification and warning; contamination avoidance through reconnaissance; individual and collective protection and decontamination. It also provides for special investigations into CB defense technology to include CB threat agents, operational sciences, modeling, CB simulants, and nuclear, biological, chemical (NBC) survivability. This project also addresses support to Program Executive Offices focusing on horizontal integration of CB defensive technologies across the armored force. Public Law 103-160 realigns chemical/biological funding from the Services and consolidates it at the DoD level in FY 1996 (PE 0602384BP).

FY 1995 Accomplishments:

- 15361 -Evaluated Bio Agent point detection technologies such as DNA Probes, electrospray mass spectrometry, planar wave guides and flow cytometry; and technologies for stand-off biological detection.
  -Evaluated cloning bacterial fermentation to produce large quantities of antibodies more cost effectively.
  -Completed demo on Lightweight Standoff Chemical Agent Detector and transitioned to engineering/manufacturing development.
  -Evaluated technologies for an Individual Soldier Chemical Detector.
  -Evaluated novel technologies for chemical images and laser standoff chemical detection.
- 7485 -Conducted studies to optimize integration of future/novel respirator designs to soldier system concepts and standardized mask performance evaluation rating methodology.
  -Evaluated limits of performance for regenerable filtration concepts for combat vehicles.
  -Evaluated novel adsorbents to enhance agent filtration performance; conducted studies on adsorbent technology to improve collective and individual protection filtration efficiencies.
  -Developed a quantitative mechanism to determine decon reactions in solids; characterized catalysts and polymers with agent reactive sites for increased activity.
- 5897 -Expanded CB battlefield modeling efforts supporting the development of a Distributed Interactive Simulation (DIS) capability for CB warfare war gaming.
  -Expanded laboratory analysis capability for special projects; evaluated novel technologies for CB antiterrorism; developed standardized test methodologies.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602622A Chemical, Smoke and Equipment Defeating Technology / PROJECT A553

FY 1995 Accomplishments: (continued)

-Conducted feasibility investigation of promising biological point detection technologies; integrated the CB environment and environmental effects into DIS; completed testing to transition the sorbent decontamination program to demonstration/validation; conducted inhalation toxicology studies on new materials

Total 28743

FY 1996 Planned Program: Funded under DoD PE 0602384BP.

FY 1997 Planned Program: Funded under DoD PE 0602384BP.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	29614	0	0
Appropriated Value	29614		
Adjustments to Appropriated Value	-871		
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			
Current Budget Estimate Submit for FY 1997	28743	0	0

Change Summary Explanation:

Funding: FY 95: Rescission within the FY 95 Supplemental Appropriation and Recessions to preserve and enhance the military readiness of the Department of Defense, (-726); Below threshold reprogramming (-145).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602623A Joint Service Small Arms Program / PROJECT AH21

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH21 Joint Service Small Arms Program (JSSAP)	5531	4975	4593	4722	5092	4941	4921		Continuing	Continuing

A. **Mission Description and Budget Item Justification:** The objective of this Program Element (PE) is to develop key individual and crew served weapons technologies that will enhance the fighting capabilities and survivability of dismounted battlefield personnel of the Services. This PE funds several efforts including the following: component technology for an Objective Crew-Served Weapon (OCSW) to replace the M2 machine gun and the MK19 grenade machine gun; 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; non-conventional target effects (NCTE) technologies for small arms-size directed energy systems (lasers/acoustics/microwaves), increased hit/incapacitation/suppression capabilities with controllable target effects (lethal to less-than-lethal); other fighting technology alternatives (FTA) promoting significant generic advances in function or form of small arms via a spectrum of applications from product improvements through all new weapon concepts (advanced materials and structures for gun systems, guided bullets, and explosively launched projectiles); personal weapon technology leading to a more effective Objective Personal Weapon (immediate incapacitation of body armored personnel out to 50 meters); an objective sniper weapon technology to increase accuracy and effective range to 2000 meters for the next sniper weapon; technology to provide alternative, non-toxic components for small caliber ammunition, to dramatically reduce future environmental contamination during training and enable the Services to comply with applicable statutes; Advanced Medium Machine Gun (AMMG) technology effort will provide a lighter, more effective/versatile system to replace current 7.62mm medium machine guns; and technology efforts leading to improved capabilities for all of the Objective Family of Small Arms. The bursting munition technology development supports the OICW Advanced Technology Demonstration (ATD) and Force XXI Soldier. All Joint Service Small Arms Program (JSSAP) efforts are based upon approved Joint Service Science and Technology Objectives (JSSTO) and the Joint Service Small Arms Master Plan (JSSAMP), plus Mission Needs Statements and Operational Requirements Documents of the Services. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armaments Research, Development and Engineering Center, Picatinny Arsenal, NJ. Work in this PE is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), PE 0603607A (Joint Service Small Arms Program), and will transition to JSSAP efforts conducted in PE 0604802A (Weapons and Munitions-Engineering Development) and PE 0604601A (Objective Crew Served Weapon-Engineering Development). This project includes non-system specific development aimed at specific military needs and therefore is appropriate to Budget Activity 2.

FY 1995 Accomplishments:

•	5531	- Completed design of critical sub-system components for an Objective Individual Combat Weapon. - Evaluated OCSW concept definitions and analyzed and downselected to the most promising approach for component demonstration. - Initiated six month study to define scope of Broad Agency Announcement (BAA) leading edge technologies follow-on efforts and evaluated/selected competitive BAA multipurpose proposals for NCTE and FTA.
Total	5531	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602623A Joint Service Small Arms Program / PROJECT AH21

FY 1996 Planned Program:

•	3254	- Develop simulation technology for the OICW. - Finalize trade-off determination for OCSW. - Demonstrate critical sub-system component technologies (i.e., air bursting munitions, miniature fuzing, enhanced fragmentation, composite weapon/mount components) for OCSW. - Initiate transition of OCSW technologies for advanced technology demonstration.
•	964	- Conduct Blue Team technology review/evaluation of BAA Phase I efforts (NCTE; Common Fuel Laser for Small Arms Application; Acoustic Rifle System; Microwave Stun Gun and FTA; Explosively Launched Projectile; Guided Bullet; Advanced Materials and Structures for Small Arms).. - Initiate feasibility demonstration phase for follow-on FTA/NCTE efforts and deliver feasibility demonstration test plan. - Conduct market survey, review concept proposals and evaluate technologies for non-toxic ammunition.
•	639	- Initiate technology assessment for new personal and sniper weapons. - Develop strategy to continuously advance technology for Objective Family of Small Arms.
•	103	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
•	15	- Revised economic assumption not available for execution.
Total	4975	

FY 1997 Planned Program:

•	2981	- Integrate Objective Crew-Served Weapon sub-system components into demonstrator design. - Conduct concept formulation and trade-off analysis for a new personal and sniper weapon.
•	1612	- Fabricate hardware for FY98 FTA/NCTE feasibility demonstrations. - Issue a BAA for Pre-Planned Product Improvement of the Objective Family of Small Arms, focusing on individual and crew weapons. - Downselect to best initial technology concepts for non-toxic ammunition and perform concept verification.
Total	4593	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	5688	5114	4839
Appropriated Amount (FY 1995)	5618		
Adjustment to FY 1995	-87		
Appropriated Amount (FY 1996)		5025	
Adjustment to FY 1996		-50	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-246
Current President's Budget Submit	5531	4975	4593

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

DATE: March 1996

2 - Applied Research | **0602624A Weapons and Munitions Technology**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	34992	23295	25611	27994	30207	30687	31438		Continuing	Continuing
AH18 Artillery & Combat Support Technology	14317	11001	9484	11012	11894	11956	12344		Continuing	Continuing
AH19 Close Combat Weaponry	5186	4919	5389	7330	8890	9336	9483		Continuing	Continuing
AH22 High Explosive Materials	7238	0	0	0	0	0	0		0	7238
AH23 Non Lethal Weapons Technology	0	0	2524	1064	0	0	0		0	3588
AH28 Munitions Technology	8251	7375	8214	8588	9423	9395	9611		Continuing	Continuing

Mission Description and Budget Item Justification: The object of this Program Element (PE) is to develop affordable technologies for advanced direct and indirect fire weapons (except small arms) and munitions. The PE funds several efforts, including the following: advanced weapon concepts and analysis supporting the Rapid Force Projection Initiative (RFPI) demonstration of increased anti-armor capabilities and increased survivability for Early Entry Forces; the Direct Fire Lethality Initiative, by developing technologies to provide upgrade opportunities for fielded ground combat systems. The latter includes: precursor defeat of explosive reactive armor (ERA), advanced composite sabots, in-flight trajectory correction, smart barrel actuators/gearless gun drives, and modeling and analytic codes for thermal analysis to reduce wear on gun tubes which degrades accuracy; high energy explosive technologies that increase projectile and warhead lethality; advanced armament fire control, and decision aids and software architecture. It includes advanced acoustic sensor technology for smart systems, and supports technology advances in anti-armor mine warfare. This PE also funds several additional efforts, including: advanced gun propulsion technologies; non-lethal munitions/weapon/device technologies; automatic loader and munition transfer mechanisms for large caliber weapons and storage devices; development of demonstration techniques in accordance with Army Battle Lab initiatives and wargame scenarios; and lightweight composite materials in projectile and extended range projectile component development. This PE also includes work on thermal management of high performance, high rate of fire, large caliber guns, and advanced air-to-air guns for rotary wing aircraft (e.g., Apache and Comanche). The work in this PE is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armaments Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ. Work in this PE is related to, and fully coordinated with, efforts in PE 0602618A (Ballistics Technology), PE 0602623A (Joint Service Small Arms Program), and transitions to work performed in PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603607A (Joint Service Small Arms Program) and PE 0603802 (Weapons and Munitions Advanced Development). These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology — PROJECT AH18

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH18 Artillery & Combat Support Technology	14317	11001	9484	11012	11894	11956	12344		Continuing	Continuing

A. <u>Mission Description and Justification</u>: **Project AH18 - Artillery and Combat Support Technology:** This project focuses on the exploratory development of technology for cannon artillery, mortar weapon, fire control and combat support systems. This project funds technology development which supports the Intelligent Minefield (IMF) and Precision Guided Mortar Munition (PGMM) Advanced Technology Demonstrations (ATDs). This work also develops advanced acoustic sensors in support of the RFPI Advanced Concept Technology Demonstration (ACTD). Technology to improve combat vehicles' first round hit probability is being pursued through the development of "smart" barrel actuators and a gearless gun drive concept. Decision aid and software technology is being developed to increase armament battlefield survivability cost-effectively for self-propelled howitzers, along with technologies for improving the effectiveness and affordability of next generation smart munitions. Low Cost Competent Munition (LCCM) concepts integrating Global Positioning System (GPS), fuzing, and possibly guidance and control (G&C) technology are being developed for artillery projectiles. The resulting screw-on module will significantly increase a projectile's overall delivery accuracy and also be readily applicable to the artillery's existing ammunition stockpile. Technology for artillery projectile rotating and obturating bands is being pursued to address an impending shortcoming when firing from high performance cannons. An enhanced mortar fire control (EMFC) concept which greatly improves fire response times is being prepared for Battle Lab Advanced Warfighting Experiment (AWE) participation. The application of light-weight, high-strength composites to mortar and artillery projectiles is being pursued to extend range, increase capacity, and ultimately enhance target effectiveness. This project also supports pulsed-power technology experiments for electric gun applications.

FY 1995 Accomplishments:

- 3657 - Developed and demonstrated Integrated Acoustic Sensor (IAS) hardware in support of RFPI ACTD.
  - Completed preliminary XM291 tank cannon and M1A1 modeling for digital control design for the gearless turret drive and completed gearless turret concept design.
  - Conducted cannon projectile compatibility (C/PC) material tests on selected 155mm obturator materials; designed, built and enhanced mortar fire control software and hardware for participation in Focused Dispatch AWE.
- 5134 - Supported Army Research Laboratory (ARL) in test firing of GPS fuze prototype; developed plan to define strategy for LCCM; spin tested prototype accelerometers; established oscillator joint working group.
  - Refined producibility for hi-G composite rear High Capacity Projectile (HICAP) module and internally scalloped body; initiated study of a centrally-mounted HICAP fuze; downselected composite mortar cartridge design with 54 Dual Purpose Improved Conventional Munition (DPICM) bomblets; completed aero study (+50% range) and lethality study (+82% AP kills).
  - Dynamically characterized XM982 front rocket motor performance; completed aero analyses confirming 54 km max range; demonstrated low-volume cargo expulsion charge.
  - Successfully tested 155mm computerized, laser ranging, direct-fire sight with image intensifier; supported hardware development of 155mm Electro-rheological (ER) Fluids demonstrator; initiated 105mm artillery Terminally Guided Projectile (TGP)/PGMM common seeker analysis.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology — PROJECT AH18

FY 1995 Accomplishments: (continued)

•	5526	- Developed, validated and documented methodologies for accessing expert system or Artificial Intelligence software; demonstrated Battlefield Imaging Projectile System (BIPS) transmission range (60 km desired, 74 km achieved) and target resolution. - Completed software coding of Self Defense decision aids module; conducted artillery Reconnaissance, Surveillance, and Occupation of Position (SOP) decision aids module Man-In-The-Loop demo with 27% reduction in time. - Installed and tested a 9 Megajoule (MJ) rail-gun to full power in the Electric Armaments Research Center; fabricated and tested an electric gun armature test launch package; provided orderly transition of electric armaments program back to Army Research Lab (ARL) for technology maturation.
Total	14317	

FY 1996 Planned Program:

•	3250	- Conduct Cannon/Projectile Compatibility Technical Review of design and material candidates for high performance 155mm obturator/rotating bands and downselect to two configurations for sub-caliber gun test qualification; develop test matrix to verify design objective; and initiate test firings. - Complete concept simulation for Dismounted Battle Lab and qualify stealth characteristics of composite 120mm mortar cartridge body; conduct top-zone gun launch of full-scale 155mm composite HICAP; confirm ballistic range and accuracy predictions. - Complete 105mm artillery TGP/PGMM common seeker analysis; evaluate Micro-Electro-Mechanical Systems (MEMS) technology for LCCM safe and arm (S&A) requirements. - Complete transponder and tracker development for the Projectile Tracking System (PTS); determine PTS operational trajectory adjustment and projectile maneuvering requirements.
•	2483	- Initiate phase I fabrication of Gearless Turret Gun Drive (GTGD); complete Silent Watch Analysis for GTGD and initiate fabrication of Smart Barrel Actuators (SBA). - Participate in Warrior Focus AWE at Ft. Polk with enhanced mortar concept; integrate and evaluate technology trade-offs of a computerized soldier sight with day/night optics via simulator, in support of 21st Century Land Warrior (21CLW) AWE. - Complete verification tests of the Self Defense decision aids module and complete project final report. - Conduct virtual prototyping for user requirement definition and trade-offs of electric tank main armament system and acquisition strategy.
•	5230	- Conduct field tests of IMF acoustic sensor hardware in support of RFPI ACTD; refine acoustic sensor hardware for RFPI ACTD. - Support Advanced Concept Technology (ACT) II open-loop flight test of Canard Module demonstrating GPS, stability and maneuver capability; initiate Auto-Registration LCCM translator component design; conduct Clear/Acquisition (C/A) Code translator flight tests. - Develop baseline ARDEC/Teknowledge (ARTek) domain model in support of Rapid/Digitized Fire Mission (RDFM) domain and initiate development of key software interface.
•	38	- Revised economic assumption not available for execution.
Total	11001	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology — PROJECT AH18

FY 1997 Planned Program:

- 2325 - Complete C/PC phase I test firing and conduct post mortem performance evaluation; modify design and fine tune material characteristics.
  - Complete final phase of gearless turret drive fabrication; integrate Smart Barrel Actuators onto XM291 tank cannon and conduct static tests.
  - Define operational concepts and conduct a requirements feasibility and trade-off analysis of applying software and hardware decision aids components to future artillery on the digitized battlefield.
- 4462 - Complete Auto-Registration LCCM GPS translator assembly and test firings; complete projectile impact prediction algorithms; support ACT II closed-loop flight test.
  - Support DIS simulations of ARDEC RFPI programs.
  - Demonstrate HICAP brassboard fuzing concept and in-flight cargo expulsion system.
  - Continue support of Focused Technology Program (FTP) and support to ARL in electric armaments planning, management and execution.
- 2697 - Refine ARTek domain architecture description based on extended domain model and develop design descriptions for candidate components associated with display, digital mapping, and database management.
  - Demonstrate noise cancellation techniques for vehicle mounted acoustic system and continue support to RFPI ACTD.
  - Develop Advanced Intelligent Minefield Management System (AIMMS) concept and design for integration into IMF simulator.

Total 9484

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	14622	11332	10512
Appropriated Amount (FY 1995)	14622		
Adjustment to FY 1995	-305		
Appropriated Amount (FY 1996)		11109	
Adjustment to FY 1996		-108	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-1028
Current President's Budget Submit	14317	11001	9484

Change Summary Explanation:

Funding: FY97: Funds (-1028) reprogrammed for higher priority requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology — PROJECT AH19

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH19 Close Combat Weaponry	5186	4919	5389	7330	8890	9336	9483		Continuing	Continuing

A. <u>Mission Description and Justification</u>: **Project AH19 - Close Combat Weaponry:** 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 are the Direct Fire Lethality Program and Non-Lethal Munitions/Weapons/Devices. Included are technologies for the tank projectile precursor defeat of explosive reactive armor (ERA), composites for sabots and gun structures, trajectory correction mechanisms, kinetic/blunt impact, entanglement, acoustic and other devices to non-lethally immobilize personnel and/or vehicles. In addition, this project develops basic technologies in the areas of weapon stabilization, projectile design and fabrication, means to increase gun life by reducing barrel wear, thermal management of high rate launch mechanisms and munition auto-loaders, feeders and storage mechanisms. This project provides opportunities for longer range, more accurate and more lethal cannon systems for armored vehicle upgrades (e.g., Abrams, Bradley Fighting Vehicle System (BFVS)) and for future systems. The approach will be to develop both the hardware and analytical tools necessary to assess system performance, identify problem areas and to develop solutions.

FY 1995 Accomplishments:

- 5186 - Statically tested first iteration live axial thruster grains; demonstrated electronic delay initiator assembly through 120mm tank round launch; completed design and analysis of three tactical precursor staging mechanisms and two prototype deployment mechanisms; manufactured US Navy MANTECH M242 25mm barrels with wear reducing liners.
  - Completed fabrication and demonstrated the light armament module (105/120mm) on a surrogate M551 Sheridan chassis; initiated real-time image processing of 360 ° field-of-view lens; fabricated compact autoloader (105/120mm) subsystem.
  - Obtained TECOM safety release and interim hazard classification for 40mm sponge grenade with subsequent contingency fielding of 300 rounds to USMC for Operation United Shield and selection as an FY 96 Soldier Enhancement Program. Obtained initial health hazard assessment (operator and target) for acoustic weapon. Successfully completed 12 gauge and 40mm commercial off-the-shelf non-lethal munitions demonstrations for US Army MP School and Dismounted Battle Space Battle Lab. Initiated SBIR efforts for 40mm ballistic net munitions.
  - Conducted 35-45mm ammo performance projection study with Army Research Laboratory (ARL) for the 2005 timeframe; established contribution of lethality program components to armor vehicles; improved virtual prototyping fidelity issues for gun systems as desired by the customer (PMs Apache, Comanche, and Phalanx).

Total 5186

FY 1996 Planned Program:

- 4867 - Conduct structural and functional tests of two precursor deployment mechanisms; demonstrate gun launch for aerodynamic jump cancellation.
  - Complete virtual prototype of Bradley upgun and candidate weapons; conduct force-on-force evaluation of Abrams (Tank 1080) lethality enhancement options.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology — PROJECT AH19

FY 1996 Planned Program: (continued)

- Conduct acoustic device demonstration; demonstrate ballistic net from 40mm M203 grenade launcher; initiate 40mm non-lethal munitions STO; draft performance specification for 40mm blunt impact munitions; initiate non-lethal vehicle immobilizer and area denial entanglement systems; complete evaluation of non-developmental item muzzle launched ordnance for M16; continue role as AMC lead for non-lethal technology development.
- Demonstrate a minimum space compact autoloader using 120mm tank ammunition applicable to current and future tanks.

•	36	Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization Act of 1992
•	16	Revised economic assumption not available for execution.
Total	4919	

FY 1997 Planned Program:

•	5389	- Test and analyze reduced wear prototype barrels in 25mm; analyze barrel test results. - Complete integration and demonstrate compact autoloader hardware (105/120mm); perform unmanned weapon system concept design study. - Complete Tank 1080/FMBT alternative ammunition cartridge system concept study. - Initiate acoustic lab demonstration to assess novel target effects for landmine applications (electric and combustion driven sources).
Total	5389	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	5274	5057	5451
Appropriated Amount (FY 1995)	5274		
Adjustment to FY 1995	-88		
Appropriated Amount (FY 1996)		4968	
Adjustment to FY 1996		-49	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-62
Current President's Budget Submit	5186	4919	5389

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

DATE: March 1996

2 - Applied Research | 0602624A Weapons and Munitions Technology | PROJECT AH22

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH22 High Explosive Materials	7238	0	0	0	0	0	0		0	7238

A. Mission Description and Justification: Project AH22 - High Explosive Materials: This project was initiated in FY 1994 in response to Congressional direction to conduct feasibility tests and process prove-outs of energetic materials and binders from low sample test quantities to small scale production. This project develops process technology for pilot lot production required to reduce costs, comply with environmental laws, eliminate pollution problems, and comply with international agreements. Work will be completed in FY 96.

FY 1995 Accomplishments:

•	7238	- Scale-up process for red powder to pilot scale. Process is safe, environmentally friendly and eliminates sole-source problem (to be completed in FY 96). - Demonstrate twin screw mixer/extruder technology for processing new explosives at the pilot scale level (to be completed FY 96). - Develop pilot plant process for prove-out of producibility of new more powerful explosives (to be completed FY 96).
Total	7238	

FY 1996 Planned Program: Project Not Funded

FY 1997 Planned Program: Project Not Funded

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	7892	0	0
Appropriated Amount (FY 1995)	7726		
Adjustment to FY 1995	-488		
Appropriated Amount (FY 1996)		0	
Adjustment to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			0
Current President's Budget Submit	7238	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology / PROJECT AH23

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH23 Non Lethal Weapons Technology	0	0	2524	1064	0	0	0		0	3588

A. Mission Description and Budget Item Justification: **Project AH23 - Non Lethal Weapons Technology:** This project is directed towards providing engagement alternative technologies, devices and munitions that are explicitly designed and employed to incapacitate personnel and/or materiel while minimizing fatalities and undesired damage to property and the environment. Technologies being investigated include - but are not limited to - acoustics, kinetic energy rounds, entanglements, envelopments, vehicle stoppers, distraction devices and non lethal agent dispensers. This project funds the only in-house non lethal materiel (devices, munitions, weapons) program in the Department of Defense. Customers include all of the Services, the Special Operations Command, and the National Institute of Justice. The program responded rapidly to urgent requirements to provide over 20,000 non lethal munitions for Operation Restore Democracy (Haiti). A DoD Senior Steering Committee provides oversight and guidance.

FY 1995 Accomplishments: Fabricated hardware for laboratory demonstrations, conducted user demonstrations, and transitioned items to appropriate program managers. These efforts were funded under Project AH19.

FY 1996 Planned Program: Conduct laboratory demonstrations on additional hardware items, provide additional items for user testing, and transition items to appropriate program managers. These efforts are funded under Project AH19.

FY 1997 Planned Program:

•	2524	- Design the next generation acoustic device and evaluate bioeffects data.
•		- Evaluate various caliber blunt impact and entanglement anti-personnel munitions.
•		- Demonstrate electrical and mechanical vehicle immobilizers and area denial entanglement systems.
Total	2524	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology — PROJECT AH23

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	0	0
Appropriated Amount (FY 1995)	0		
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		0	
Adjustment to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			2524
Current President's Budget Submit	0	0	2524

Change Summary Explanation:

Funding: FY97: This new project to develop non lethal weapons technology was established at the direction of USD(A&T).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology — PROJECT AH28

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH28 Munitions Technology	8251	7375	8214	8588	9423	9395	9611		Continuing	Continuing

A. <u>Mission Description and Justification</u>: **Project AH28 - Munitions Technology:** This project supports advanced technologies in propellants, explosives, warheads, insensitive munitions (IM) and penetrators. Advances in warhead technology will provide improved explosively formed penetrators (EFP), shaped charges and heavy metal alloy penetrators and liners to defeat the current and future threat systems. High energy/density explosives are needed to increase lethality. New, improved energetic materials have numerous transition opportunities for weapons system upgrades. The IM efforts conducted in this project will increase the survivability of tanks, artillery, helicopters and infantry fighting vehicles, as well as safety in manufacturing plants and storage depots.

FY 1995 Accomplishments:

- 6286 - Established feasible laboratory scale synthesis routes for new insensitive explosives such as nitro imidazole compounds.
  - Scaled up synthetic routes for trinitroazetidine (TNAZ) explosives to 50 pound batches.
  - Initiated development of high efficiency reinforced concrete defeat mechanisms.
- 1965 - Developed process and characterized/evaluated mechanical properties of fully dense, tungsten composite (an environmentally acceptable replacement for depleted uranium (DU) in penetrators).
  - Demonstrated pilot plant production capability for manufacture of high performance gun propellant.
  - Fabricated test hardware of imaging seeker pyrotechnic decoy expendable flare.

Total 8251

FY 1996 Planned Program:

- 3331 - Conduct sensitivity/performance tests and develop process for CL-20 explosive/TNAZ formulations.
  - Develop pilot lot process technology for TNAZ explosives and synthesize more highly nitrated cubane explosives.
- 3986 - Demonstrate advanced EFP anti-armor warhead designs and develop concrete defeat mechanism.
  - Optimize tungsten composite (an environmentally acceptable replacement for DU in penetrators) for 1/4 scale testing.
  - Develop new high energy propellant for advanced KE cartridge.
- 33 Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
- 25 Revised economic assumption not available for execution.

Total 7375

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602624A Weapons and Munitions Technology — PROJECT AH28

FY 1997 Planned Program:

•	3110	- Conduct warhead testing with advanced CL-20/TNAZ formulations. - Demonstrate polynitrocubane synthesis and transition TNAZ for pilot plant processing.
•	5104	- Demonstrate a high efficiency lightweight concrete defeating warhead. - Complete 1/4 scale testing of tungsten composite penetrators (an environmentally acceptable replacement for DU in penetrators) and conduct final effectiveness analysis. - Develop continuous process for producing thermoplastic elastomer propellants.
Total	8214	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	8421	7579	8288
Appropriated Amount (FY 1995)	8401		
Adjustment to FY 1995	-150		
Appropriated Amount (FY 1996)		7447	
Adjustment to FY 1996		-72	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-74
Current President's Budget Submit	8251	7375	8214

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

DATE: March 1996

2 - Applied Research | **0602705A Electronics and Electronic Devices**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	23317	19928	20922	21478	23827	24436	27674		Continuing	Continuing
AH11 Battery/Individual Power Technologies	0	2877	2123	2271	1887	1866	1924		Continuing	Continuing
AH94 Electronics and Electronic Devices	23317	17051	18799	19207	21940	22570	25750		Continuing	Continuing

Mission Description and Budget Item Justification This program consists of research in the physical sciences essential to all land combat systems that contain electronics, chem/bio sensors, photonics, magnetic materials, ferroelectrics, microwave and millimeter-wave components, batteries, and fuel cells. Supported systems include the Future Soldier System (FSS), autonomous missile systems, advanced land combat vehicles, brilliant anti-tank munitions, electric weapons, secure jam-resistant communication, Automatic Target Recognition (ATR), foliage-penetrating radar, Combat Identification, and digitizing of the battlefield. The work under this program element provides enabling capability to perform precision deep fires against critical mobile and fixed targets, to provide exceptional all-weather, day or night, theater air defense against advanced enemy missiles and aircraft, and to develop small, low-cost, lightweight, high-energy sources of power for communications, target acquisition, miniaturized displays and microclimate cooling for Future Soldier System. Under Defense Reliance agreements this program supports the in-house exploratory development effort at a single Army site which serves as both the center for display technology development and the center for frequency control and timing for the Army, Navy, Air Force, Ballistic Missile Defense Organization, and Defense Nuclear Agency. It supports all of the Science and Technology Thrust areas that employ electronic and portable power-source technology. This project includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602705A Electronics and Electronic Devices — PROJECT AH11

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH11 Battery/Individual Power Technologies	0	2877	2123	2271	1887	1866	1924		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project AH11 - Battery/Individual Power Technologies This project provides exploratory development in the application of the physical sciences of electrochemistry, electronics, and process science, as they apply to improving existing systems and enabling newer, more advanced battery, fuel cell, and electromechanical (including engines and permanent magnetic alternators) technologies. The goal is to develop small, low-cost, environmentally compatible, light weight, high energy density sources of power for communications, target acquisition, miniaturized displays, combat service support applications, as well as for microclimatic cooling for the Future Soldier System. Technology developments support thrusts aimed at reduced acquisition costs, reduced operations and support costs, Army Modernization, Advanced Technology Demonstrations and Advanced Technology Transition Demonstrations, described in the Army Science and Technology Master Plan. Mobile Electric Power and fuel cell technology conducted under Project AH20 in prior years is restructured to this project beginning in FY 1997. Battery technology conducted under Project AH94 is restructured to this project in FY 1997.

FY 1995 Accomplishments: Work conducted under Project AH94.

FY 1996 Planned Program (The FY 1996 Program is based on a one year Congressional appropriation):

•	2766	- Develop ultra-safe, high performance, rechargeable lithium-ion batteries containing no free metallic lithium.
		- Continue development of low cost, high energy, rechargeable alkaline military batteries.
		- Continue development of very high energy density, ultra-safe zinc-air batteries.
•	98	- SBIR/STTR
•	13	- Revised economic assumption not available for execution.
Total	2877	

FY 1997 Planned Program:

•	776	- Complete development of optimum sized lithium ion cells and associated charge/discharge controls to assure maximum performance and safety in all of the Army standard family of lithium batteries.
		- Complete design for high rate cylindrical and prismatic zinc-air cells for low cost, high energy density primary battery alternative to the BA-5590.
		- Design and demonstrate prototype capacitor-battery hybrid power source for field testing in SAWE/MILES equipment.
		- Design and demonstrate an instantly reusable thermophoto-voltaic battery alternative to the present BA-5590 primary battery.
•	1347	- Complete development of a low temperature, high conductivity electrolyte system for the lithium-manganese dioxide primary battery.
		- Design light weight, man portable, electronically controlled, signature suppressed 3kW generator set capable of operating on JP-8 fuel.
		- Reduce size and weight of fuel cells, improve thermal management and hydrogen generation techniques.
Total	2123	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602705A Electronics and Electronic Devices — PROJECT AH11

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	0	0	0
Appropriated Amount (FY 1995)			
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		4421	
Adjustment to FY 1996		-1544	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current President's Budget Submit	0	2877	2123

Change Summary Explanation: FY 96: A portion of this program has been reduced for an amount which reflects revised economic assumptions and/or may be offered for rescission (-1500).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602705A Electronics and Electronic Devices — PROJECT AH94

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH94 Electronics and Electronic Devices	23317	17051	18799	19207	21940	22570	25750		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project AH94 - Electronics and Electronic Devices:** This project provides exploratory development in the application of the physical sciences of physics, electrochemistry, biotechnology, electronics, and process science, as they apply to improving existing systems and enabling newer, more advanced systems. Technology developments support thrusts aimed at reduced acquisition cost, reduced operations and support costs, Army Modernization, Advanced Technology Demonstrations and Advanced Technology Transition Demonstrations, described in the Army Science and Technology Master Plan.

FY 1995 Accomplishments:

- 8663 - Demonstrated high performance fully addressable 1280x1024 pixel head-mounted display for Gen II Soldier, 21 Century Land Warrior, and Crewman's Associate. Demonstrated stereoscopic workstation.
  - Delivered to AMC master plan for disposition of 1600 electronic part MIL Spec/Stds. Developed fully coordinated tri-service procurement documents for Plastic Encapsulated Microcircuits. Generated final report on reliability assessment of GaAs integrated circuits.
  - Demonstrated advances in low power logic implementations to reduce power requirements for battery powered communication devices. Developed circuits to detect Angle of Arrival of frequency hopped BPSK signals.
  - Developed micromachining process for 64x64 pixel arrays for infrared scene emulator. Designed and fabricated ice detection sensors for aircraft rotors and wings for Vehicle Structures Directorate. Prototyped acoustics plate mode sensor oscillator for biosensor.
- 11741 - Demonstrated novel ferroelectric phase shifter for electronic scanning radar. Demonstrated M16 mountable antenna for Battlefield Combat Indentification System. Designed and fabricated Ku-band ceramic T/R module for ALERT Radar.
  - Completed report on Polymer Exchange Membranes for fuel cell stacks. Demonstrated proof-of-principle pouch battery. Prototyped Li-ion version of battery for thermal weapon sight.
  - Developed network synthesis tool for rapid design of miniaturized heterogeneous multiprocessor circuits. Integrated hardware description language behavioral synthesis tools and integrated circuit design tools for flexible manufacturing.
  - Conducted Congressionally mandated program for development of rechargeable and alkaline/manganese batteries.
- 2913 - Developed electronics materials including a monolithic optical parametric oscillator (OPO) for the 1.54 micron spectral region; modeling nonlinear optical processes; and improvement of ZGP material for mid-infrared OPO.
  - Developed and characterized advanced high performance, full-color display technology and associated technology for utilization of interactive displays.
  - Evaluated and advanced the scientific understanding of advanced hybrid processing components and architectures that are scaleable to support the requirements of both combat platforms and mobile decision nodes.

Total 23317

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602705A Electronics and Electronic Devices — PROJECT AH94

FY 1996 Planned Program:

•	8337	- Demonstrate an electronic component design tool featuring a behavioral accelerator for architectural assessment/optimization. Investigate integration of MW/analog/digital design tools into a single Hardware Description Language (HDL). - Design and fabricate advanced Microwave/Millimeter Microwave components to enable line of sight space and terrestrial communications, Battlefield Combat Identification System for the dismounted soldier, and Moving Target Indicator (MTI) radar Advanced Technology Demonstration. Develop sub-MMW/terahertz components to enable commo devices operating at frequencies where detection, interference, and countermeasures are inhibited. - Design and fabricate new oscillator technologies based on micromachined silicon, quartz, and piezoelectric thin-film resonators as well as new piezoelectric materials such as langasite and lithium tetraborate for components for Army land combat command and control situations.
•	5686	- Exploit improved processing technologies to fabricate miniature sensors/actuators for mine detection, hand-held optoelectronic biosensors, and missile seekers. Develop a biochemical sensor system to determine the feasibility of coupling mechanisms critical to biosensor development. - Improve fabrication processes based on phosphor physics and luminescence properties to develop and demonstrate ruggedized, high resolution, low power, flat panel and head-mounted displays for command post situations, personal commo, and training applications. Investigate reliability issues and commercial practices. - Synthesize/evaluate novel fluorinated carbon cathode material for future primary Lithium battery with energy density greater than 200 Wh/kg; Develop high energy/power density LiMnO2 pouch battery for the 21st Century Land warrior (21CLW).
•	2845	- Demonstrate low temperature heteroepitaxial growth for circuit integration; continue modeling of nonlinear optical processes for optical oscillators/amplifiers and improvement of ZGP material. - Demonstrate a massively parallel, scaleable processor in an architecture of sufficient throughput of support real-time 3-D visualization of terrain and battlefield information across distributed computing environments.
•	128	SBIR/STTR
•	55	Revised economic assumption not available for execution.
Total	17051	

FY 1997 Planned Program:

•	10440	- Improve integrated computer-aided design technologies and apply to electronic components to achieve a 4x reduction in time and cost to develop/upgrade high performance devices, components, sensors and process modules for Army land combat systems. - Continue effort to design and fabricate advanced MW/MMW/quasi-optical components to improve line-of-sight space and terrestrial communication, and fire control applications. Design and prototype sub-MMW/terahertz components to enable communication devices to operate at frequencies where detection, interference, and countermeasures are inhibited. - Develop and characterize new piezoelectric materials and novel resonators and microresonators for low noise oscillators and high-accuracy clock applications. Develop high-accuracy, low-noise, low-power quartz and atomic clocks and resonant sensors for uncooled infrared, chemical and acceleration sensing.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602705A Electronics and Electronic Devices — PROJECT AH94

FY 1997 Planned Program: (continued)

•	4003	- Design, fabricate, and transition improved miniature sensors/actuators for mine detection, and missile seekers. Develop hand-held optoelectonic biosensors provide new and critically needed capabilities in biological/chemical warfare agent detection for the warfighter. - Apply improved fabrication processes based on phosphor physics and luminescence properties to emerging display technologies and demonstrate ruggedized, high resolution, low power, flat panel displays for command post situations, personnel communications, and training applications. - Jointly evaluate with Air Force high temperature super conducting (HTSC) antenna feed for Military Strategic Tactical Relay System (MILSTAR); Demonstrate and integrate MMW devices into MTI radar.
•	4356	- Prototype lithium batteries utilizing highly energetic oxyhalide and transition metal oxide cathode materials; demonstrate proof-of-principle thermophotovoltaic power source for quiet mobile electric power field generators. - Continue investigation of nonlinear optical processes; investigate additional materials; extend modeling of nonlinear processes; optimize mid-IR OPO. - Develop a prototype to validate scalability of processors and architectures from combat platforms to mobile command nodes. Transition technology to Battlespace C2 ATD.
Total	18799	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	24004	17525	17555
Appropriated Amount (FY 1995)	23765		
Adjustment to FY 1995	-448		
Appropriated Amount (FY 1996)		17219	
Adjustment to FY 1996		-168	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			1244
Current President's Budget Submit	23317	17051	18799

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602709A Night Vision Technology — PROJECT DH95

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DH95 Night Vision and Electro-Optic Technology	18956	16624	16994	17842	19143	19156	19583		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project DH95 - Night Vision and Electro-Optics Technology:** This project develops core night vision and electronic sensor technologies for army weapons systems. Advanced focal plane arrays, both infrared and multispectral, are being developed that will see farther, provide advanced signal processing, and provide improved performance in the dirty battlefield. Lightweight, high resolution common module optics, display, and sensor technologies for future head-mounted vision systems are being developed for future aviators, infantry, armored vehicle crewmen, and field maintenance personnel. Multiwavelength, multifunction laser sources will provide affordable, high performance technology options for Army tactical laser countermeasures, obstacle avoidance, biological agent detection, rangefinding, enhanced target recognition and laser radar applications. Automatic target recognition technologies will enable dramatic reductions in the time to acquire targets and intelligence data while also reducing the warfighter's cognitive workload. Low-cost, low-observable multispectral technologies are being developed and evaluated to camouflage and conceal friendly force assets from threat sensors and to enable our sensors to acquire enemy low observable targets. Hardware-in-the-loop multispectral sensor simulations are being developed that will allow end-to-end predictive modeling, hardware design, and evaluation of new technologies in a virtual environment, while allowing warfighters to test these capabilities, develop tactics and techniques, and train in parallel with the hardware development process. This program element supports all major weapons systems as well as the Joint Precision Strike Demo (JPSD) and Rapid Force Projection Initiative (RFPI) advanced concept technology demonstrations (ACTDs), and Force XXI Soldier. 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. This work is related to and fully coordinated with efforts in the following program elements: PE 0602712A/AH24, Countermine Technology; PE 0603710A, Night Vision Advanced Technology. This project includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. This program is primarily managed by Communications-Electronics Command Research, Development and Engineering Center, at Fort Belvoir, VA.

FY 1995 Accomplishments:

- 2700 -Demonstrated initial thermal scene rendering capability for virtual imagery and validated 3-dimensional thermal models.
- 1800 -Demonstrated multi-sensor aided targeting (MSAT)-air aided target recognition (ATR) algorithm in high-density processor testbed and provided high-performance processor module technology to hunter sensor system and target acquisition technology demonstrations in PE 0603710A.
- 1935 -Initiated open system architecture studies and analysis to apply commercial practices and architectures to Aladdin-like multi-chip module processor technology.
- 4360 -Demonstrated monolithic integration of readout and long-wave length infrared (LWIR) detector array and initiated staring sensor testbed with analog to digital (A/D) on-chip and neural type processing.
- 3607 -Evaluated state-of-the-art optics technologies such as binary, diffractive and holographic for head-mounted vision system applications.
- 700 -Demonstrated high-efficiency diode-pumped laser with diverse wavelength module (visible to near infrared (IR)) and transitioned to laser counter measure systems (LCMS), PE 0604710A.
- 928 -Developed models of low observable targets for incorporation into electronic terrain board simulation system.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602709A Night Vision Technology / PROJECT DH95

FY 1995 Accomplishments: (continued)

•	2926	-Evaluated emerging staring focal plane arrays (FPAs) for imaging applications and established critical improvements methods.
Total	18956	

FY 1996 Planned Program:

•	6412	- Complete thermal scene rendering capability for virtual imagery and provide data base for simulated night scene to the Dismounted Battlespace Battle Lab. - Validate representation of low observable target models in electronic terrain board system. - Integrate high density multi-chip modules into a commercial processing architecture and demonstrate selected critical ATR algorithm functions.
•	6904	- Demonstrate fabrication of 128x128 staring detector array with on chip analog to digital conversion using molecular beam epitaxial (MOMBE) microfactory. - Continue evaluation of staring FPAs for imaging applications and establish performance metrics and preliminary performance models.
•	3126	- Complete design trade-offs for objective and ocular optics for common helmet mounted vision system (HMVS) and demonstrate binary optics hybrid for potential cost/weight reductions. - Conduct laboratory demonstrations of optical phase oscillator (OPO) techniques to generate multiple wavelengths in the 1-5 micron region for multiple laser applications, and initiate development of multifunctional control software.
•	128	Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
•	54	Revised economic assumption not available for execution.
Total	16624	

FY 1997 Planned Program:

•	5585	- Evaluate staring focal plane performance against preliminary model; refine modeling capability and staring focal plane array metrics and assess producibility. - Demonstrate readout integrated circuits for non-uniformity correction, image enhancement and dynamic range control for Standardized Advanced Dewar Assembly II (SADA II) focal plane array.
•	4398	- Develop core display electronics and sensor technologies for multiple HMVS applications and fabricate advanced optic components for demonstration. - Demonstrate multifunction laser control software for rangefinding, designating, and profiling and burst-mode eye-safe laser technology. Initiate produciblity/affordability program.
•	7011	- Complete development of ATR evaluation facility and demonstrate rapid prototyping of processor modules utilizing commercial computer-aided design techniques and architecture standards. - Demonstrate virtual scene simulation, integrated with realistic terrain and cultural features, shadowing, diurnal cycle effects, and near infrared image intensifier simulation.
Total	16994	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602709A Night Vision Technology — PROJECT DH95

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	19326	17086	17175
Appropriated Amount (FY 1995)	19271		
Adjustment to FY 1995	-315		
Appropriated Amount (FY 1996)		16788	
Adjustment to FY 1996		-93	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-181
Current President's Budget Submit	18956	16695	16994

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

DATE: March 1996

2 - Applied Research

0602712A Countermine Systems Exploratory Development

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	0	6029	6601	7722	7019	7118		Continuing	Continuing
AH24 Countermine Technology	0	0	4670	6263	7384	7019	7118		Continuing	Continuing
AC61 Tractor Quake	0	0	1359	338	338	0	0		0	2035

Mission Description and Budget Item Justification: This program element provides countermine and advanced signature management technologies. The specific countermine efforts include remote detection of minefields, and detection and neutralization of individual mines from moving vehicles and manportable systems. Advanced robotic systems will be emphasized to minimize threats to weapons systems and personnel. Breaching and neutralization techniques will be developed for both conventional and electronically activated mines that can act at a distance. Advanced signature management systems will provide mobile and semi-mobile assets (e.g., Abrams, Theater Missile Defense (TMD) with low cost, low burden survivability enhancements addressing detection avoidance and hit avoidance in global battlefield conditions. Low Observable Simulation (LOSIM) will provide a capability to evaluate operational effectiveness of sensors and low observable (LO) targets against one another and provide the input data to realistically portray LO and deception in wargame simulations. 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 weaponry and ground vehicles. Work in this program element is related to and fully coordinated with PE 0603606A (Countermine and Barrier Development). This program is managed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program is dedicated to conducting applied research and tests of general technologies to meet specific military needs and is therefore correctly placed in Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602712A Countermine Systems Exploratory Development — PROJECT AH24

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH24 Countermine Technology	0	0	4670	6263	7384	7019	7118		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **AH24 Countermine Technology.** Countermine research will focus on remote detection of minefields, and detection and neutralization of individual mines from moving vehicles and manportable systems. Advanced robotic systems will be developed to minimize threats to weapons systems and personnel. Breaching and neutralization techniques will be developed for both conventional and electronically activated mines that can act at a distance. Advanced signature management systems will provide mobile and semi-mobile assets (e.g., Abrams, Theater Missile Defense) with low cost, low burden survivability enhancements addressing detection avoidance and hit avoidance in global battlefield conditions. Low Observable Simulation (LOSIM) will provide a capability to evaluate operational effectiveness of sensors and LO targets against one another and provide the input data to realistically portray LO and deception in wargame simulations. This project is a restructure from PE 0602786A, project AH20. Tactical power efforts included under PE 0602786A, project AH20, were restructured to PE 0602705A.

FY 1995 Accomplishments: See PE 0602786A, AH20

FY 1996 Planned Program: See PE 0602786A, AH20

FY 1997 Planned Program:

•	708	- Demonstrate passive low observable/deception technologies for suppression of mobile and semi-mobile assets' multispectral signatures reducing detection ranges by 50 percent in woodland, desert, arctic and urban battlefield environments.
•	3962	- Evaluate imaging IR and frequency agile radar for application to the mine hunter-killer; fabricate and integrate directed energy brassboard system.
Total	4670	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602712A Countermine Systems Exploratory Development — PROJECT AH24

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	0	0
Appropriated Amount (FY 1995)	0	0	0
Adjustment to FY 1995			
Appropriated Amount (FY 1996)	0	0	0
Adjustment to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			4670
Current President's Budget Submit	0	0	4670

Change Summary Explanation: Funding: FY 1997: Restructure from PE 0602786A/AH20.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602716A Human Factors Engineering Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	13834	15600	14072	15080	14877	14563	14897		Continuing	Continuing
AH34 Rural Health Technology	0	3405	0	0	0	0	0		0	3405
AH70 Human Factors Engineering Systems Development	13834	12195	14072	15080	14877	14563	14897		Continuing	Continuing

Mission Description and Budget Item Justification: The objectives of this program are first to maximize the effectiveness of the soldier 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 project focuses on improving health care in remote areas through research and technology development in distance learning and professional collaboration (teleconsulting and telepracticing). The work in this latter effort complements related Army programs in soldier performance, training and evaluation methodologies, and will provide direct research benefits to the Army's medical community, including combat casualty care on the battlefield and in other remote areas of operation. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. All work under this PE is part of the Human Systems Tri-Service Reliance panel. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602716A Human Factors Engineering Technology / PROJECT AH34

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH34 Rural Health Technology	0	3405	0	0	0	0	0		0	3405

A. Mission Description and Budget Item Justification This project focuses on improving health care in remote areas through research and technology development in distance learning and professional collaboration (teleconsulting and teleproctoring). The objectives are: (1) identify the best practices in remote training, education and telemedicine, and (2) demonstrate the value of selected strategies, technologies and methodologies. This project is jointly performed by Saint Francis College in Loretto, Pennsylvania and its Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA), and the University of Maryland Shock Trauma Center with technical oversight and coordination with the Army Research Laboratory and the Naval School of Health Sciences. Telemedicine project demonstrations are conducted with rural health care providers and facilities in central Pennsylvania. The work in this program complements related Army programs in soldier performance, team 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.

FY 1995 Accomplishments: Project not funded.

FY 1996 Planned Program:

•	3319	- Develop and demonstrate distance learning technologies for increasing specific health care providers skills and education, and linking these providers to innovative distance learning modalities, such as short term continuing education units, community-based wellness education, school-based health programs, and Masters of Medical Science remote education prototype and Internet prototype. - Complete two telemedicine demonstration projects linking rural health care providers with clinical specialists in definitive care facilities, demonstrating more timely and appropriate patient referrals and enhanced capabilities via teleconsulting for radiology interpretation. Develop mobile monitoring and evaluation devices for providing a broad range of monitoring and diagnostic capabilities for remote health care providers.
•	76	- SBIR/STTR
•	10	- Revised economic assumption not available for execution.
Total	3405	

FY 1997 Planned Program: Project not funded.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602716A Human Factors Engineering Technology
	PROJECT AH34

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	0	0	0
Appropriated Amount (FY 1995)			
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		3439	
Adjustment to FY 1996		-34	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current President's Budget Submit	0	3405	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602716A Human Factors Engineering Technology
	PROJECT AH70

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH70 Human Factors Engineering Systems Development	13834	12195	14072	15080	14877	14563	14897		Continuing	Continuing

A. Mission Description and Budget Item Justification This program focuses on maximizing the effectiveness of the soldier in concert with his material, in order to survive and prevail on the battlefield. The 21st Century Land Warrior (21CLW) program is directly supported by this soldier-system performance and supportability enhancement program. 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 1995 Accomplishments:

- 3724 - Completed Knowledge-based Logistics Planning Shell (KBLPS) Style Guide, including domain definition, conceptual design, and design requirements for all major KBLPS components with justifications derived from user studies. Completed an operational prototype of map-based user interface management system.
  - Completed integration of mobile manipulator platform control. Completed Variable Reach Rough Terrain Forklift (VRRTFL) sensor and automation enhancements for pallet acquisition. Demonstrated robotic manipulators with force and tactile sensors and investigated time-delay and reduced bandwidth communication. Developed a robotic workcell to research automated materials handling, including hazardous environments.
  - Expanded use of auditory detection model to include predictions for impulse noise, and demonstrated operator guidance with 3-D auditory display, including development of speech intelligibility measures for possible insertion to future individual soldier equipment ensembles.
  - Completed experiments on aids for collaborative decision making with a force "on the move".
- 5000 - Continued efforts to develop individual soldier simulation capability and enhanced the JACK Model.
  - Prepared HARDMAN III incremental review report. Developed Improved Performance Research Integration Tool (IMPRINT), version 1.0, with initial analysis capability.
  - Exercised battlefield-hazardous environment simulator with fielded and prototype systems to develop calibration procedures, data collection procedure, and a standard operating procedure (SOP) for human use.
- 5110 - Enhanced human factors engineering field evaluation methods with soldier-in-the-loop operational test exercise data to upgrade capabilities to assess new-technology systems.
  - Derived field, laboratory, and simulation exercise data to form parameters for human factors engineering evaluation and design support to Training and Doctrine Command (TRADOC), Army Material Command (AMC), BattleLabs, Research, Development and Engineering Centers (RDECs), and laboratories.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602716A Human Factors Engineering Technology
	PROJECT AH70

FY 1995 Accomplishments: (continued)

- Completed evaluations of proposed symbology for MIL-STD-2525 (Common Warfighting Symbology), and analyzed results; presented results to the Defense Information Systems Agency (DISA).
- Completed transition of Visual Imaging Projectile/Global Positioning System(VIP/GPS) technology to the Armaments RDEC.
- Developed and evaluated Human Computer Interface (HCI) for operator control module of an autonomous scout vehicle.

Total 13834

FY 1996 Planned Program:

- 3579 - Develop operational prototype of information exploration tool, including operational prototype of the management of the multitude of assumptions made by the user (ASSUMPTION MANAGER), and interactive logistics planning prototype with automated graphics generation.
- Collect performance data on sensor-human feedback interface devices, exoskeleton control devices for human positioning and monitoring and multi degree of freedom force sensors. Complete advanced armored vehicle technology (AAVT) study on armor vehicle containerization. Continue the palletized loading system container lift kit study.
- Improve the auditory detection model (ADM) through localization and impulse noise detection.
- Conduct Performance Research to evaluate advanced controls and displays for a force "on the move" in adverse environments.
- 6850 - Complete input of latest asthropometric data and add the capability for surface mapping, simulated uniforms and basic equipment restrictions to the human figure performance model (JACK).
- Develop Improved Performance Research Integration Tool (IMPRINT), version 1.0, accreditation review report. Develop IMPRINT version 2.0, with full-scale analysis and process-linked capability. Develop trade-off tool to assess effects of available manpower and personnel characteristics on system redesign options, and validate tool with human factors engineering field data.
- Continue efforts to develop a simulation capability for the individual soldier fighting system in a distributed interactive simulation (DIS) environment through the use of virtual reality and synthetic environment technologies.
- Continue enhanced human factors engineering field evaluation methods with soldier-in-the-loop operational test exercise data to upgrade capabilities to assess new technologies and systems.
- 1697 - Provide human factors engineering (HFE) support to AMC, AMC RDEC installations, Training and Doctrine Command (TRADOC), battle labs and laboratories.
- Initiate development of soldier-information system Performance Metrics for the Digitized Battlefield.
- 27 - SBIR/STTR
- 42 - Revised economic assumption not available for execution.

Total 12195

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602716A Human Factors Engineering Technology / PROJECT AH70

FY 1997 Planned Program:

•	4598	- Within the KBLPS tool framework, demonstrate mechanisms for constructing, automatically updating and interactively presenting multi-media staff briefings, incorporating large quantities of complex information for command and control and logistics. - Develop forklift enhancement data on International Standard Organization (ISO) container unstuffing to validate operator interface improvements. - Investigate control and operator sensing strategies and configurations for teleoperated manipulator devices doing military tasks. Complete development and evaluation of the automated field material handling workcell concept. - Continue efforts to collect performance data on sensor human feed back interface devices and exoskeleton control devices. Research focus will be on lightening the soldiers load, focusing primarily on fatigue reduction. - Incorporate auditory performance parameters into metrics to enhance soldier survivability. - Conduct simulations in a distributed interactive simulation (DIS) environment for decision making by a dispersed force.
•	3683	- Demonstrate and distribute human figure performance model (JACK) Army wide. - Complete Improved Performance Research Integration Tool(IMPRINT), version 2.0 accreditation review report and continue efforts to develop trade-off tools to evaluate soldier and unit performance and life cycle cost implications of choices in concept and system designs. - Demonstrate and deliver a Virtual Reality (VR) capability for the individual soldier fighting system in a DIS environment through the use of VR and synthetic environment technologies, e.g., high resolution visual displays, computer image generators, 3-D audio, etc.
•	5791	- Evaluate and validate soldier-system analysis tools in an operational environment and evaluate new system concepts, e.g., battle command vehicle. - Provide HFE support to AMC, AMC RDEC installations, Training and Doctrine Command (TRADOC), battle labs and laboratories. - Develop a draft Army standard set of soldier-information system performance metrics and demonstrate in the context of Division 97.
Total	14072	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	14265	12534	15012
Appropriated Amount (FY 1995)	14195		
Adjustment to FY 1995	-361		
Appropriated Amount (FY 1996)		12314	
Adjustment to FY 1996		-119	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-940
Current President's Budget Submit	13834	12195	14072

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	41145	25977	19457	19191	18887	19117	20163		Continuing	Continuing
D048 Industrial Operations Pollution Control Technology	3223	1498	2072	2626	3635	3731	3917		Continuing	Continuing
A822 Facility Environmental Management and Monitoring System (FEMMS)	4812	0	0	0	0	0	0		0	4812
A823 Hawaii Small Business Development Center	2600	5253	0	0	0	0	0		0	7853
A826 Unexploded Ordnance Remediation	4729	0	0	0	0	0	0		0	4729
A829 National Defense Center for Environmental Excellence (NDCEE) Technology	8505	12836	8170	5273	0	0	0		0	34992
A830 Biodegradable Packaging Technology	4073	0	0	0	0	0	0		0	4073
A833 Saltsburg Remediation Technologies	904	0	0	0	0	0	0		0	904
A835 Military Medical Environmental Criteria	4027	2179	3169	3416	3804	3776	3953		Continuing	Continuing
A896 Base Facility Environmental Quality	4519	2425	3412	4553	6439	6425	6861		Continuing	Continuing
AF25 Military Environmental Restoration Technology	3753	1786	2634	3323	5009	5185	5432		Continuing	Continuing

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 8 to 10 billion dollars. This PE also provides technology to avoid the potential for future hazardous waste problems, by reducing hazardous waste generation through process modification and control, materials recycling and substitution. This PE develops pollution control technology which assists installations to

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology

comply with environmental regulations at less cost. The PE also provides technology to mitigate noise impacts and maneuver area damage resulting from Army training activities. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Defense Reliance Agreements on Civil Engineering and Environmental Quality with oversight provided by the Joint Engineers and Armed Services Biomedical Research Evaluation and Management. These projects include non-system specific development efforts directed at specific military needs and are appropriate to Budget Activity 2.

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: D048

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D048 Industrial Operations Pollution Control Technology	3223	1498	2072	2626	3635	3731	3917		Continuing	Continuing

A. **Mission Description and Budget Item Justification:** This project provides pollution control technologies required to reduce the cost of treating hazardous toxic effluent from operation of Army industrial installations which include ammunition plants, depots, arsenals, and to satisfy increasingly stringent wastewater discharge standards under the Clean Water Act and relevant state regulations. Federal facilities are now subject to fines and facility shutdowns for violation of Federal, State, and Local air and wastewater discharge regulations. This new technology is essential to control and reduce generation of hazardous waste and in order to satisfy hazardous waste reduction goals and to avoid future hazardous waste disposal costs and liabilities to the Army. This project will provide compliance tools to control toxic air pollutants regulated under the Clean Air Act Amendments. Efforts will begin to focus on new energetic materials which will enter the Army inventory within the next decade to assure that ammunition plants will remain compliant. Changes in solid, liquid, and gaseous emissions resulting from pollution prevention efforts will require technology changes to existing treatment systems to compensate. The primary developing agency is the US Army Construction Engineering Research Laboratories, Champaign, IL.

FY 1995 Accomplishments:

•	1903	- Initiated open burning/open detonation alternatives technology. - Developed model for simulations of advanced oxidation processes effectiveness based on physiochemical properties of wastewater. - Completed development of treatment technology for nitrocellulose fines.
•	1320	- Developed guidance for treating hazardous waste containing heavy metals. - Developed technologies for metals and oil separation from waste water. - Initiated development of technologies for reducing hazardous air pollutants and volatile organic compound (VOC) emissions from industrial operations.
Total	3223	

FY 1996 Planned Program:

•	1010	- Develop transition plans for Nitrocellulose fines capture and treatment technology. - Develop guidance on reduced smoke propellants as a fuel source. - Develop guidance on air toxins from plating operations.
•	482	- Initiate development of technology for reuse of waste ammonium nitrate. - Develop volatile organic compound (VOC) treatment technology for industrial operations.
•	6	- Revised economic assumption not available for execution.
Total	1498	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology
	PROJECT D048

FY 1997 Planned Program:

- 2072 -Develop alternatives for hazardous materials used in production processes.
- -Develop preliminary guidance on pyrolytic behavior of energetic materials.
- -Develop guidelines for treatment and use of munitions wastes.
- -Develop biofilter technology for treatment of COV from industrial operations

Total 2072

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3384	1539	2083
Appropriated Amount (FY 1995)	3320		
Adjustments to FY 1995	-97		
Appropriated Amount (FY 1996)		1512	
Adjustment to FY 1996		-14	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-11
Current Budget Estimate Submit	3223	1498	2072

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A822

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A822 Facility Environmental Management and Monitoring System (FEMMS)	4812	0	0	0	0	0	0		0	4812

A. Mission Description and Budget Item Justification **Project A822 - Facility Environmental Management and Monitoring System (FEMMS):** This Congressionally mandated Pollution Prevention Project is managed by the Army to develop and implement the two-phased acquisition of a testbed demonstrator at Tobyhanna Army Depot (TYAD) for an automated control and real-time monitoring management of environmental emissions, pollutants, wastes and other issues such as toxins elimination or reduction opportunity assessment.

FY 1995 Accomplishments:

- 4812 Using FY 1994 funds, demonstrated and Initiated Phase I, the identification and analysis of TYAD facility environmental management needs, the conceptualization of the FEMMS, prototype module design and implementation in coordination with the National Defense Center for Environmental Excellence (NDCEE). Phase II initiation to complete the specification of FEMMS module designs, implementation, system deployment and selected pollution prevention efforts (to be completed in FY 1996 with FY 1995 funds).
- Formed a TYAD environmental and information management team to support implementation of the FEMMS.

Total 4812

FY 1996 Planned Program: Project completed.

FY 1997 Planned Program: Project completed.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4933	0	0
Appropriated Amount (FY 1995)	4829		
Adjustments to FY 1995	-17		
Appropriated Amount (FY 1996)			
Adjustment to FY 1996			
Adjustments to Budget (FY 1997) Year since FY 1996 President's Budget			
Current Budget Estimate Submit	4812	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A823

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A823 Hawaii Small Business Development Center	2600	5253	0	0	0	0	0		0	7853

A. Mission Description and Budget Item Justification: **Project A823 - Hawaii Small Business Development Center** - This congressionally mandated project is a continuation of an effort begun and funded in FY 93 under project A830. The project has technology policy goals favoring activities that meet dual-use and employment-creating criteria. The former refers to commercializing products that are used by Armed Services personnel as well as the civilian population. The latter is offered as a contribution to US economic revitalization. The approach being followed involves private-public partnerships to carry out activities leading to the commercialization of these products. Advisory personnel from Federal agencies (primarily the Departments of Defense and Agriculture) and State agencies participate at the work group level and oversight committee levels.

FY 1995 Accomplishments:

•	2600	Continued development of agricultural-industrial products having potential for dual use and commercialization focusing on native Hawaiian agricultural crops with potential application for medicine/food/biofuel use in the military.
Total	2600	

FY 1996 Planned Program:

•	5121	Continue development of agricultural-industrial products having potential for dual use and commercialization focusing on native Hawaiian agricultural crops with potential application for medicine/food/biofuel use in the military.
•	117	Redirected for Small Business Innovative Research.
•	15	- Revised economic assumption not available for execution.
Total	5253	

FY 1997 Planned Program: Project completed.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A823

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5327	0	0
Appropriated Amount (FY 1995)	5215		
Adjustments to FY 1995	-2615		
Appropriated Amount (FY 1996)		5306	
Adjustment to FY 1996		-53	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	2600	5253	0

Change Summary Explanation:

Funding: FY 95: Rescission within the FY 95 Supplemental Appropriation and Rescissions to preserve and enhance the military readiness of the Department of Defense ($-2615).

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A826

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A826 Unexploded Ordnance Remediation	4729	0	0	0	0	0	0		0	4729

A. Mission Description and Budget Item Justification **Project A826 - Unexploded Ordnance Removal:** This project has been designated Congressional special interest. The purpose of the project is to conduct a demonstration of commercially available technology to detect and remediate unexploded ordnance (UXO) at Jefferson Proving Ground (JPG). The project is managed by the US Army Environmental Center, Aberdeen Proving Ground, MD.

FY 1995 Accomplishments:

•	4729	-Initiated and conducted UXO Technology Demonstrations at JPG - Phase III (program completion to occur in FY 96 with FY 1995 funds).
Total	4729	

FY 1996 Planned Program: Project completed.

FY 1997 Planned Program: Project completed.

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4933	0	0
Appropriated Amount (FY 1995)	4829		
Adjustments to FY 1995	-100		
Appropriated Amount (FY 1996)			
Adjustment to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	4729	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A829

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A829 National Defense Center for Environmental Excellence (NDCEE) Technology	8505	12836	8170	5273	0	0	0		0	34992

A. Mission Description and Budget Item Justification Project A829 - National Defense Center for Environmental Excellence (NDCEE) Technology: This Congressionally mandated project is managed by the Army on behalf of the Office of the Deputy Undersecretary of Defense for Environmental Security (DUSD-ES). The mission of the NDCEE is three-fold: (1) Demonstrate and export new environmentally-acceptable technology to the industrial base; (2) train the industrial base on the use of the new technology; and (3) perform research and development, where necessary, to mature a new technology prior to demonstrating and exporting the new technology to the industrial base. The NDCEE, which is located in Johnstown, Pennsylvania, has the goal of resolving the environmental technology requirements of the DoD community and commercial industrial base. The NDCEE is to evaluate alternative manufacturing materials, treatments and processes which comply with environmental and OSHA regulations. The primary in-house development agency is the U.S. Army Materiel Command's Armament Research, Development, and Engineering (RDE) Center, Picatinny Arsenal, NJ.

FY 1995 Accomplishments:

- 8505 -Maintained and upgraded of Environmental Technology Facility (powdercoat, e-coat, power /rotary washers, honeycomb cleaner, dual-use ultrasonic, advance immersion system, solid state media booth, waterjet, manual plating, ion plating, mobile recovery units), industrial base integration, environmental analyses.
- -Continued execution of: plastic sortation, industrial health risk assessments, coal cleaning and medical waste tracking, phosphoric acid fuel cell investigation, nitrem removal process demonstration, adams process investigation, biological approaches to remediation and pollution prevention, and assessment of strategic coal reserves.
- -Conducted tests at crane NAWC for energetic material processing and support (to be accomplished in FY 96 with FY 1995 funds).
- -Technology transfer and transition of: ion beam processing, non-halogenated metal parts cleaning, electrodeposited coatings, powder coating demonstration, non-chrome conversion coatings, waterjet paint stripping.

Total 8505

FY 1996 Planned Program:

- 12516 - Maintenance/upgrade of environmental technology facility (flashjet, spongejet, CO2 turbine wheel stripper, water recycle units, ion beam implanter, supercritical painting system), industrial base integration, environmental analyses, and support to Army & DOD acquisition programs (environmental technology, cost/benefit analyses, alternative materials and risk reduction).
- - Continued execution of: plastic sortation, industrial health risk assessments, nitrem removal process demonstration, adams process investigation.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A829

FY 1996 Planned Program: (continued)

•		- Demonstration, technology transfer and transition of: non-halogenated metal parts cleaning, electrodeposited coatings, powder coating demonstration, non-chrome conversion coatings, waterjet paint stripping, paint handling & spraying equipment, ion beam processing, material & process substitution program, and supercritical carbon dioxide as a replacement for solvents in paint.
•	284	- Redirected for Small Business Innovative Research.
•	36	- Revised economic assumption not available for execution.
Total	12836	

FY 1997 Planned Program:

•	8170	- Maintenance/upgrade of environmental technology facility (supercritical cleaning system, automatic plating, thermoplastic coatings, wet/dry blast booth, high velocity oxygen fuel spray, central water polishing unit), industrial base integration, environmental analyses.
•		- Continued execution of: industrial health risk assessments, nitrem removal process demonstration.
•		- Demonstration, technology transfer, and transition of: non-halogenated metal parts cleaning, electrodeposited coatings, powder coating demonstration, non-chrome conversion coatings, waterjet paint stripping, paint handling & spraying equipment, flashjet stripping, ion beam processing, material & process substitution program, cadmium plating alternatives, and supercritical carbon dioxide as a replacement for solvents in paint.
Total	8170	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	8936	13196	12690
Appropriated Amount (FY 1995)	8748		
Adjustments to FY 1995	-243		
Appropriated Amount (FY 1996)		12966	
Adjustment to FY 1996		-130	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-4520
Current Budget Estimate Submit	8505	12836	8170

Change Summary Explanation:

Funding: FY97: Following an analysis of (a) the projected carryover of FY 1996 funds into FY 1997 and (b) the projected increase in reimbursable funding to be received by NDCEE in FY 1997, it was determined that the FY 1997 budget could be reduced with no impact upon staffing levels or overall workload at NDCEE.

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A830

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A830 Biodegradable Packaging Technology	4073	0	0	0	0	0	0		0	4073

A. Mission Description and Budget Item Justification: **Project A830 - Biodegradable Packaging Technology** - This project is a joint DoD, Department of Agriculture, and industry program to commercialize biodegradable polymers for packaging applications and develop advanced materials of military interest from renewable resources. The project has been designated Congressional special interest. The program addresses agricultural-based and other technologies to support material needs for the four Military Services, Special Operations Command, and the Defense Logistics Agency. Thrust areas include research and development of biodegradable packaging materials as replacements for existing packaging to enhance disposability, reduce signature in the field, meet environmental requirements, meet international treaty obligations, and lighten the load for the individual soldier through advanced fibers and composites from renewable resources. The primary developing agency is the U. S. Army Natick Research, Development and Engineering Center, Natick, MA. The work is performed through the Department of Agriculture, Cooperative State Research Service located in Washington, DC, through contracts with University of Massachusetts, Tulane University, Illinois Institute of Technology, Lebensmittel, Inc. of Fostoria, Ohio, and Woods Hole Oceanographic Institute.

FY 1995 Accomplishments:

- 4073 - Develop advanced materials, such as new ceramics from biometrics, enzymatically active substrates, and high strength fibers from the expression of silk genes in tobacco and soy plant cells (work to be performed in FY 1996 with FY 1995 funds).
- - Conduct Army field evaluations of agriculturally derived products, such as packing materials, bio-derived fluids, peelable coating, and energy absorbing foams (work to be performed in FY 1996 with FY 1995 funds).
- - Demonstrate biodegradable coatings for paper products to be applied to new biodegradable hot drink cups (Work to be performed in FY 1996).
- - Develop enzymatically active adsorbents for use in waste removal in streams; pursue soil remediation via new genetically engineered root plant technology (Work to be performed in FY 1996 with FY 1995 funds).

Total 4073

FY 1996 Planned Program: Project completed.

FY 1997 Planned Program: Project completed..

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology
	PROJECT A830

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4440	0	0
Appropriated Amount (FY 1995)	4347		
Adjustments to FY 1995	-274		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	4073	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A833

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A833 Saltsburg Remediation Technologies	904	0	0	0	0	0	0		0	904

A. Mission Description and Budget Item Justification **Project A833 - Saltsburg Remediation Technology:** This project, which was added by Congress, investigates the feasibility of existing technologies for the intact removal of buried drums containing potentially hazardous materials at a site near Saltsburg, Pennsylvania. A contractor, Federal Laboratories, operated a facility here to manufacture munitions prior to the 1970's. The project will be performed by the Army Corps of Engineers Waterways Experiment Station.

FY 1995 Accomplishments:

•	904	- Conduct investigations to determine feasibility of existing technologies for intact removal of buried drums containing potentially hazardous materials at a site near Saltsburg, Pennsylvania (to be accomplished in FY 96 with FY 1995 funds).
Total	904	

FY 1996 Planned Program: Project completed.

FY 1997 Planned Program: Project completed.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	984	0	0
Appropriated Amount (FY 1995)	965		
Adjustments to FY 1995	-61		
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current Budget Estimate Submit	904	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT A835

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A835 Military Medical Environmental Criteria	4027	2179	3169	3416	3804	3776	3953		Continuing	Continuing

A. **Mission Description and Budget Item 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 U.S. 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 U.S. Army Biomedical Research and Development Laboratory (USABRDL), Ft. Detrick, MD, the Center for Health Promotion and Preventive Medicine (CHPPM), and the Waterways Experiment Station (WES).

FY 1995 Accomplishments:

•	2867	Constructed models for carcinogenicity using non-mammalian aquatic species and non-mammalian models (USABRDL). Validated combined field biomonitoring methods for acute toxicity, developmental toxicity, and carcinogenicity (USABRDL). Developed microbial fate models and biomarkers of exposure (CHPPM).
•	1160	Produced health advisories and criteria for Army inventory chemicals and developed methods for ecological health advisories (CHPPM). Conducted hazard assessment of byproducts of munitions-contaminated soils incineration and from bioremediation of contaminated groundwater (CHPPM). Developed models/methods to predict effect on humans from exposure to contaminated soils and water, ecological effects, and structure/activity relationships (CHPPM).
Total	4027	

FY 1996 Planned Program:

•	875	- Develop munitions biomarkers and bioeffects (CHPPM). - Toxicological evaluation of munitions and degradation products (CHPPM). -Develop toxicity predictions using structure activity relationships and produce health advisories and criteria for military unique chemicals (CHPPM).
•	1252	- Develop cross species extrapolation of non-mammalian bioassays (USABRDL/CHPPM). - Develop fate and transport of military unique compounds and develop microbial biomarkers (WES). - Identify biomarkers to monitor bioattenuation of military unique compounds and develop exposure models (WES). - Apply sentinel biomonitoring systems and apply methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology
PROJECT A835	

FY 1996 Planned Program: (continued)

•	48	- Redirected for Small Business Innovative Research.
•	4	- Revised economic assumption not available for execution.
Total	2179	

FY 1997 Planned Program:

•	2015	- Develop munitions biomarkers and bioeffects and conduct toxicological evaluation of munitions and degradation products (CHPPM). - Produce health advisories and criteria for military unique chemicals and develop toxicity predictions using structure activity relationships (CHPPM). - Develop cross species extrapolation of non-mammalian bioassays (USABRDL/CHPPM), apply sentinel biomonitoring systems (USABRDL), and apply methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
•	1154	- Develop fate and transport of military unique compounds and microbial biomarkers (WES). - Identify biomarkers to monitor bioattenuation of military unique compounds (WES). - Develop exposure models and decision making framework for ecological risk assessment (WES).
Total	3169	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4166	2240	3263
Appropriated Amount (FY 1995)	4079		
Adjustments to FY 1995	-52		
Appropriated Amount (FY 1996)		2201	
Adjustments to FY 1996		-22	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-94
Current Budget Estimate Submit	4027	2179	3169

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602720A Environmental Quality Technology

PROJECT: A896

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A896 Base Facility Environmental Quality	4519	2425	3412	4553	6439	6425	6861		Continuing	Continuing

A. **Mission Description and Budget Item Justification:** This project provides the Army with the technical capability to protect and improve the biological and physical characteristics of fixed installation training and testing areas needed to sustain readiness while also conserving protected natural and cultural resources, including threatened and endangered species. Technology developed within this project will enable training and testing land users to match usage events and schedules to the capabilities of specific landscaped areas, and will also provide advanced methods to restore lands damaged in readiness exercises. Efforts under this project will also enable the Army to prevent pollution in facilities base operations, and to comply with the myriad of Federal, state and host country environmental regulations dealing with hazardous and non-hazardous water, wastewater, air emission, solid waste (including sediment discharge) and noise. An additional effort is the development of environmental monitoring and modeling capabilities to support environmentally sustainable installation lands and facilities. The primary developing agency is the U.S. Army Construction Engineering Research Laboratories, Champaign, IL.

FY 1995 Accomplishments:

•	2235	- Assessed air and soil impacts of conventional lead-based paint removal technologies.
		- Developed automated capability to report the status of threatened and endangered species.
		- Developed prototype knowledge-based system for air pollution compliance strategies for Army operations.
•	2284	- Developed methodologies for defining installation environmental carrying capacity.
		- Developed improved interim techniques for weapons noise contours.
		- Developed spatial and temporal models to predict erosion.
Total	4519	

FY 1996 Planned Program:

•	2416	- Develop automated system for selecting re-vegetation plant species.
•		- Develop threatened and endangered species (TES) inventory and monitoring protocols.
•		- Develop guidelines for mitigating environmental impacts of lead-based paint removal.
•		- Develop guidance for small arms range noise mitigation.
•	9	- Revised economic assumption not available for execution.
Total	2425	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology
PROJECT A896	

FY 1997 Planned Program:

•	2382	- Develop validated risk assessment models to determine the effects of Army activities on threatened and endangered species. - Develop land-based carrying capacity model. - Develop Army capability to sustain land for combat training.
•	1030	- Develop integrated natural and cultural resource data analysis protocols. - Evaluate and assess lead-based paint (LBP) abatement technologies. - Develop closure procedures for Open Burning/Open Detonation (OB/OD) burning grounds on military installations.
Total	3412	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4483	2491	3422
Appropriated Amount (FY 1995)	4583		
Adjustments to FY 1995	-64		
Appropriated Amount (FY 1996)		2448	
Adjustments to FY 1996		-23	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-10
Current Budget Estimate Submit	4519	2425	3412

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology PROJECT AF25

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AF25 Military Environmental Restoration Technology	3753	1786	2634	3323	5009	5185	5432		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u> **Project AF25 - Military Environmental Restoration Technology:** 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 DoD Base Realignment and Closure Program and the Formerly Used Defense Sites Program. The primary thrust of this effort is to expedite site cleanup, reduce the cost of cleanup of contaminated soil, groundwater, and structures, and to ensure that human health and the environment are protected. Research is conducted in major areas: innovative and cost effective site identification, characterization, and monitoring technologies; groundwater systems; and treatment technologies to remediate soil and groundwater contaminated with military-unique contaminants such as explosives/energetics, chemical agents, heavy metals, and other organics. Emphasis is placed on the development of in-situ remediation technologies and real or near real-time sensing technologies. Development of existing technologies (FY 95-98) provides near-term solutions, while adding to the knowledge base applicable to successful development of more complex in situ technologies (FY98-00). The primary developing agency is the U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

FY 1995 Accomplishments:

•	3287	- Established guidance on selecting, designing, and operating biotreatment systems for explosives/organics-contaminated soils and groundwater. - Configured technical data package and guidance documents on physical separation technologies for metals-contaminated soils. - Determined evaluation techniques for enhanced sensors and sampling devices for SCAPS.
•	466	- Developed a computer-based DoD Groundwater Modeling System incorporating enhanced contaminant transport algorithms for explosives and military-unique compounds. - Developed analytical methods for assessing explosives, explosive degradation products, and military-unique compounds in complex environmental media such as compost, slurries, and soils.
Total	3753	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602720A Environmental Quality Technology
	PROJECT AF25

FY 1996 Planned Program:

•	1441	- Provide improved analytical methods for hydrazine and field analysis techniques for nitrocellulose. - Begin development of design criteria and assessment of in-situ and ex-situ physical processes for remediation of explosives/organics-contaminated soils. - Develop methods of assessing extraction techniques for metals-contaminated soils.
•	305	- Develop remediation technology modules for Groundwater Modeling Systems. - Conduct field demonstration of SCAPS analytical/sampler interface.
•	35	- Redirected for Small Business Innovative Research.
•	5	- Revised economic assumption not available for execution.
Total	1786	

FY 1997 Planned Program:

•	2634	Develop improved laboratory analytical methods for identifying organic contaminants in soils.
•		Demonstrate thermal desorption sampler for volatile organic compounds and solvent detection.
•		Complete design criteria and assessment of in-situ and ex-situ chemical processes for remediation of explosives/organics-contaminated soils.
•		Demonstrate physical separation technology for remediation of heavy metals-contaminated soils and test methods to predict mobility of metals.
Total	2634	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3975	1838	2706
Appropriated Amount (FY 1995)	3891		
Adjustments to FY 1995	-138		
Appropriated Amount (FY 1996)		1805	
Adjustments to FY 1996		-19	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-72
Current Budget Estimate Submit	3753	1786	2634

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

DATE: March 1996

2 - Applied Research

0602782A Command, Control, Communications Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	16451	13204	15307	16979	17924	19545	20051		Continuing	Continuing
AH92 Communications Technology	9751	8584	8042	9240	9907	11031	11318		Continuing	Continuing
A779 Command/Control (C2) and Platform Electronics Technology	6700	4620	7265	7739	8017	8514	8733		Continuing	Continuing

Mission Description and Budget Item Justification: This program contains two related projects: communications technology and command/control (C2) and platform electronics technology. Faced with an increasing responsibility for meeting contingencies worldwide, field commanders must be capable at short notice of providing battlefield communications to and from virtually any place on earth. The communications technology project (AH92) explores the development of those advanced communications technologies required to provide a worldwide communications capability. The objective of the C2 and platform electronics technology project (A779) is to expand scientific knowledge for demonstration of state-of-the-art technologies, including command/control and electronic systems/subsystems, performance reliability, maintainability, safety, survivability, and man-machine interface for all Army air and ground platforms, including soldier systems and equipment. Development of an infrastructure that will allow timely distribution, display and use of C2 data on Army platforms will lead to greater battlefield functional capabilities, survivability and total integration into the digitized battlefield. 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 & Software Technology) and PE 0603734A (Military Engineering Advanced Technology). It includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. Work in this program element is performed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Monmouth, NJ.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602782A Command, Control, Communications Technology / PROJECT AH92

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH92 Communications Technology	9751	8584	8042	9240	9907	11031	11318		Continuing	Continuing

A. **Mission Description and Budget Item Justification** **Communications Technology:** The exploratory development efforts in this project address the need for an increased communications capability required to support digitization of the battlefield. They are focused to meet the threat of electronic countermeasures (ECM), the need for survivability on the automated battlefield, and the need to avoid unauthorized access to friendly communications systems. This project contains exploratory development efforts for combat net radio in the high frequency (HF) and very high frequency (VHF) regions of the electromagnetic spectrum, and for common user technology in the ultra high frequency (UHF), microwave (MW) and millimeter wave (MMW) regions of the spectrum. The ECM and survivability technology programs include: multichannel services, distributed communications (photonic and fiber optic systems), internet architecture, integrated services, packet appliqués, Mobile Subscriber Equipment (MSE) applications, and frequency management. The communication security technology programs involve computer operating systems supporting Ada applications that will provide multilevel security for Army Tactical Command and Control System (ATCCS), prevent compromise of classified information, and protect against subversive software. Finally, this project addresses enhanced modeling of communications system capacity and dynamic field environments required to support the global deployment of new communications technology.

FY 1995 Accomplishments:

- 3475 -Demonstrated mobile asynchronous transfer mode (ATM) networks interconnection; initiated test of tactical multinet gateway (TMG), product manager (PM) Single Channel Common Ground Air Radio System (SINCGARS) internet controller (INC), Broadcast ATM technology video technology and automated network management.
- 1447 -Developed prototype aviation (laser) radio, began effort on airborne relay, super high frequency (SHF), wireless private branch exchange (PBX) and distributed cellular control.
- 965 -Designed and developed two prototype UHF antennas to support satellite communications (SATCOM) on the move.
- 550 -Developed and demonstrated wideband HF antenna mounted on a standardized integrated command post (SICP) shelter and high mobility multi-purpose wheeled vehicle (HMMWV).
- 1444 -Fabricated photonic integrated phase and amplitude controller (IPAC) for integrated photonics sub-systems.
- 1870 -Developed algorithms used in burst propagation models to support communication realism for modeling and simulation products.
-

Total 9751

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602782A Command, Control, Communications Technology / PROJECT AH92

FY 1996 Planned Program:

•	4399	-Demonstrate Broadcast ATM capability and monitoring and control function for mobile networks. -Develop prototype platform conformal antenna for UHF structurally embedded reconfigurable antenna technology (SERAT) and for appliqué SHF antenna. -Continue development of a fully integrated photonic device for beam shaping and steering, wideband fiber optic link for use in optically controlled phased array antennas and SHF SATCOM line of sight.
•	4166	-Demonstrate validity of improved spectrum efficiency modeling as it supports wide band data radios and high capacity trunk radio systems design and planning. -Develop and demonstrate wideband aerial relays and prototype personal communications system (PCS) wireless private branch exchange (PBX) for support of digital battlefield communications advanced technology demonstration, SATCOM on the move and the multiband multimode radio. -Develop range extension test bed and a tracking and reporting system (TRS). -Develop Joint AF/Army solar blind ultra violet light (SBUV) radio technology providing a short range covert link.
•	19	Revised economic assumption not available for execution.
Total	8584	

FY 1997 Planned Program:

•	3938	-Continue technology development of integrated subsystems for application of optical control of single beam phased array antennas and fiber optic point to point links, LANs and antenna remoting systems. -Develop software for modeling communications system capacity and performance in dynamic battlefield environments. -Demonstrate advanced wireless PBX technology; initiate final distributed cellular communications control system.
•	4104	-Demonstrate hierarchical video routing between ATM and internet protocol (IP) multicast networks, and integrate broadcast protocol with the radio access point. -Complete SERAT conformal antenna for helicopter and start testing, and continue development of SHF antenna. -Continue development of range extension and testing in conjunction with digital battlefield communications radio access point and high capacity trunk radio programs. -Complete development of solar blind ultra violet radio technology and conduct joint testing.
Total	8042	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602782A Command, Control, Communications Technology / PROJECT AH92

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	9907	8830	8965
Appropriated Value (FY 1995)	9907		
Adjustments to FY 1995	-156		
Appropriated Value (FY 1996)		8668	
Adjustments to FY 1996		-84	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-923
Current President's Budget	9751	8584	8042

Funding: FY97: Funds (-923) reprogrammed for higher priority requirements

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602782A Command, Control, Communications Technology — PROJECT A779

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A779 Command/Control (C2) and Platform Electronics Technology	6700	4620	7265	7739	8017	8514	8733		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project A779 - Command/Control and Platform Electronics Technology:** The objective of this project is the exploration of new concepts and techniques in command/control and platform electronics integration to achieve new and enhanced military functional capabilities. Emphasis is on aided pilotage, mission planning, rehearsal, execution and monitoring, precision navigation and landing, command and control, soldier systems and integration with the evolving digital battlefield. New enabling technologies which support the current thrusts are also explored, such as controls and displays, voice interactive technology, 3D visualization, decision aides and tactical planning aides, data transfer, distributed data bases and advanced open system architectures and integration concepts, which contribute to digitization of the battlefield and provide command and control on the move.

FY 1995 Accomplishments:

•	1200	-Developed digital terrain model (DTM) requirements for battlefield digitization integration.
•	2500	-Integrated aided pilotage capability onto test bed aircraft and conducted simulations for threat symbology and nap-of-the-earth (NOE) flight symbology.
•	785	-Developed data preparation software for aircraft mission rehearsal (AMR), a software package that produces a 3D real-time view which heightens the pilot's situational awareness.
•	2215	-Demonstrated improved global positioning system (GPS) satellite selection algorithms utilizing the precision navigation system.
Total	6700	

FY 1996 Planned Program:

•	2240	-Develop and demonstrate GPS/Sensor integration technologies reducing the impact of GPS vulnerabilities. -Evaluate proposed improvements to DTM technologies via simulation. -Implement alternative GPS satellite selection algorithms and validate performance for on/near ground level application (soldier, ground vehicle, helicopter at nap-of-the-earth).
•	2364	-Add environmental features to AMR (clouds, fog , shadows, etc.), threat information (e.g. threat domes) and other objects as overlays to the real satellite images. -Conduct initial multi-sensor (inertial baro, doppler, GPS) differential GPS precision approach and landing test while operating in the selective availability/anti-spoof (SA/AS) mode.
•	16	-Revised economic assumption not available for execution.
Total	4620	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602782A Command, Control, Communications Technology — PROJECT A779

FY 1997 Planned Program:

- 4136 -Integrate improved DTM technology with a precision navigation system with enhanced electronic countermeasure protection.
  -Demonstrate mission planning and near real-time rehearsal with speaker independent continuous speech recognition.
- 3129 -Integrate emerging technologies to demonstrate concepts which significantly enhance battlespace awareness and enable commanders and their staffs to electronically interface to the battlespace in an effective and intuitive manner. Technologies integrated include: computer/graphics hardware to support real-time 3D rendering of information; hardware and algorithms to facilitate natural human/machine interfaces [natural language (NL), touch and gestures, and large screen displays]; and software to implement battle planning (BP) functions. Concepts include: 3D interactive fly-through; 3D perspective views; route planning; definition of force structure; overlay of control measures; and voice control.
  -Initiate development of a real-time multi-sensor differential GPS precision approach and landing concept to support operation during periods of temporary loss due to jamming or outages and including a data link to provide both secure and electronic counter-countermeasures capabilities.

Total 7265

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	6920	6896	7286
Appropriated Value (FY 1995)	6775		
Adjustments to FY 1995	-75		
Appropriated Value (FY 1996)		4665	
Adjustments to FY 1996		-45	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-21
Current President's Budget	6700	4620	7265

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602783A Computer and Software Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	4366	3883	6638	7299	8109	8131	8317		Continuing	Continuing
DY10 Computer and Information Science Technology	2424	2134	2317	2501	2585	2575	2628		Continuing	Continuing
A094 Tactical Software Technology	1942	1749	4321	4798	5524	5556	5689		Continuing	Continuing

Mission Description and Budget Item Justification: This Program Element develops and applies software technology to improve the performance and reduce the cost of computer software for Army tactical, strategic, and administrative information systems, tactical embedded real-time systems, high performance computational technology, and simulation technology. Tactical software technology efforts capitalize on computationally intensive approaches that exploit the rapidly evolving capabilities of emerging computer technology. Focus is on providing general solutions that can be applied to a wide variety of specific problems. Current examples include information distribution paradigms for constrained environments (e.g., bandwidth or security limited but not computationally limited), for application to tactical systems. Further specific concentrations are on applications to support tactical information distribution for situation awareness and interoperability of tactical systems. In the computer and information science technology areas, the efforts exploit advances in computer and communication technologies, and develop and modernize standard information management systems to support the soldier. The program addresses technical issues in the development of the Army's information mission areas of automation, communication, visual information, records management, and publication systems. In addition, the program investigates the infrastructure in communications and computers to support the information and communications needs of weapons technology. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. This program is managed primarily by the Army Research Laboratory(ARL). Efforts in this Program Element include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2. This Program Element reflects movement of funds within ARL due to the Federated Laboratory Restructuring.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602783A Computer and Software Technology — PROJECT DY10

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DY10 Computer and Information Science Technology	2424	2134	2317	2501	2585	2575	2628		Continuing	Continuing

A. Mission Description and Justification: **Project DY10 - Computer and Information Science Technology:** This project provides for the adaptation and application of research for the development and modernization of standard Army computer, command and control, and information systems. The project addresses technical issues in the development of an Information Architecture which will interconnect regional, local, and end user computing services resulting in a fully connected information management system with minimum data storage and maximum data access. The objectives of this project are to improve computer and communication system efficiencies by exploiting emerging technologies to reduce system development and maintenance costs and time, and to support modernization efforts of computing and communications hardware and software presently used in Army deployments throughout the world in both tactical and non-tactical environments. In addition, this project will facilitate transition to Ada for Army systems software development and achieve significant software reuse across Department of Defense (DoD) systems. This project also includes the application of Intelligent System Techniques in such areas as medical and maintenance diagnostics. New techniques which include fuzzy logic and neural networks will allow for expansion of applications and an increased focus on predictive application. Both medical and maintenance diagnostics applications of Intelligent Systems Techniques need exploration for identification of high payoff applications. Intelligent decision support has the potential for significant military impact in these areas. The potential payoffs of this project are: measurable improvements in productivity and quality; reductions in utilization of life cycle resources by institutionalizing software management procedures and practices with savings in development and maintenance costs; increased communication systems capacity; responsiveness, reliability, interoperability, availability, and maintainability.

FY 1995 Accomplishments:

•	2424	- Demonstrated technologies to support wide-area information search, retrieval, and exchange. - Developed and demonstrated capability to conduct meetings in an any-time, any-place environment and supported two Louisiana Maneuvers(LAM) Task Force General Officer Working Group meetings. - Established Computer-Aided Prototyping System (CAPS) test bed at ARL, the Aviation Applied Technology Directorate of the Aviation and Troop Command and Tank-Automotive Research Development and Engineering Center. - Completed model to interface dissimilar communication protocols using Very High Speed Integrated Circuit Hardware Development Language (VHDL).
Total	2424	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602783A Computer and Software Technology — PROJECT DY10

FY 1996 Planned Program:

•	2099	- Identify candidate medical and maintenance diagnostics applications of advanced Intelligent Systems Techniques. - Demonstrate the capabilities of self-describing databases for direct database to database information exchange using the U.S. Message Text Formats. - Create an Electronic Meeting System (EMS) environment that can be accessed by geographically distributed users over the Internet or dial-up modem. - Begin to transition the CAPS Rapid Prototyping Environment into the Army Materiel Command Life Cycle Software Engineering Centers and other software development agencies.
•	29	- SBIR/STTR
•	6	- Revised economic assumption not available for execution.
Total	2134	

FY 1997 Planned Program:

•	2317	- Develop prototype medical and maintenance diagnostics applications using intelligent system techniques. - Develop concepts to be used in formulating DoD policy and in developing or procuring systems for a unified DoD records management process. - Extend records management research to incorporate data warehousing concepts and techniques into Army information systems and C3I applications. - Develop testbed for the creation, testing, and analysis of computer and information-based technologies in system design and evolution to meet warfighter information requirements. - Use Group Systems in a Distributed Mode with one or more Army commands.
Total	2317	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2467	2194	2361
Appropriated Amount (FY 1995)	2416		
Adjustment to FY 1995	8		
Appropriated Amount (FY 1996)		2156	
Adjustment to FY 1996		-22	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-44
Current President's Budget Submit	2424	2134	2317

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

DATE: March 1996

2 - Applied Research | 0602783A Computer and Software Technology | PROJECT A094

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A094 Tactical Software Technology	1942	1749	4321	4798	5524	5556	5689		Continuing	Continuing

A. Mission Description and Justification: **Project A094 - Tactical Software Technology:** This project addresses the development of software techniques to exploit the rapid advances in computer (hardware) performance that are becoming equally available to both the scientific and tactical community. The vast gap in computational performance and capabilities that used to exist between computer systems in these two domains is rapidly diminishing. Computer power previously available only to scientists and engineers is now becoming routinely available to the soldier and new concepts for one domain will be applicable to the other. This project ensures that a fresh perspective on the application of this power is maintained. It concentrates on computationally intensive paradigms for information distribution and manipulation in severely constrained environments such as those encountered in the use of existing low-bandwidth tactical radios. This includes the automation of information exchange and research into the tactical aspects of the data abstractions of military concepts. It identifies the necessary functions for a simulation capability that supports the evaluation of C4I battlefield architectures and digitization and communications science technologies for operational utility and predicted technical performance. This project seeks to develop the computational technology to achieve efficient utilization of advanced computer architectures at the tactical level. This project reflects movement of funds within ARL due to the Federated Laboratory Restructuring.

FY 1995 Accomplishments:

•	1942	- Developed adaptive information distribution process based on active database technology that allows information exchange requirements to vary automatically in constrained environments. - Developed and simulated computationally intensive paradigm for route execution and monitoring that provided at least a 50% decrease in bandwidth required for situational awareness at tactical echelons. - Conducted research on a new control system which uses fuzzy logic to improve the information exchange rate in battlefield environment. Successfully demonstrated, on newly acquired parallel computing platforms, two major Computational Fluid Dynamics codes used in weapons related research.
Total	1942	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602783A Computer and Software Technology / PROJECT A094

FY 1996 Planned Program:

•	1741	- Conclude research and development of adaptive information distribution and incorporate into prototype software. Provide real-time display of network performance. Evaluate successfulness of approach under field conditions and transition to Combined Arms Command and Control Advanced Technology Demonstration. - Demonstrate testing of executable specifications using VHDL. - Develop techniques to passively monitor an automated information distribution environment to develop statistics to support the research into heuristics to maximize network throughput, minimize network delay and to respond to anomalies in network performance.
•	8	- Revised economic assumption not available for execution.
Total	1749	

FY 1997 Planned Program:

•	4321	- Demonstrate synthesis of communication interfaces using Very High Speed Integrated Circuit (VHSIC) Hardware Development Language (VHDL). - Incorporate heuristics of network performance into software and transition to the Communication and Electronics Command Battlespace Command and Control Advanced Technology Demonstration. - Develop software to support reasoning at multiple levels of abstraction which cooperatively process information from multiple heterogeneous databases. - Conduct research to advance the science of rendering complex terrain, abstract data and battlefield objects in 3-D to avoid clutter, perceptual and cognitive overload.
Total	4321	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2062	1798	1981
Appropriated Amount (FY 1995)	2034		
Adjustment to FY 1995	-92		
Appropriated Amount (FY 1996)		1767	
Adjustment to FY 1996		-18	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			2340
Current President's Budget Submit	1942	1749	4321

Change Summary Explanation:
Funding: FY97: Restructure of ARL funding (+2340).

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

DATE March 1996

2 - Applied Research | **0602784A Military Engineering Technology**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	39406	34260	37898	40524	43898	43371	44452		Continuing	Continuing
A855 Topography, Image Intelligence, and Space Technology	8986	7922	8556	8773	9605	10056	10315		Continuing	Continuing
AH71 Atmospheric Investigations	5613	5270	6691	7067	7343	6940	7095		Continuing	Continuing
AT40 Mobility & Weapons Effects Technology	11834	10520	11403	12643	13480	11980	12291		Continuing	Continuing
AT41 Military Facilities Engineering Technology	4947	4332	4285	4756	5780	6070	6220		Continuing	Continuing
AT42 Cold Regions Engineering Technology	5455	4168	4541	4739	4804	5438	5570		Continuing	Continuing
AT45 Energy Technology Applied to Military Facilities	2571	2048	2422	2546	2886	2887	2961		Continuing	Continuing

Mission Description and Budget Item Justification: The research conducted in this program element provides technology in direct support of the critical warfighter functions of mobility, countermobility, survivability, sustainment engineering and topography needed to win on the modern battlefield. Research is also conducted that supports the special requirements for battlefield visualization, tactical decision aids, weather intelligence products and capabilities to exploit space assets. Key operational technologies developed are demonstrated to Army units under program element 0603734A (Military Engineering Advanced Technology). Results are tailored to support the material development, test and acquisition community in evaluating the impacts of weather, terrain and atmospheric obscurants. Research develops and exploits a wide range of innovative technologies and applies them to Defense unique infrastructure planning, acquisition, revitalization, and sustainment processes. The goal of this research is to improve the efficiency and cost effectiveness of Defense infrastructure 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 element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on Civil Engineering and Battlespace Environments with oversight provided by the Joint Directors of Laboratories and Joint Engineers. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

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

DATE: March 1996

2 - Applied Research | **0602784A Military Engineering Technology** | PROJECT: **A855**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A855 Topography, Image Intelligence, and Space Technology	8986	7922	8556	8773	9605	10056	10315		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A855 - Topography, Image Intelligence and Space Technology:** This project funds the technology to enhance the tactical commander's ability to visualize the battlefield in an easily understandable, 3-D perspective and exploit his knowledge of combat relevant intelligence as a force multiplier to conduct and win Force XXI operations across the operational continuum. Using tactical/strategic/space sensor data, together with terrain data bases as input, the technology program emphasizes automating the processes of detecting changes on the battlefield, identifying battle significant features, exploiting space based/remote sensing information (especially for deep operations and over denied areas), and integrating the impacts of the battlefield environment to significantly improve combat planning and operations. Development efforts will enable the commander to locate and position enemy and friendly forces in day/night all-weather conditions, provide crucial terrain data for command and control systems (C2) as well as modeling and simulation systems, and enhance the speed and accuracy of maneuver and weapon systems. The technology being developed will help those who move, shoot, and communicate on the battlefield to "fight smarter" through superior knowledge of the total battlefield terrain and environment. Work in this project will develop an effective architecture to reuse standard digital mapping software for assuring that digital topographic data can be processed correctly and consistently to increase system interoperability in Army and/or joint operations. Weather/atmospheric effects data is provided by Army Research Laboratory Project AH71 in this PE. This work is managed by the US Army Topographic Engineering Center, Alexandria, VA.

FY 1995 Accomplishments:

- 8986 -Developed automated regional environmental effects summary and demonstrated laboratory feasibility for identifying natural and man-made materials from spectral signature data.
- -Developed initial DoD standard dynamic environment and terrain capability for operating in a field environment using high resolution, geometrically correct 3-D scenes, and implemented automated elevation editing.
- -Developed an initial standard software architecture for digital terrain data import, datum transformation and coordinate conversions and display; and initiate procedures for preparing software for submission to the Army Software Reuse Center.
- -Developed prototype model of personal navigation and reporting capability.

Total 8986

FY 1996 Planned Program:

- 7895 -Develop and implement the automated environmental decision support system that portrays the battlespace environment to include automated data generation .
- -Develop an integrated virtual reality interface to the Synthetic Environment visualization system enabling soldiers to immerse in fog, haze, dust, clouds, smoke, flares, minefields, craters, and penetrable buildings.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology / PROJECT A855

FY 1996 Planned Program: (continued)

•		-Develop standardized basic software tools for data import , export, formatting and display, and populate Army Software Reuse library to increase system interoperability in Army/Joint operations.
•		-Develop and implement capabilities of identification of man-made materials from hyperspectral data and signature data bases.
•	27	-Revised economic assumption not available for execution.
Total	7922	

FY 1997 Planned Program:

•	8556	-Develop and implement computer-based identification of man-made materials from hyperspectral data and signature data bases.
•		-Develop rapid, dynamic, 3-D battlefield environment/terrain visualization capabilities in a virtual reality environment for tactical applications.
•		-Develop an effective architecture for assuring that digital terrain data can be directly imported and processed by standardized Mapping, Charting, and geodesy software to increase system(s) interoperability with Army/Joint operations.
•		-Develop enhanced classification and feature extraction accuracy based on optical and multispectral imagery .
Total	8556	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	8986	8142	8581
Appropriated Amount (FY 1995)	8986		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		8000	
Adjustments to FY 1996		-78	
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			-25
Current Budget Estimate Submit for FY 1997	8986	7922	8556

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

DATE: March 1996

2 - Applied Research | 0602784A Military Engineering Technology | PROJECT AH71

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH71 Atmospheric Investigations	5613	5270	6691	7067	7343	6940	7095		Continuing	Continuing

A. Mission Description and Justification **Project AH71 - Atmospheric Investigations:** This project realistically models atmospheric effects on target acquisition, mobility, lethality, and survivability to provide weather limitations for design and operation of smart weapons, improved war game realism and tactics and improved intelligence preparation of the battlefield. It develops weather decision aids for the commander applying advanced computer techniques; incorporates new technology in meteorological sensor design; develops data fusion techniques to horizontally integrate data from advanced weather sensors and non-weather sensors into decision aids to enhance combat power on the battlefield. This project supports Project Reliance theater data fusion and prediction, atmospheric effects assessment, and battlefield environmental effects sub-sub area joint programs. The work is managed by the Army Research Laboratory (ARL), Battlefield Environment Directorate, White Sands Missile Range, New Mexico.

FY 1995 Accomplishments:

•	3958	- Integrated realistic weather effects into advanced technology demonstrations and the Army Battle Labs models. - Developed and evaluated new versions of "best met" and "met partials" techniques for implementation of computer assisted artillery meteorology on the advanced field artillery system (AFAS) and other field artillery delivery systems. - Exploited meteorological satellite and atmospheric profiling technology in order to collect critical environmental data, and then executed Mobile Profiler radar design improvement.
•	1655	- Developed a tactical decision aid for displaying sound pressure levels in the two dimensional turbulent planetary boundary layer over flat terrain - Incorporated terrain and weather effects into operational chemical/biological hazards prediction model.
Total	5613	

FY 1996 Planned Program:

•	3370	- Develop the capability for the Integrated Weather Effects Decision Aid (IWEDA) to use Battlespace Forecast Model field output, and to operate on Army Common Hardware. - Exploit tactical geosynchronous meteorological satellite receiver technology to improve temporal resolution of battlefield/target area weather data. - Develop prototype mobile profiling system (MPS) in order to be more deployable; improve MPS satellite profiles; and perform cost benefit analysis of mesoscale model for artillery accuracy.
•	1844	- Develop user interface for 2-dimensional limited complex terrain acoustic propagation model and integrate into real time system architecture. - Integrate realistic hazard predictions from chemical-biological agent into war game models and visualization environment.
•	17	Revised economic assumption not available for execution.
•	39	- Has been decremented for Small Business Innovative Research.
Total	5270	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology / PROJECT AH71

FY 1997 Planned Program:

•	4638	- Complete the horizontal and seamless integration of the Integrated Weather Effects Decision Aid (IWEDA) into Battlefield Automated Systems (BASs). - Develop an initial capability to forecast precipitation over the battlefield and add 4D data assimilation and met satellite initialization capability to the Battlespace Forecast Model. - Develop a prototype 4D Computer Assisted Artillery Meteorology software system which provides trajectory and target area meteorology for close and deep attack systems; and develop a Proof-of-Concept downsized Mobile Profiling (MPS).
•	2053	- Develop user interface for 2-dimensional limited complex terrain acoustic propagation model. - Adapt direct numerical simulations for operational/DIS chemical/biological hazard modeling. - Enhance real time scene visualization data transformation and rendering algorithms to support the integration of battlefield environment data in situation awareness displays.
Total	6691	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5766	5416	5931
Appropriated Amount (FY 1995)	5766		
Adjustments to FY 1995	-153		
Appropriated Amount (FY 1996)		5322	
Adjustments to FY 1996		-52	
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			+760
Current Budget Estimate Submit	5613	5270	6691

Change Summary Explanation

Funding: FY97: Readjustment and alignment of projects to better meet Army requirements (+760).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology / PROJECT AT40

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AT40 Mobility & Weapons Effects Technology	11834	10520	11403	12643	13480	11980	12291		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u> **Project AT40 - Mobility and Weapons Effects Technology:** This project will provide warfighters the technologies for: rapid establishment and repair of lines of communications by both light and heavy engineers in support of US force deployment; optimal obstacle siting based on accurate predictions of enemy movement and the synergistic effects between obstacles and weapons systems; rapid obstacle and barrier creation; accurate assessments of battlefield mobility for maneuver commanders (and materiel developers during virtual prototyping); methodologies to predict coastal effects on logistics-over-the-shore (LOTS) operations; camouflage, concealment, and deception for fixed facilities to deny accurate acquisition and engagement by threat weapon systems; and designs, materials, and construction methods for battlefield, fixed, and forward base survivability against advanced conventional weapons and terrorist weapons. Civil engineering science and technology (S&T) in this project directly supports the Army's DoD Project Reliance S&T responsibilities in airfields and pavements, survivability and protective structures, and sustainment engineering. The work is managed by the US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

FY 1995 Accomplishments:

- 4976 - Developed a stochastic mobility model with capabilities to quantify reliability of predictions and measures of risk; developed algorithms describing torque/traction/soil motion resistance of maneuvering vehicles on deformable soil.
  - Developed and integrated indirect-fire/obstacle synergistic relationship algorithms and riverine analysis model into obstacle planning software and developed techniques or methodologies for rapid obstacle creation immediately following last use of terrain and lines of communications by friendly forces.
  - Constructed a theater infrastructure assessment model integrating convoy operation system assessment and logistics-over-the-shore models; provided real-time sea state forecast capability.
- 6858 - Evaluated effectiveness of new high-strength, high-ductility materials against hard target penetrators; upgraded designs and unprotected versus protected vulnerability evaluations for generic hardened facility subjected to direct hits and finalized design procedures for hardening windows and doors to bomb threats.
  - Developed methods for rapid stabilization of loose dry soils in arid regions to provide operating surfaces (paved and unpaved) for contingency military operations and established design criteria for use of modifiers in asphalt concrete to improve durability, reduce maintenance costs, and increase pavement life.
  - Determined protective measures that will increase the survivability of brigade and division command centers without interfering with mobility and operational requirements and established design criteria for chapter on camouflage, concealment, and deception to protect long dwell assets and publish in Army survivability manuals.

Total 11834

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology / PROJECT AT40

FY 1996 Planned Program:

•	5330	- Determine pressure/sinkage algorithms that account for soil's cyclic remolding produced by multiple vehicle passages; validate and document mobility data inference routines for the world's major climatic zones. - Conduct two-dimensional laboratory experiments of concepts for rapidly emplaced breakwaters; incorporate engineer workload determination and resource allocation in theater infrastructure planning and assessment model. - Perform subscale experiments of robust penetrators against layered targets; develop vulnerability analysis computer code for field evaluation and develop methodology and database for designing construction components to resist "very low" and "low" forced entry threat levels; develop analytical procedures for predicting component delay times to "medium" threat severity.
•	5154	- Conduct field evaluations of lightweight expedient surfacing for contingency operating surfaces and develop design and construction guidance for pavement joints and pavement smoothness; complete critical pavement durability parameter investigations. - Evaluate concepts for deployable protective field fortifications for light forces; determine applicability of existing terrorist threat countermeasures for deploying forces and provide fully dynamic 3-D environmental information base procedures for infrared (IR) signatures; develop CCD measures for Army aviation fixed/long-dwell facilities. - Develop precise techniques to predict the effects of localized, point-of-attack target damages on entire structures; conduct field experiments of assault breaching and obstacle creation technologies and develop and integrate knowledge-based decision making algorithms for obstacle placement into obstacle planning software (OPS).
•	36	Revised economic assumption not available for execution.
Total	10520	

FY 1997 Planned Program:

•	5932	- Complete development of first generation robust theoretical mobility model incorporating non-linear and hysteretic vehicle-terrain interaction; complete development of automated methods to rapidly derive, from standard available data, world-wide high-resolution mobility model input data. - Conduct 3-D lab-scale experiments of rapidly emplaced breakwater concepts for logistics-over-the-shore operations. - Develop design criteria for complex layered antipenetration systems to defeat large penetrating munitions and develop methodology and database for designing construction components to resist "high" forced entry threat levels.
•	5471	- Demonstrate advanced materials for construction of operating surfaces on soft soils; provide guidance for design, placement, and procurement of materials for soft soil stabilization for integration into TM 5-430-00-2 and synthesize theoretical equations, laboratory experiment results, and field data into a preliminary interactive analytical pavement response and performance model. - Complete protective concepts for US Army aircraft parked in forward battle areas, criteria and guidance for the protection of deploying forces from sabotage attack, and concepts for protective shelters packages for light forces and conduct fixed/long-dwell facility decoys experiments; analyze sprayable radar absorbing material coatings with visual and thermal camouflage properties. - Develop analytic techniques and software suitable for soldier use to predict demolitions effects on reinforced concrete and rock structural targets and evaluate integrated obstacle planning software (OPS) algorithms during full-scale field training exercise.
Total	11403	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology — PROJECT AT40

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	11834	10812	11436
Appropriated Amount (FY 1995)	11834		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		10623	
Adjustment to FY 1996		-103	
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			-33
Current Budget Estimate Submit	11834	10520	11403

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology / PROJECT AT41

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AT41 Military Facilities Engineering Technology	4947	4332	4285	4756	5780	6070	6220		Continuing	Continuing

A. **Mission Description and Budget Item Justification:** This project exploits innovative developments in a wide range of technologies to achieve critically needed cost reductions in Army facility life cycle processes (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal). Current Army infrastructure operations, maintenance, and repair costs alone are about $8.5 billion per year. The goal for the DOD Technology Area Plan is to reduce facility acquisition and maintenance and repair costs 15% by FY 2001 from a 1985 baseline. Meeting this critical goal is not possible without application of significant technology innovation. Products already developed and projected for the future have high civilian sector dual use potential. These include innovations in composite materials, concurrent engineering, collaborative decision support, corrosion resistant coatings, seismic vulnerability evaluations, and knowledge processing. Additionally, significant soldier retention benefits also accrue from providing professional work environments and high quality communities for military families. Under the DOD Project Reliance initiative, the Army is responsible for managing the conventional facilities research and development needs of all the military services through the Construction Engineering Research Laboratories, Champaign, Illinois.

FY 1995 Accomplishments:

•	2990	- Established capability to support design quality via computer aided design (CAD) standards verification. - Tested retrofitted complex concrete and masonry systems and developed seismic strengthening techniques for Army facilities. - Field tested super polymer scale/corrosion resistant condensate pipe coatings and robotic crawler corrosion assessment system.
•	1957	- Established strategy for integrating state-of-the-art documentation management capabilities for installation management workers. - Established condition indices and prediction models for an engineered management system for buildings.
Total	4947	

FY 1996 Planned Program:

•	3421	- Develop building engineered management system to provide holistic decision support for building maintenance and repair. - Evaluate smart roofing systems and construction materials recycling for design, repair and revitalization of Army facilities. - Develop concurrent engineering environment for facility design and construction to improve life cycle decision making.
•	897	- Test pre-cast concrete wall connectors for seismic retrofit. - Provide collaborative performance support environment for knowledge workers to improve installation management.
•	14	Revised economic assumption not available for execution.
Total	4332	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology / PROJECT AT41

FY 1997 Planned Program:

•	3464	- Integrate installation commander's facility maintenance management systems for optimal resource allocation with special emphasis on automated inspection procedures. - Demonstrate concurrently engineered facility delivery process that facilitates multiple discipline interaction. - Develop criteria for recycling construction and demolition materials.
•	821	- Create seismic protection technique for non-structural building components. - Develop conductive concrete for electromagnetic shielding applications for secure facilities.
Total	4285	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4947	4453	4298
Appropriated Amount (FY 1995)	4947		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		4375	
Adjustments to FY 1996		-43	
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			-13
Current Budget Estimate Submit	4947	4332	4285

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology — PROJECT AT42

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AT42 Cold Regions Engineering Technology	5455	4168	4541	4739	4804	5438	5570		Continuing	Continuing

A. <u>Mission Description and Justification:</u> **Project AT42 - Cold Regions Engineering Technology.** This project is the only DoD exploratory development program focused on the knowledge base and engineering principles needed to sustain an effective war fighting force in winter and the cold regions of the world, including combat support, combat engineering and base/facility construction, operation and maintenance. Research directly lowers high life-cycle costs and extends the abbreviated service life of DoD facilities and provides the basis for extending the operability of forces and materiel in cold weather. Research supports readiness and effectiveness of DoD conventional, light and special operations forces in the Arctic, Alaska, Scandinavia, Korea, Japan, Europe, the US 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 US projection of power and operational capabilities in cold weather areas of the world. The work is managed by the Cold Regions Research and Engineering Laboratory, Hanover, NH.

FY 1995 Accomplishments:

•	5455	-Developed radar backscatter model for synthesis of winter background scenes and completed analysis for optimizing seismic/acoustic system performance applicable to smart weapons and mines.
•		-Developed advanced design concepts for light excavation equipment in frozen soil supporting lines of communications (LOC).
•		-Developed standards that permit the cost effective placement of concrete at temperatures down to -10 degrees C, mechanistic design and evaluation of pavements in cold regions, and design/construction criteria for "low temperature" heat distribution systems.
Total	5455	

FY 1996 Planned Program:

•	4154	-Validate millimeter-wave radar backscatter model, and demonstrate dynamic scene rendering for the Smart Weapons Operability Enhancement (SWOE) Science and Technology Objective (STO).
•		-Integrate deep snow model into the Comprehensive Army Mobility Model System (CAMMS); create cold weather effects data bases for Janus wargame analysis model.
•		-Develop prototype guidelines for long-lasting, low-maintenance coatings and application procedures for concrete, brick, and masonry buildings supporting military infrastructure repair, operation, and design cost reduction programs.
•	14	-Revised economic assumption not available for execution.
Total	4168	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology / PROJECT AT42

FY 1997 Planned Program:

- -Complete integrated mobility modeling for snow, thawing soil and surface icing conditions for engineer mission analysis.
- -Complete prototype radio frequency (RF) band environmental features signature model for simulation of advanced sensing systems.
- -Validate prototype materials for low-temperature repairs to concrete, brick, and masonry, and design guidance for use of recycled waste material in pavements supporting military infrastructure repair, operation, and design cost reduction programs.

Total 4541

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5455	4292	4554
Appropriated Amount (FY 1995)	5455		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		4209	
Adjustments to FY 1996		-41	
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			-13
Current Budget Estimate Submit	5455	4168	4541

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

DATE: March 1996

2 - Applied Research | 0602784A Military Engineering Technology | PROJECT AT42

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AT45 Energy Technology Applied to Military Facilities	2571	2048	2422	2546	2886	2887	2961		Continuing	Continuing

A. **Mission Description and Budget Item Justification** Energy is essential for the modern Army to meet its mission. The research conducted in this project provides the technology for providing energy efficient facilities, adapting new energy source technologies to military facilities, applying cost effective renewable energy technologies for Army uses, and improving the efficiency of Army central energy plants. Research focuses on leveraging industry technology investments and integrating a broad range of advanced technologies into a comprehensive system to meet the specialized needs of the Army utilities systems. Activities include modeling and simulation of thermal loops and electrical systems, developing new analytic techniques, and incorporating new system designs and hardware in conjunction with industry. Research products/systems are integrated in a "low energy" model installation program. Research products are transferred to the field and used in new construction and in upgrades of existing facilities. The Executive Order implementing the Energy Policy Act of 1992 requires the Army to reduce energy consumption 20% by 2001 from the 1985 baseline. The work is managed by the Construction Engineering Research Laboratories, Champaign, Illinois.

FY 1995 Accomplishments:

•	1621	- Incorporated collaborative methods into existing concurrent engineering software for energy efficient facilities.
		- Developed central energy plant operations management system and advanced gas distribution system.
		- Developed indoor air quality detection and diagnostics model.
•	950	- Established methods for electric/motor drive analysis and selection for retrofits to Army facilities.
		- Developed chlorofluorcarbons (CFC)conservation techniques for existing Army air conditioning equipment.
Total	2571	

FY 1996 Planned Program:

•	2041	-Develop computer assisted training modules for achieving energy efficient facilities.
•		-Apply energy efficient commercial/off-the-shelf (COTS) lighting technologies to Army facilities.
•		-Develop refined cost-benefit model for prioritization of energy conservation alternatives applicable for DoD facilities.
•		-Develop energy usage-workforce productivity relationship model.
•	7	-Revised economic assumption not available for execution.
Total	2048	

FY 1997 Planned Program:

•	2422	Provide DOE a repository of designs for standard military facilities.
•		Develop methods for adopting fuel cell technology in Army energy plants.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602784A Military Engineering Technology — PROJECT AT42

FY 1997 Planned Program: (continued)

- Develop advanced digital control for heating, ventilation, air-conditioning (HVAC) to improve accuracy, reduce energy costs, and improve indoor air quality.
- Complete application guidelines for emerging natural gas based cooling systems.

Total 2422

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2571	2105	2429
Appropriated Amount (FY 1995)	2571		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		2068	
Adjustments to FY 1996		-20	
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			-7
Current Budget Estimate Submit	2571	2048	2422

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602785A Manpower/Personnel/Training Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	9761	7298	9528	10674	11898	11365	11284		Continuing	Continuing
A790 Personnel Systems and Performance Technology	3009	2582	3107	3224	3704	3704	3800		Continuing	Continuing
A791 Education and Training Technology	6752	4716	6421	7450	8194	7661	7484		Continuing	Continuing

Mission Description and Budget Item Justification: The objective of this program element (PE) is to provide a scientifically-sound basis for maximizing soldier and unit performance through empirical research, the results of which lead to cost-effective training strategies for synthetic training environments, optimum simulator designs to achieve maximum learning at minimum cost, enhanced battle command performance, and improved selection and classification of soldiers to maintain the Army's warfighting edge. The majority of the research conducted in this PE transitions to manpower, personnel, and training advanced development work in PE 0603007A. Work in this PE is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. These projects include non-system specific development efforts pointed toward specific military needs and are therefore appropriate to Budget Activity 2. This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Alexandria, VA

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602785A Manpower/Personnel/Training Technology — PROJECT A790

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A790 Personnel Systems and Performance Technology	3009	2582	3107	3224	3704	3704	3800		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project A790 - Personnel Systems and Performance Technology:** The objectives of this project are to provide the scientific basis for improved methods for leader assessment and development, enhanced selection and classification procedures to ensure the right person is placed in the right job, improved organizational design to enhance warfighting decision making, and methods for determining effective utilization of soldiers with minimal entry qualifications. This project will also develop methods for effective organizational design and leadership. Research under this project supports the manpower and personnel Defense technology area.

FY 1995 Accomplishments:

•	1888	- Developed new measures of performance-related aptitude, leadership, and stress tolerance.
•		- Developed leader development model for testing linkages among problem-solving capabilities, leadership style, and rated effectiveness.
•		- Developed new approaches for teaching selected cognitive skills important for battle command.
•		- Conducted a broad-range investigation of the selection, training, integration, and development of reserve volunteers for peacekeeping missions in the Sinai.
•		- Identified salient dimensions of operations other than war (OOTW) related to career development.
•	1121	- Developed new selection techniques for enlists with low mental aptitude scores.
Total	3009	

FY 1996 Planned Program:

•	2573	- Validate new measures of performance-related aptitude, leadership, and stress tolerance.
•		- Model the development of commander knowledge and skills.
•		- Develop methods for measuring the leadership knowledge acquired through operational experience.
•		- Identify economic, family support and career commitment factors that influence a reservist's decision to volunteer for operations other than war.
•	9	- Revised economic assumption not available for execution.
Total	2582	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602785A Manpower/Personnel/Training Technology — PROJECT A790

FY 1997 Planned Program:

- 1709 - Develop structural models of impact of peacekeeping operations on career development and commitment.
- - Complete development of new measures of aptitude related to enlisted leader performance requirements.
- - Design techniques for developing and training decision making skills.
- - Develop new measures for assessing leadership potential in officer candidates.
- 1398 Identify preliminary set of leader attributes needed in 2010 and beyond.

Total 3107

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3119	2653	3116
Appropriated Amount (FY 1995)	3054		
Adjustments to FY 1995	-45		
Appropriated Amount (FY 1996)		2607	
Adjustments to FY 1996		-25	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-9
Current President's Budget Submit for FY 1997	3009	2582	3107

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602785A Manpower/Personnel/Training Technology — PROJECT A791

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A791 Education and Training Technology	6752	4716	6421	7450	8194	7661	7484		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project A791 - Education and Training Technology: The objectives of this project are to provide the behavioral technologies required for the development of effective individual and collective (unit) training strategies using simulation-based synthetic environments. Research conducted in this project builds on recent advances in the cognitive sciences and will provide an empirical basis for improved collective (unit) training strategies and techniques for brigade and below, with focus on the digitized battlefield of the future. It will develop training methods to improve night operations, individual training strategies exploiting "virtual reality" technology for training and rehearsal of warfighting missions and stability operations, "intelligent tutor" technology for foreign language training, and determination of task-based fidelity requirements for cost-effective simulator training on selected aviation tasks. Research under this project directly supports the training systems Defense technology area.

FY 1995 Accomplishments:

•	2755	- Validated field expedient methods for maximizing soldier visual acuity at night.
•		- Demonstrated a portable, computer-based foreign language tutor prototype.
•		- Developed model for predicting amount of training needed to retrain mobilized soldiers.
•		- Developed prototype training methods to facilitate team training and the acquisition of collective skills in a distributed interactive simulation environment.
•		- Empirically determined the content requirements of flight simulator scenes for critical aviation tasks.
•		- Demonstrated multi-service training methods in a DIS environment.
•	3997	- Determined performance and training requirements for future digitized forces.
Total	6752	

FY 1996 Planned Program:

•	2808	- Design and test methodology for developing brigade and multi-service training and assessment programs.
•		- Determine display resolution requirements for flight simulator-based task training.
•		- Extract training lessons learned from Mounted Battlespace Battle Lab's "Focused Dispatch" Advanced Warfighting Experiment.
•		- Develop experimental training techniques to improve thermal target acquisition skills.
•		- Demonstrate and assess capability to conduct team training in virtual reality environments.
•	1892	- Extend skill retraining model to complex MOS tasks, e.g., Intelligence.
•	16	- Revised economic assumption not available for execution.
Total	4716	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602785A Manpower/Personnel/Training Technology — PROJECT A791

FY 1997 Planned Program:

•	5016	- Determine fidelity required for command and control in networked aviation training systems.
•		- Develop training and performance evaluation techniques to support Force XXI digital capabilities.
•		- Develop prototype simulation-based immersive training techniques for dismounted combatants.
•		- Develop training techniques for using infrared sensing devices to enhance performance in night operations.
•	1405	- Demonstrate technologies to improve the effectiveness and efficiency of Individual Ready Reserve (IRR) at mobilization.
Total	6421	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	6912	4847	6939
Appropriated Amount (FY 1995)	6912		
Adjustments to FY 1995	-160		
Appropriated Amount (FY 1996)		4762	
Adjustments to FY 1996		-46	
Adjustments to Budget Year (FY 1997) since FY 1996 Presidents Budget			-518
Current President's Budget Submit	6752	4716	6421

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Logistics Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	33204	27260	17808	19297	20662	20989	21617		Continuing	Continuing
AH20 Mobility Equipment Technology	9637	7004	0	0	0	0	0		0	23994
AC60 TRACTOR ZINC	0	0	2277	2027	2066	2151	949		0	9470
AH98 Clothing & Equipment Technology	11471	12273	9464	9920	10635	10716	12354		Continuing	Continuing
AH99 Joint Services Food/System Technology	4851	5263	4402	5444	5810	5975	6121		Continuing	Continuing
DJ10 Combat Rations Quality Enhancement	2527	1228	0	0	0	0	0		0	7780
D283 Airdrop Advanced Technology	1936	1492	1665	1906	2151	2147	2193		Continuing	Continuing
A427 Tactical Shelters	2782	0	0	0	0	0	0		0	5364

Mission Description and Budget Item Justification: Unusual demands will be placed on the soldier and Army logistics systems by future hardware. In order to achieve the logistics efficiency and responsiveness that will be required, there must be associated technology developments evolving in logistics equipment, supplies, and systems to make them smaller, lighter, more reliable and durable, more survivable, less manpower intensive, affordable, and more mobile. Technology efforts on clothing and equipment and on field shelters provide enhanced individual soldier protection from both combat threats and from the natural field environment. The Joint Services Food/System Technology program supports all the military services, the Special Operations Command, and the Defense Logistics Agency with research and development of advanced military food products, packaging, and combat food service equipment. The Combat Ration Quality Enhancement project will establish quality quantification parameters and criteria to minimize physical, chemical, and nutritional degradation of combat rations, thus maintaining/enhancing acceptance and consumption by the military community. Similarly, work on advanced airdrop technology supports all Services' requirements for dropping larger combat and logistics loads while improving delivery accuracy, minimizing vulnerability of aircraft and reducing life cycle costs. This is a critical capability for rapid force projection, particularly into hostile environments. Moving personnel and equipment in support of the ground Army is the focus of investigation into mobility equipment technology. This includes renewed emphasis on landmine detection and neutralization, counter-surveillance, improved warehousing and supply distribution, and low-signature, high efficiency mobile electric power sources. 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 food, as well as fuels and lubricants with oversight and coordination provided by the Joint Directors of Laboratories. There is no unwarranted duplication of effort among the military departments. Efforts are coordinated with those in PE 0603001A (Logistics Advanced Technology). The program is managed primarily by the U.S. Army Natick Research, Development and Engineering Center, Natick, MA. The Night Vision and Electronic

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Logistics Technology

Sensors Directorate of the Communications-Electronics Command manages the Mobility Equipment Technology project within the PE . Research in this program element includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2.

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Logistics Technology

PROJECT: AH20

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH20 Mobility Equipment Technology	9637	7004	0	0	0	0	0		0	23994

A. **Mission Description and Budget Item Justification:** **Project AH20 - Mobility Equipment Technology** - This exploratory development program addresses the need for advanced combat support and combat service support equipment and material. The project is directed toward providing the technology to solve deficiencies in the Army mission areas of engineer-mine warfare and combat service support. It includes efforts in low-cost signature reduction, counter-surveillance, deception, survivability, countermine, logistic supply and support, materials, mobile electric power, environmental control, and corrosion. Fuels and lubricants technology work conducted under Project AH20 in prior years was transferred to PE/Project 0602601A/AH91 beginning in FY 1996. Beginning in FY 1997 the work for this project is a zero sum restructure to PE/Project 0602712A/AH24 and 0602705A/AH11.

FY 1995 Accomplishments:

- 7966 - Tested/evaluated ability of reduced signature appliqués for rapid force projection vehicles to deny enemy surveillance of friendly activities.
  - Built and tested detector arrays for the Vehicle Mounted Mine Detector test bed and transitioned to advanced development at completion of test.
  - Tested and evaluated performance of smart mine emulator and counter-measure techniques; transitioned emulator to support off-route smart mine clearance advanced development.
  - Evaluated the combination of a forward looking detector (microwave or infrared) with a directed energy or explosive projectile to create a mine-hunter killer.
- 1671 - Initiated fuel cell program for "Soldier Individual Power" by awarding contracts and implementing program plans.
  - Tested/evaluated performance of commercial engines modified to operate on JP-8 fuel and novel 100, 300, and 1000 Watt permanent magnet.
  - Evaluated capability of novel polymer and inside skin hollow fiber membrane to desalinate and remove nuclear, biological, chemical (NBC) contaminants.
  - Completed full-scale powertrain performance evaluations with candidate environmentally compliant combat engine oil using kerosene and distillate fuels.

Total 9637

FY 1996 Planned Program:

- 6107 - Develop multisensor deception materials and collect field data to validate representation of low observables in target acquisition/wargame simulations
  - Evaluate imaging infrared (IR) and frequency agile radar for mine detection on mobile combat vehicle testbed; develop preliminary design of directed energy neutralization system.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Logistics Technology
	PROJECT AH20

FY 1996 Planned Program: (continued)

		- Conduct castforem simulations to develop scenarios for countermine demonstration; select software architecture and insertion points for integrating mine/countermine functions in distributed interactive simulation (DIS) environment.
•	873	- Demonstrate fuel cell power sources at 50W and 150W levels; test and evaluate fuel cells. - Initiate fabrication and testing of portable, JP-8 fuel burning 1.5kW engine driven generator set comprised of novel permanent and advanced fuel injection hardware.
•	24	- Revised economic assumption not available for execution.
Total	7004	

FY 1997 Planned Program: Work restructured to PE/Project 0602712/AH24 and 0602705A/AH11

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	9457	7203	7397
Appropriated Amount (FY 1995)	9457		
Adjustment to FY 1995	+180		
Appropriated Amount (FY 1996)		7073	
Adjustment to FY 1996		-69	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-7397
Current President's Budget Submit	9637	7004	0

Change Summary Explanation:

Funding: FY 1997: Work restructured to PE/Projects 0602712A/AH24 and 0602705A/AH11.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602786A Logistics Technology — PROJECT: AH98

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH98 Clothing & Equipment Technology	11471	12273	9464	9920	10635	10716	12354		Continuing	Continuing

A. **Mission Description and Budget Item Justification:** **Project AH98 - Clothing and Equipment Technology** - This exploratory development improves soldier survivability and performance through significantly improved materials and new technology applications for combat clothing and personal equipment. Areas of emphasis include material development to improve: ballistic, chemical/biological, flame, nuclear thermal, and directed energy protection; enhanced countersurveillance/camouflage; microclimate conditioning; materials/concepts for protection in arctic/desert environments; and improvements to lighten the soldier's load. Human factors research and simulation and modeling tools applicable to the soldier system are used to quantify soldier performance and determine optimal Research and Development (R&D) alternatives. Beginning in FY 1997, technology on selectively permeable membranes for chemical protection is restructured to a DoD PE as part of the consolidated Defense Nuclear, Biological, and Chemical program.

FY 1995 Accomplishments:

- 5630 - Improved performance (10-25% weight reduction) of currently available textile-based materials (through construction modifications) for use in soft and composite armor sytems for fragmentation protective vests and helmets.
  - Selectively solubilized recombinant silk from silk proteins, a key step in spinning fibers for advanced ballistic protection.
  - Evaluated signature reducing materials for combat clothing and equipment.
  - Developed dielectric stack laser eye protection technology, increasing visual transmission by 78% over existing dye technology and extended protection to include areas between 694 and 1064 nanometers; demonstrated feasibility of using nonlinear materials for passive broadband protection against tunable lasers.
- 5841 - Optimized performance of selectively permeable membrane for use in lightweight (20% less than standard overgarment) chemical protective clothing to allow higher rates of water vapor transmission with reduced chemical agent penetration for Joint Service Lightweight Integrated Suit Technology (JSLIST) and Land Warrior; optimized permeable chemical protective materials with increased durability and flame resistance for JSLIST II and Land Warrior.
  - Developed first generation soldier-on-the-battlefield simulation for virtual prototyping of soldier protective systems to reduce system costs and risks; applied the first generation Distributed Interactive Simulation (DIS) certified soldier system model to develop system performance and survivability data for use in Army combat models to support 21st Century Land Warrior (21 CLW) analysis; initiated parametric analysis of proposed 21 CLW component and system designs to support optimization of soldier performance and survival.
  - Evaluated a novel fiber with superior flame resistance for insulation applications; transitioned materials with integrated protection to Joint Service Lightweight Integrated Suit Technology program; finalized material system for electrically heated handwear.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Logistics Technology
	PROJECT AH98

FY 1995 Accomplishments: (continued)

- Established design parameters based on physical and human user tests of commercial and military footwear systems for development of a biomechanically improved combat boot which will reduce injuries; developed biomechanically-efficient packframe comprised of plastic molded material; developed and demonstrated a high-efficiency 1.75 lb compressor-motor for microclimate cooling systems.

Total 11471

FY 1996 Planned Program:

- 6601 - Conduct optimization of components for multiple ballistic threat protection (fragments and small arms) to reduce weight and bulk while increasing performance of body armor for soldiers and police; determine viability of flexible ballistic protective materials system for small arms protection through analytical and experimental analysis.
  - Develop first generation silk protein-based high performance fibers for genetically engineered ballistic materials.
  - Optimize and scale-up thermal signature reducing materials for personal camouflage.
  - Insert combined dye technology (for 532 nm) and broadband (694 through 1064 nm) dieletric technology into polycarbonate protective eyewear.
- 5630 - Integrate optimized, selectively permeable membranes and flame resistant permeable fabrics into lightweight (20% less than standard overgarment), highly moisture vapor permeable textile systems for chemical protection for JSLIST II and Land Warrior.
  - Investigate feasibility of new carbonaceous fiber into existing nylon-cotton protective uniform fabrics to impart durable flame resistance; demonstrate electrically heated handwear with an optimized design of the controller/liner; define the protective technology requirements for flame and thermal battlefield threats.
  - Complete parametric analysis of proposed 21 CLW component and module designs to support optimization of soldier performance and survival; provide modeling, simulation, and analysis support to clothing and textile development to quantify and maximize the viability/capability of proposed systems; provide critical soldier performance data for Integrated Unit Simulation System (IUSS) model; provide a first generation individual soldier simulation to support virtual simulation for 21 CLW.
  - Evaluate optimal designs for biomechanically efficient prototype footwear and develop protocol for military field testing; apply motion analysis techniques to assess soldier-clothing/equipment interface; validate 3D whole-body laser scanning methodology; develop prototype lightweight, modular microclimate cooling system..
  - Fabricate and demonstrate full scale Large Area Night Maintenance Shelter using airbeam technology for the structural members.
- 42 - Revised economic assumption not available for execution

Total 12273

FY 1997 Planned Program:

- 5610 - Conduct integration of optimized small arms protective technologies and fragmentation protective technologies leading to a 20-30% total weight reduction and evaluate against multiple ballistic threats.
  - Evaluate ballistic properties of high-performance genetically engineered silk; produce prototype bioengineered ceramic materials for ballistic protection.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Logistics Technology
	PROJECT AH98

FY 1997 Planned Program: (continued)

- Incorporate thermal signature reducing materials into combat clothing and equipment.
- Improve nonlinear materials and develop methods for incorporating them into ballistic protective substrate for broadband protection against tunable lasers in the remaining vulnerable portions of the visible spectrum.

• 3854 - Establish DoD-wide flame/thermal hazard assessment scale, standardized flame/thermal protocol and material property data base; construct and test potential laser protective fabrics.
- Provide modeling, simulation and analysis to support the design of the 21 CLW Integrated Technology Program (ITP) field demonstration; develop initial suite of modeling, simulation and analytic tools around integrated ballistics, heat stress and ground mobility to support systems performance and survivability assessments of emerging Land Warrior systems.
- Incorporate optimized flame resistant permeable textile systems into lightweight (20% less than standard overgarment) garments and evaluate for durability and reduced physiological burden for JSLIST II and Land Warrior.
- Conduct field investigation of soldier performance in combat-related activities to validate lab findings on the soldier-clothing/equipment interface; perform lab-based biomechanical evaluations on prototype footwear and conduct small scale military field test to obtain user feedback and verification of evaluations on footwear characteristics; demonstrate a battery operated microclimate cooling system weighing less than 10 pounds.

Total 9464

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	11966	12615	12886
Appropriated Amount (FY1995)	11928		
Adjustment to FY 1995	-457		
Appropriated Amount (FY1996)		12394	
Adjustment to FY 1996		-121	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-3422
Current President's Budget Submit	11471	12273	9464

Change Summary Explaination:
Funding: Significant FY1997changes include: Restructure of funding within this PE (-1345); reprogramming of funds for higher priority requirements(-1277); and restructure to DoD PE 0602384BP as part of the consolidated Defense Nuclear, Biological, and Chemical program (-800).

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Logistics Technology

PROJECT: AH99

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
AH99 Joint Services Food/System Technology	4851	5263	4402	5444	5810	5975	6121		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project AH99- Joint Service Food/System Technology** - This DoD program addresses food and food system technologies to support all military Services, Special Operations Command, and the Defense Logistics Agency. Thrust areas include the exploratory development of combat rations, packaging, field food service equipment and combat food service systems, all of which enhance the survivability, sustainability, and supportability of the Armed Forces by ensuring optimal nutritional intake to maximize cognitive and physical performance on the battlefield.

FY 1995 Accomplishments:

- 3190 - Completed laboratory testing of rapid analyses for determining microbiological parameters of temperature stressed fresh/frozen rations; conducted demonstration of Self Heating Group Ration components; completed laboratory evaluations of four new mobility enhancing ration components; continued investigation of commercial irradiated food products using combination processes; awarded contract for investigations of renewability, utilization, cost and consumer acceptability of marine products for operational rations.
  - Improved stability in starch and protein based foods; proved feasibility of intrinsic chemical marker/microbiological validation of ohmic heating; investigated glass coated materials as primary packaging material for field rations; completed studies to identify parameters for improving shelf stable, high heat rations.
  - Investigated natural food constituents from complex carbohydrates, chain triglycerides, caffeine, phosphatidyl choline and other natural micronutrients to promote significant positive enhancements to mental acuity and physical endurance; incorporated components into consumer acceptable ration items for use in limited field evaluations.
- 1661 - Conceptualized and analyzed feasibility of producing a flexible, horizontal form-fill-seal tray, similar to commercially produced, that could be adaptable for self-heating rations; investigated spray-on coated barriers for food packaging; fabricated prototype food package which actively absorbs oxygen to extend storage life.
  - Initiated experimental development of Nonflammable Ration Heater; developed and tested catalytic vaporizers for nonpowered field burners; initiated development of nonpowered heat driven adsorption refrigeration based on ammoniated complex compounds.
  - Conducted trade-off/cost analyses for technology insertions for the Mobile Kitchen Trailer; initiated development of Thermoelectric Generator for Field Burners; investigated equipment aspects of food packaging waste reduction; completed and transitioned to Navy an improved system for shipboard food service equipment management.

Total 4851

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Logistics Technology
	PROJECT AH99

FY 1996 Planned Program:

•	1570	- Evaluate the use of post-coatings for primary and secondary food packaging materials to determine feasibility to increase use of Commercial Off The Shelf (COTS) items in operational rations; conduct accelerated and long-term storage, sensory and microbiology testing on food products packaged in oxygen absorbent packaging; evaluate feasibility of prototype field waste management equipment. - Conduct small scale field testing of new mobility enhancing ration components; conduct field evaluation on performance/utility and acceptability of Institutional Sized Pouch for use in Unitized Group Ration; continue to investigate technologies (e.g., high dose sterilization, pasteurization) which allow the safe incorporation of chilled items (i.e., fresh poultry, fruit, luncheon meats) into operational rations; complete analytical database to assess operational rations for performance-enhancing nutrients.
•	2126	- Complete laboratory and storage studies for improved high heat, shelf stable ration; complete sensory acceptability studies of novel processed marine products; continue analysis of preservation technologies for destruction of microorganisms in marine products; complete field trials of microbial and chemical test kits to assess sanitation in food processing, assuring ration quality and reducing risk of food borne illness. - Complete selection of constituents and identify acceptable formulation for ration components which ensure enhanced performance under different combat situations; conduct field testing of components to quantify performance enhancement under varied tactical conditions. - Identify and optimize complex carbohydrate components which meet energy requirements during periods of high performance; conduct limited, accelerated technical tests and user studies to evaluate ability to modulate metabolic release over time and in various temperature scenarios. Identify key process parameters for optimizing innovative thermal processing of rations (i.e., ohmic heating and microwave sterilization) to support the incorporation of "fresh-like" components into operational rations; evaluate emerging microbial issues for safety assessment of temperature abused food to maintain safe/wholesome food supply.
•	1502	- Complete performance testing and conduct field evaluation of anhydride and hydrogen suppression-based Nonflammable Ration Heaters and transition technology to fielded individual ration improvement program; complete experimental development of catalytic-vaporizing burners; design, fabricate and evaluate experimental heat-driven and non-electric refrigeration systems. - Design, fabricate, test and evaluate prototype thermoelectric generator/cooktop and transition technology to Powered Multifuel Burner program as power source; investigate new food service equipment technologies (e.g., multifunctional, energy efficient, modular equipment) to reduce cost and improve reliability of present and future shipboard galleys.
•	26	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	39	- Revised economic assumption not available for execution
Total	5263	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Logistics Technology
	PROJECT AH99

FY 1997 Planned Program:

- 1632 - Conduct performance tests for continued ration quality on post coated primary and/or secondary food containers of commercially available food items which will improve acceptability; develop processing parameters for microwave sterilized meals; conduct storage and sensory tests of ration components packaged in oxygen absorbent materials; investigate application of Horizontal Form Fill Seal (HFFS) technology for packaging shelf-stable loaf bread, deli-sandwiches or muffins).
  - Conduct large scale field evaluation of consumer acceptable rations with effective components demonstrating performance enhancement to identify potential components for technology insertion into fielded rations; select/incorporate neurotransmitter percursors in ration components or as supplements for anti-stress.
- 1605 - Transition new formulations and processing techniques for highly stabilized rations to fielded rations, in order to maintain initial ration quality over storage life; fabricate prototype remote ration quality monitoring system for real-time prediction and assessment of shelf-life of rations/food, particularly at elevated temperatures.
  - Identify a system to monitor and adjust electrolytes used to supplement rations to assure maximum nutrient bioavailability; exploit capability to non-invasively measure physiological indices when evaluating nutrients for performance enhancements.
  - Continue to identify process parameters for optimizing innovative thermal processing of rations (i.e., ohmic heating and microwave sterilization) and novel hurdle systems to support the incorporation of "fresh-like" and intermediate moisture food components into operational rations.
- 1165 - Initiate investigation of an advanced fuel conversion process to reformulate diesel fuel into gases (including hydrogen) for operation of gas fired appliances in a field kitchen.
  - Complete experimental developement of low output diesel burner to convert commercial adsorption refrigerator for military use.
  - Test and evaluate feasiblity and functionality of future shipboard galley concept incorporating new food service equipment technologies.

Total 4402

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	5202	5409	5567
Appropriated Amount (FY1995)	5093		
Adjustment to FY 1995	-242		
Appropriated Amount (FY1996)		5315	
Adjustment to FY 1996		-52	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-1165
Current President's Budget Submit	4851	5263	4402

Change Summary Explaination:
Funding: FY1997: Funds (-1165) reprogramed for higher priority requirements.

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Logistics Technology

PROJECT: DJ10

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DJ10 Combat Rations Quality Enhancement	2527	1228	0	0	0	0	0		0	7780

A. **Mission Description and Budget Item Justification:** **Project DJ10 - Combat Rations Quality Enhancement** - This project was initiated in FY92 at the request of Congress to establish a 5 year project to develop technologies for quantifying food quality in combat rations and other emergency feeding situations to enhance consumer acceptance. Parameters affecting food quality, including interrelationships among raw materials, processing, packaging, and storage, will be determined and analytical techniques for quantification will be developed. Innovative processing methods (ohmic heating and combination preservation processes) will be investigated. Optimal raw material processing techniques and packaging systems will be selected to minimize deteriorative changes in foods and maximize the deliverable quality of subsistence to the user community. It also involves the use of novel electric and magnetic field technologies to pasteurize chilled items; the efficacy and practicality of cold pasteurization will be explored. Work in this project will be completed in FY 1996.

FY 1995 Accomplishments:

•	626	- Identified specific antibodies against spores of thermophilic spoilage bacteria and demonstrated potential for rapid identification and quantification procedure based on immunomagnetic separation and DNA amplification. - Established liposome and microsome model systems for studying mechanisms of oxidation and their prevention in meats. - Developed analytical method for measuring and tracking the process of oxidation in dehydrated meats. - Awarded two BAA contracts to explore rapid/novel technologies of biosensors and elastography for predicting ration quality.
•	1901	- Initial experiment combining high pressure and irradiation processing resulted in a reduction of one-half of the irradiation dosage required to obtain a sterile chicken product. - Awarded research contracts to demonstrate and develop ration components produced by non-thermal high pressure and/or pulsed electric fields (work to be accomplished in FY96).
Total	2527	

FY 1996 Planned Program:

•	1197	- Complete identification and characterization of factors affecting ration quality and identify test methods for quantifying the quality of combat rations.
•	28	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	3	- Revised economic assumption not available for execution
Total	1228	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602786A Logistics Technology
	PROJECT: DJ10

FY 1997 Planned Program: Project completed.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2719	1263	0
Appropriated Amount (FY1995)	2662		
Adjustment to FY 1995	-135		
Appropriated Amount (FY1996)		1241	0
Adjustment to FY 1996		-13	0
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current President's Budget Submit	2527	1228	0

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Logistics Technology

PROJECT: D283

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D283 Airdrop Advanced Technology	1936	1492	1665	1906	2151	2147	2193		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project D283 - Airdrop Advanced Technology** - This project involves exploratory development to enhance personnel and cargo airdrop capabilities. These are key capabilities for force projection, particularly into hostile areas. Areas of emphasis include parachute technology for improved performance, precision offset aerial delivery, soft landing system development, airdrop simulation, and low altitude/high speed airdrop systems technologies. Efforts will result in increased personnel safety and reduced personnel, aircraft, and cargo vulnerability.

FY 1995 Accomplishments:

- 1283 - Completed full-scale parachute opening experiments on the effects of electrostatic charges on parachute opening in order to reduce the risk of airdrop system failure.
  - Completed an analysis on the performance and accuracy of the automatic ripcord release device to improve airdrop safety.
  - Evaluated concepts for soft landing parachute retraction and gas-injection airbags with potential for reduced jumper injuries and drop zone derigging time/vulnerability.
  - Completed feasibility testing of a new extraction/recovery parachute release system reducing the potential for aircraft damage and loadmaster injury.
- 653 - Constructed and completed full-scale test of a new parachute canopy based on a concept of block-like canopy design providing low altitude application to Operations Other Than War.
  - Analyzed and compared survivability of cargo delivered by Guided Precision Aerial Delivery Systems (GPADS) to that delivered by conventional airdrop systems.

Total 1936

FY 1996 Planned Program:

- 663 - Develop experimental methods for measuring parachute performance to validate parachute opening model and to provide reliable designs for low altitude airdrop systems.
  - Apply computational fluid dynamics, trajectory analysis, advanced concepts and improved experimental techniques to enhance low altitude parachute performance.
  - Continue testing and development of the new canopy for low altitude heavy equipment drop.
- 816 - Conduct experimental and theoretical analysis of the opening dynamics and aerodynamics of large gliding wing parafoils to deploy at higher altitudes and greater lateral distances to reduce aircraft vulnerability.
  - Complete virtual analysis of GPADS precision delivery system, assessing its warfighting benefit.
  - Continue experimentation on soft landing concepts of airbags and parachute retraction.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A Logistics Technology
	PROJECT D283

FY 1996 Planned Program: (continued)

- 8 - Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
- 5 - Revised economic assumption not available for execution.

Total 1492

FY 1997 Planned Program:

- 1030 - Complete experimental and theoretical analysis of the opening of large deployable gliding wings for use at higher altitudes and greater lateral distances to reduce aircraft vulnerability.
  - Conduct analysis and experiments on aerodynamics of gliding wings.
  - Develop 3-D computer model to analyze inflation of round canopy parachutes and ram-air gliding wings to minimize full-scale airdrop testing.
  - Continue full-scale testing of soft landing systems.
- 635 - Complete development of experimental methods for measuring parachute performance to validate parachute opening model and to provide reliable designs for high speed low altitude airdrop systems.
  - Using the results of computational fluid dynamics and trajectory analyses, determine characteristics/factors that will enhance low altitude parachute performance.
  - Identify parameters for developing a model of human performance/biomechanics to improve parachutist's safety.

Total 1665

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	1924	1546	1680
Appropriated Amount (FY1995)	1884		
Adjustment to FY 1995	+52		
Appropriated Amount (FY1996)		1506	
Adjustment to FY 1996		-14	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-15
Current President's Budget Submit	1936	1492	1665

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602786A Logistics Technology

PROJECT: A427

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A427 Tactical Shelters	2782	0	0	0	0	0	0		0	5364

A. **Mission Description and Budget Item Justification:** **Project A427 - Tactical Shelters-Exploratory Development** - This project addresses requirements for transportable maintenance tentage and soldier quality-of-life tentage technologies, both identified in Operation Desert Storm (ODS) as required improvements. Thrusts focus on tentage structures and lightweight materials for advanced pressure-stabilized rib tentage, and improved shelter habitability through ventilation modeling/advanced designs. Exploited technologies will significantly increase mobility through reduction of tentage weight and shelter erect/strike times, increase service life, enhance sustainability, and reduce operating and support (O&S) costs. Work in this project is completed with the FY1995 funding.

FY 1995 Accomplishments:

•	2782	- Conducted testing on the prototype full-scale inflatable airbeam. - Initiated fabrication of a shelter module demonstrating the airbeam technology. - Completed design details of the Large Area Night Maintenance Shelter. - Optimize airbeam technology fabrication techniques (Work to be performed in FY 1996).
Total	2782	

FY 1996 Planned Program: Project not funded

FY 1997 Planned Program: Project not funded

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2279	0	0
Appropriated Amount (FY1995)	2842		
Adjustment to FY 1995	-60		
Appropriated Amount (FY1996)		0	
Adjustment to FY 1996		0	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			0
Current President's Budget Submit	2782	0	0

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

DATE: March 1996

2 - Applied Research | **0602787A Medical Technology**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	91279	63539	55490	56775	59064	57968	58034		Continuing	Continuing
A825 Combat Maxillofacial Injury	816	1029	514	535	564	555	565		Continuing	Continuing
A863 Battlefield Surgical Tissue Replacement	4524	0	0	0	0	0	0		0	4524
A864 Epidermolysis Bullosa	899	0	0	0	0	0	0		0	899
A870 DoD Medical Defense Against Infectious Diseases	24352	25190	24643	25752	26749	26247	25670		Continuing	Continuing
A871 Medical Biological Defense-Exploratory Development	13941	0	0	0	0	0	0		Continuing	Continuing
D873 HIV Exploratory Research	2941	2801	2931	3054	3235	3213	3272		Continuing	Continuing
A874 Combat Casualty Care Technology	11812	11916	11415	10444	10607	10383	10595		Continuing	Continuing
A875 Medical Chemical Defense-Exploratory Development	14619	0	0	0	0	0	0		Continuing	Continuing
A878 Health Hazards of Military Materiel	7661	6984	7294	7745	8227	8121	8274		Continuing	Continuing
A879 Medical Factors Enhancing Soldier Effectiveness	9714	9901	8693	9245	9682	9449	9658		Continuing	Continuing
A898 Wound Healing	0	1946	0	0	0	0	0		0	1946
A899 Emergency Medical Teams	0	3772	0	0	0	0	0		0	3772

Mission Description and Budget Item Justification: This program element funds exploratory development in Department of Defense (DoD) medical defense against chemical agents, medical defense against biological threats, medical protection against naturally occurring diseases of military importance, and combat dentistry, as well as exploratory development for Department of Army care of combat casualties, health hazard assessment of military materiel, and medical factors enhancing soldier

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology

effectiveness. The primary goal of medical research and development is to sustain the medical technology superiority to improve the protection and survivability of U.S. forces on the conventional battlefields as well as in potential areas of low intensity conflict and military operations short of war. This program element is the core DoD technology base to develop methods and materials for: medical chemical defense in the areas of antidotes, drug treatments, medical protection against chemical agents, personnel and casualty decontamination, medical management of chemical casualties, and combat effectiveness and sustainability; medical biological defense and infectious disease prevention and treatment including vaccines, prophylactic and therapeutic drugs, insect repellents, and methods of diagnosis and identification of biological warfare threats or 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 Program Element is consistent with the resource constrained Army Science and Technology Master Plan, Army force modernization plans, and Project Reliance. This program is managed primarily by the US Army Medical Research and Materiel Command. Efforts in this Program Element include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

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

DATE: March 1996

2 - Applied Research | **0602787A Medical Technology** | PROJECT: **A825**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A825 Combat Maxillofacial Injury	816	1029	514	535	564	555	565		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project A825-Combat Maxillofacial Injury:** This project has as its major thrusts exploratory development of new/improved methods and material for rapid simplified treatment of face and neck wounds and provision of field dental treatment.

FY 1995 Accomplishments:

- 408 Continued data acquisition on clinical study comparing oral motor function of patients treated by surgical means with those treated by non-surgical means.
- 34 Identified factors potentially contributing to loss of efficacy of local anesthetics during storage in conditions typical of military deployments.
- 374 Demonstrated feasibility of micro-holographic pattern generation for use by robotic surgical assistant in medical inspection; incorporated improved video capabilities into surgical assistant test bed.

Total 816

FY 1996 Planned Program:

- 506 Complete clinical study comparing oral motor function of fracture patients treated by surgical means with those treated by non-surgical means.
- 43 Evaluate efficacy of sustained-action and receptor-selective analgesics in animal models.
- 454 Complete and deliver hyper-speed parallel video camera for incorporation into robotic surgical assistant test bed.
- 3 Revised economic assumption not available for execution.
- 23 SBIR/STTR

Total 1029

FY 1997 Planned Program:

- 50 Evaluate toxicity of novel analgesics.
- 464 Begin design of hyper-speed parallel computer interface to hyper-speed parallel camera for robotic surgical assistant test bed.

Total 514

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology

PROJECT A825

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	997	1058	529
Appropriated Amount (FY 1995)	985		
Adjustments to FY 1995	-169		
Appropriated Amount (FY 1996)		1040	
Adjustments to FY 1996		-11	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-15
Current Budget Estimate Submit For FY 1997	816	1029	514

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

DATE: March 1996

2 - Applied Research | **0602787A Medical Technology** | PROJECT: **A863**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A863 Battlefield Surgical Tissue Replacement	4524	0	0	0	0	0	0		0	4524

A. **Mission Description and Budget Item Justification:** **Project A863-Battlefield Surgical Tissue Replacement:** By Congressional direction, the purpose of this project is to initiate research on surgical tissue replacement.

FY 1995 Accomplishments:

•	4524	Award competitive contracts/grants to initiate research on surgical tissue replacement in accordance with established defense acquisition procedures. (to be accomplished in FY 96).
Total	4524	

FY 1996 Planned Program: Project not funded

FY 1997 Planned Program: Project not funded

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4933	0	0
Appropriated Value	4829		
Adjustments to Appropriated Value	-305		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	4524	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology / PROJECT A864

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A864 Epidermolysis Bullosa	899	0	0	0	0	0	0		0	899

A. Mission Description and Budget Item Justification: **Project A864-Epidermolysis Bullosa:** By Congressional direction, the purpose of this project is to initiate research on epidermolysis bullosa.

FY 1995 Accomplishments:

•	899	Award a competitive contract/grant to initiate research on epidermolysis bullosa in accordance with established defense acquisition procedures (to be accomplished in FY 96).
Total	899	

FY 1996 Planned Program: Project not funded

FY 1997 Planned Program: Project not funded

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	986	0	0
Appropriated Value	965		
Adjustments to Appropriated Value	-66		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	899	0	0

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

DATE: March 1996

2 - Applied Research | 0602787A Medical Technology | PROJECT A870

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A870 DoD Medical Defense Against Infectious Diseases	24352	25190	24643	25752	26749	26247	25670		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A870-DoD Medical Defense Against Infectious Disease:** This project supports development of medical countermeasures to naturally occurring infectious disease, 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 1995 Accomplishments:

- 5208 Conducted animal studies to evaluate vaccine induced mucosal immunity to shigella, enterotoxigenic E coli, and Campylobacter; determined cross protection of different hepatitis E strains in animals.
- 9013 Evaluated the safety and immunogenicity of a candidate malaria vaccine in primates; evaluated several dengue virus constructs for their ability to protect animals from lethal challenges.
- 2840 Evaluated drug resistance in field isolates of malaria & leishmania to characterize field sites; synthesized prodrugs and metabolites of drug candidates.
- 4178 Prepared naked DNA scrub typhus vaccine candidate and prepared field site; completed evaluation of repellents and leishmania skin test, and initiated studies of emerging diseases in OCONUS labs.
- 736 Constructed a capsule negative meningococcal vaccine strain; conducted animal model studies of sepsis; prepared a gonococcal native outer membrane complex as a vaccine candidate.
- 2377 Evaluated viral hemorrhagic fever vaccine candidates in animal models; evaluated candidate deployable diagnostic tests for malaria, dengue, and Campylobacter.

Total 24352

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology — PROJECT A870

FY 1996 Planned Program:

•	10846	Prepare malaria candidate vaccines and test them in animals; prepare and evaluate prophylactic/therapeutic drugs to address resistant parasites; evaluate insecticide barrier and repellent methods of protection from insect vectors.
•	6197	Construct and evaluate candidate vaccines against shigella, ETEC, Campylobacter and other enteric bacteria using novel methodology; conduct animal safety and immunogenicity studies of vaccines to prevent meningitis, gram negative sepsis, and gonorrhea.
•	7246	Prepare and evaluate killed and recombinant vaccine candidates for dengue and hemorrhagic fevers; evaluate deployable diagnostic tests; evaluate baculovirus expressed and vaccinia vectored hepatitis E vaccine candidates.
•	720	Evaluate recombinant rickettsial antigens; evaluate antibiotic resistance in clinical scrub typhus isolates.
•	84	Revised economic assumption not available for execution.
•	97	SBIR/STTR
Total	25190	

FY 1997 Planned Program:

•	4906	Complete safety and efficacy of Shigella flexneri vaccine candidates in animal models; determine whether there is natural immunity to hepatitis E following infection.
•	4027	Evaluate candidate malaria drug resistance modulators capable of reversing parasite resistance to standard antimalarial drugs to select candidate for transition to clinical trials.
•	5258	Evaluate gonorrhea vaccine candidates for safety and efficacy to select candidate for transition to clinical trials; evaluate in animal models safety and efficacy of combined vaccine against common bacteria causing septic shock in wound infections.
•	5366	Evaluate safety and efficacy of candidate blood stage and infective stage P. vivax malaria vaccines to select candidate for transition to clinical trials.
•	5086	Evaluate candidate dengue vaccines to select best technology for transition to advanced development; continue capability to identify and assess threat to deployed forces of high hazard viral diseases.
Total	24643	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	24763	24889	24768
Appropriated Amount (FY 1995)	24762		
Adjustments to FY 1995	-410		
Appropriated Amount (FY 1996)		25437	
Adjustments to FY 1996		-247	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-125
Current Budget Estimate Submit For FY 1997	24352	25190	24643

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

DATE: March 1996

2 - Applied Research | 0602787A Medical Technology | PROJECT A871

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A871 Medical Biological Defense-Exploratory Development	13941	0	0	0	0	0	0		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A871-Medical Biological Defense-Exploratory Development:** This project funds exploratory research on the development of vaccines and drugs to provide an effective medical defense against validated biological threat agents including bacteria, toxins, viruses and other agents of biological origin. By employing biotechnology, medical systems will be designed to rapidly identify, diagnose, prevent and treat disease due to exposure to biological threat agents.

FY 1995 Accomplishments:

- 2613 Characterized the role of specific genes that code for virulence in bacterial threat agents, identified those for anthrax bacillus.
- 993 Developed specific intervention strategies for threat agents; tested two promising peptides as second generation vaccine candidates for staphylococcus enterotoxin B.
- 9441 Screened numerous drugs and compounds for inhibition of toxicity of threat toxins such as ricin using an in vitro system.
- 894 Evaluated sensitive and specific biosensor designs for confirmatory diagnosis of BW agent present in clinical specimens.

Total 13941

FY 1996 Planned Program: Project moved to DoD PE 0602384BP, Project number 871.

FY 1997 Planned Program: Project moved to DoD PE 0602384BP, Project number TB2.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	14454	0	0
Appropriated Value	14261		
Adjustments to Appropriated Value	-320		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	13941	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology / PROJECT D873

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D873 HIV Exploratory Research	2941	2801	2931	3054	3235	3213	3272		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project A873-HIV Exploratory Research:** This project provides for exploratory development of improved diagnostics, epidemiology, candidate immunogens, promising drugs and behavioral modification for prevention and treatment of 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 OCONUS deployment. A safe and effective vaccine for prevention of infection and intervention techniques will permit all service members to become worldwide deployable.

FY 1995 Accomplishments:

•	194	Characterized Thailand as a field site for testing vaccines for the prevention of HIV-1.
•	962	Determined the immune response to a conformational envelope HIV antigen formulated with structural stabilizers in animals.
•	644	Characterized 3-deaza-adenosine analog chemotherapeutic agents against HIV in vitro.
•	529	Studied alternate bacterial and viral vaccine delivery systems to enhance cell mediated immunity to antigens of HIV.
•	612	Characterized clinical isolates to identify new vaccine candidates from global variants of HIV and to devise promising new vaccine constructs.
Total	2941	

FY 1996 Planned Program:

•	936	Conduct vaccination/challenge studies of HIV candidate vaccines and bacterial and viral delivery system in non-human primates.
•	474	Improve vaccine candidate diversification to increase coverage of global variants of HIV.
•	237	Develop a preventive vaccine product (DNA vaccine) from information derived from studies of worldwide variability of the HIV genome.
•	474	Evaluate mucosal immunity induction (proteosome, microspheres) to enhance cell mediated immunity to HIV.
•	610	Conduct assay for humoral and cellular correlates of immunity, diagnostic immunotyping across HIV-1 isolates.
•	8	Revised economic assumption not available for execution.
•	62	SBIR/STTR
Total	2801	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology / PROJECT D873

FY 1997 Planned Program:

•	485	Conduct vaccination/challenge studies of HIV candidate vaccines and bacterial and viral delivery systems in an animal model.
•	485	Determine correlates of immunity and identify less virulent strains of HIV to assist in vaccine construction.
•	485	Evaluate live attenuated HIV-1 for clinical development potential.
•	1476	Improve vaccine candidate diversification to increase coverage of global variants.
Total	2931	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3102	2879	3019
Appropriated Amount (FY 1995)	3037		
Adjustments to FY 1995	-96		
Appropriated Amount (FY 1996)		2829	
Adjustments to FY 1996		-28	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-88
Current Budget Estimate Submit For FY 1997	2941	2801	2931

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology — PROJECT A874

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A874 Combat Casualty Care Technology	11812	11916	11415	10444	10607	10383	10595		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A874-Combat Casualty Care Technology:** 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 blood substitutes and blood preservation.

FY 1995 Accomplishments:

•	2066	Produced purified hemoglobin and chemically modified hemoglobins for evaluation as blood substitutes; identified basic mechanisms of toxicity induced by model blood substitute compounds, including effects on vasoactive mediators and platelet aggregation.
•	4808	Demonstrated complete *in vitro* protection by heat-induced heat shock protein on subsequent thermal or hypoxic injury.
•	446	Completed advanced prototype of Life Support for Trauma and Transport (LSTAT) enclosure and design of servo-controlled resuscitation pump for far forward use.
•	4492	Evaluated techniques and materials for burn wound management to include topical agents, hormones, and skin substitutes.
Total	11812	

FY 1996 Planned Program:

•	1195	Continue production of purified and chemically modified hemoglobins and characterize their physiological effects in animal models.
•	820	Determine the efficacy and safety of red cells stored for eight weeks in standard refrigeration; prepare for transition to advanced development; identify optimal fibrin sealant formulations for hemorrhage control; explore methods for lyophilized storage of platelets.
•	3613	Define requirements for oxygen administration to hemorrhaging individuals in an animal model; characterize physiological effects of moderate hypothermia and heat shock protein induction as protective measures against hemorrhagic shock and organ failure.
•	795	Demonstrate in vivo neuroprotective efficacy of lead candidate dextromethorphan and carbetapentane analogs in rodent models to justify advanced clinical development.
•	405	Determine the efficacy of immune therapy (antibodies to lipopolysaccharide) in the treatment of septic shock, using appropriate animal models.
•	463	Complete prototype resuscitation pump and bench testing; evaluate feasibility of servo-controlled resuscitation in large animal models.
•	4389	Explore clinical efficacy and safety of countermeasures to burn and inhalation injury, including skin grafting materials, synthetic pulmonary surfactants, and antimicrobial agents.
•	35	Revised economic assumption not available for execution.
•	201	SBIR/STTR
Total	11916	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology — PROJECT A874

FY 1997 Planned Program:

•	190	Identify best approaches for lyophilized platelet storage and prepare for transition to advanced development.
•	1659	Characterize efficacy of potential countermeasures for hemoglobin toxicity.
•	3700	Evaluate methods of hypothermia induction for protection against shock; determine effects of hibernation vs. hypothermia on cell metabolism and analyze risks vs. benefits; explore pharmacological inducers of heat shock proteins.
•	788	Characterize biochemical and pharmacological mechanisms of traumatic brain injury and define effects of potential countermeasures; define in vivo neuroprotective efficacy of lead candidate dextromethorphan and carbetapentane analogs in large animal models to justify advanced clinical development.
•	540	Conduct evaluations of candidate biodegradable bone screw materials in sheep osteotomy model.
•	238	Evaluate efficacy of microencapsulated anesthetic and analgesic compounds in animal models.
•	202	Develop interfaces and controllers to link medical sensors to monitoring systems (Soldier Individual Computer or other dedicated system).
•	4098	Evaluate use of silver-nylon fabric as an antimicrobial wound dressing.
Total	11415	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	11978	12249	11670
Appropriated Amount (FY 1995)	11871		
Adjustments to FY 1995	-59		
Appropriated Amount (FY 1996)		12035	
Adjustments to FY 1996		-119	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-255
Current Budget Estimate Submit For FY 1997	11812	11916	11415

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

DATE: March 1996

2 - Applied Research | 0602787A Medical Technology | PROJECT A875

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A875 Medical Chemical Defense-Exploratory Development	14619	0	0	0	0	0	0		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A875-Medical Chemical Defense-Exploratory Development:** This project funds medical chemical defense exploratory development, and emphasizes the prevention of chemical casualties through application of pharmaceuticals for prevention and treatment of the toxic effects of nerve, blister, respiratory, and blood agents. This project supports exploratory development of prophylaxes, pretreatment, antidotes, decontaminants, and therapeutic compounds that will counteract the lethal, physical, and behavioral toxicity of chemical agents. It also supports development of medical chemical defense material that insures adequate patient care, field resuscitation, and patient procedures.

FY 1995 Accomplishments:

•	1447	Demonstrated that in HEK an increase in intracellular free Ca ion and an activation of DNA repair enzyme legase 1 occurred after HD exposure.
•	1678	Quantified changes in protein levels as a function of HD damage. These protein changes could not be blocked by serine protease inhibitors.
•	1367	Developed multiple fluorescent probe assay to examine changes in cellular physiology following HD exposure.
•	2867	Developed validated EEG model for screening candidate pharmaceuticals to suppress NAS.
•	1619	Developed a physiological based pharmacokinetic model describing steroisomers of soman.
•	1737	Synthesized hydrophobic affinity resins for purification of stoichiometric scavengers of nerve agents.
•	2538	Expressed recombinant human CaE in three cell lines and esterified C-terminal signal tetrapeptide for CaE retention.
•	1366	Amplified light and heavy chains of monoclonal antibody with potential for catalytic activity to nerve agent.
Total	14619	

FY 1996 Planned Program: Project moved to DoD PE 0602384BP, Project number 872.

FY 1997 Planned Program: Project moved to DoD PE 0602384BP, Project number TC2.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	14985	0	0
Appropriated Value	14881		
Adjustments to Appropriated Value	-262		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	14619	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology — PROJECT A878

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A878 Health Hazards of Military Materiel	7661	6984	7294	7745	8227	8121	8274		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project A878-Health Hazards of Military Materiel:** 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: steady-state acoustical energy, repeated impact jolt and vibration stress from operation of combat vehicles and aircraft; blast over pressure and impulse noise generated by firing weapons systems; toxic chemical hazards associated with Army materiel such as gun and rocket munitions and their combustion byproducts; non-ionizing radiation directed energy sources (laser and microwave); and environmental stressors (e.g. heat, cold, terrestrial altitude). Specific medical research tasks include characterizing the extent of exposure to potential hazards; delineating exposure thresholds for illness or injury; identifying exposure thresholds for performance degradation; establishing biomedical databases to support protection criteria; and developing and validating models for hazard assessment, injury prediction, and health and performance protection.

FY 1995 Accomplishments:

•	650	Characterized health hazards of prototype electo-optic displays.
•	3726	Validated and refined a computer model (INJURY 3.7) to predict Blast Over pressure Injury.
•	96	Identified biomedical and mission factors increasing the risk of thermal injury and performance decrements.
•	2296	Determined the mechanism underlying wavelength dependent interactions for laser-induced retinal alteration in near IR (700-900 NM) region.
•	893	Completed animal reproductive and neurobehavioral studies on liquid gun propellant.
Total	7661	

FY 1996 Planned Program:

•	721	Determine guidelines to minimize eye-strain with extended use of vision enhancement devices.
•	1206	Publish field guide to prevent environmental injury in hot, wet, tropical environments.
•	1400	Develop safe exposure criteria for frequency agile lasers.
•	1230	Characterize health risks from combustion products of new artillery system.
•	2251	Determine validated tolerance limits for shoulder-fired anti-armor weapons fired from enclosures.
•	20	Revised economic assumption not available for execution.
•	156	SBIR/STTR
Total	6984	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology — PROJECT A878

FY 1997 Planned Program:

•	919	Develop chemoprophylaxis to prevent spatial disorientation.
•	153	Demonstrate effectiveness of individual soldier medical monitoring system in preventing heat and cold injury.
•	1787	Characterize the health hazards of electromagnetic pulse from prototype electro-magnetic weapon systems.
•	1569	Characterize effects of likely concurrent exposure to multiple chemicals from Army systems.
•	2866	Develop recommended safe exposure criteria for repeated impulse noise in reverberant enclosures.
Total	7294	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	7986	7181	7509
Appropriated Amount (FY 1995)	7861		
Adjustments to FY 1995	-200		
Appropriated Amount (FY 1996)		7055	
Adjustments to FY 1996		-71	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-215
Current Budget Estimate Submit For FY 1997	7661	6984	7294

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE March 1996
2 - Applied Research	0602787A Medical Technology	PROJECT A879

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A879 Medical Factors Enhancing Soldier Effectiveness	9714	9901	8693	9245	9682	9449	9658		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A879-Medical Factors Enhancing Soldier Effectiveness:** This project focuses on sustaining warfighting capability by preventing health and performance degradation in the military environment. 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: steady-state acoustical energy, repeated impact jolt and vibration stress from operation of combat vehicles and aircraft; blast over pressure and impulse noise generated by firing weapons systems; toxic chemical hazards associated with Army materiel such as gun and rocket munitions and their combustion byproducts; non-ionizing radiation directed energy sources (laser and microwave); and environmental stressors (e.g. heat, cold, terrestrial altitude). Specific medical research tasks include characterizing performance decrements produced by environmental stressors; developing strategies to overcome these decrements, including training, nutrition, and pharmacological solutions; delineating exposure thresholds for illness or injury; identifying exposure thresholds for performance degradation; establishing biomedical databases to support sustainment criteria; and developing and validating models for hazard assessment, injury prediction, and health and performance protection.

FY 1995 Accomplishments:

•	2795	Demonstrated the rapid reversal of triazolam- and zolpidem-induced sedation with flumazenil in humans.
•	3730	Created databases on psychiatric risks, stresses, and health consequences for soldiers deployed to Operations Other Than War.
•	3189	Provided a prediction model for effectiveness of microclimate cooling systems for the 21st Century Land Warrior Program.
Total	9714	

FY 1996 Planned Program:

•	6062	Identify biomedical and mission factors affecting work and performance at high terrestrial altitudes.
•	3707	Demonstrate behavioral and materiel means to reduce musculoskeletal injuries during military operations.
•	32	Revised economic assumption not available for execution.
•	100	SBIR/STTR
Total	9901	

FY 1997 Planned Program:

•	6181	Determine the physiological limits to performance of key soldier occupational tasks.
•	2512	Demonstrate behavioral and pharmacological strategies to enhance thermoregulation in hot and cold environments.
Total	8693	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology — PROJECT A879

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	9879	8402	8796
Appropriated Amount (FY 1995)	9846		
Adjustments to FY 1995	-132		
Appropriated Amount (FY 1996)		9999	
Adjustments to FY 1996		-98	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-103
Current Budget Estimate Submit For FY 1997	9714	9901	8693

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602787A Medical Technology / PROJECT A898

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A898 Wound Healing	0	1946	0	0	0	0	0		0	1946

A. Mission Description and Budget Item Justification: **Project A898 Wound Healing:** By Congressional direction, the purpose of this project is to develop initial research models for advanced methods of promoting wound healing.

FY 1995 Accomplishments: Project not funded.

FY 1996 Planned Program:

- 1897 Award competitive contracts/grants to initiate research on wound healing.
- 6 Revised economic assumption not available for execution.
- 43 SBIR/STTR

Total 1946

FY 1997 Planned Program: Project not funded

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget	0	0	0
Appropriated Amount (FY 1995)	0		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		1965	
Adjustments to FY 1996		-19	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Submit/President's Budget	0	1946	0

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

DATE: March 1996

2 - Applied Research | **0602787A Medical Technology** | PROJECT: **A899**

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A899 Emergency Medical Teams	0	3772	0	0	0	0	0		0	3772

A. Mission Description and Budget Item Justification: Project A899: By Congressional direction, the purpose of this project is to develop initial research models for emergency medical teams.

FY 1995 Accomplishments: Project not funded

Y 1996 Planned Program:

•	3673	Award competitive contracts/grants to initiate research on emergency medical teams.
•	15	Revised Economic Assumption not available for execution.
•	84	SBIR/STTR
Total	3772	

FY 1997 Planned Program: Project not funded

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget	0	3878	0
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		3810	
Adjustments to FY 1996		-38	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Submit/President's Budget	0	3772	0

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

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602789A Army Artificial Intelligence Technology

PROJECT: A880

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A880 Army Artificial Intelligence Technology	2233	2107	2226	2645	3317	3344	3317		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project A880 - Army Artificial Intelligence Technology** The goal of the Artificial Intelligence (AI) exploratory development program is to mature AI technology for future insertion into Army applications to achieve the strategic advantage needed to perform the Army's world-wide mission. The threefold purpose of the program is to: (1) develop/apply AI technology to solve large scale, highly complex management problems; (2) investigate AI technology for use Army-wide (policy, personnel training and management, and applications development); and (3) transfer technology to the Army through exploratory development efforts. In addition, the program seeks to identify high potential, but embryonic AI methodologies and mature them for high payoff applications through targeted technology demonstration projects and the development of working models. This program has established a number of sophisticated AI cells (knowledge engineering groups (KEGs)) focusing on the integration and application of AI technologies to problems in functional communities such as command and control, management, force integration, logistics, modeling, intelligence, resource management, test and evaluation, training, and medical. Focus for this science and technology effort is assisted through these functionally oriented cells. In addition, an office of AI research, analysis and evaluation has been established at the United States Military Academy to conduct AI applications research and development. The AI exploratory research program has established a solid foundation that will enable the Army to centrally manage and prevent duplication of effort in the Artificial Intelligence development arena. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Force XXI. This project includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. This program is overseen by the U.S. Army AI Program General Officer Steering Committee (GOSC) and is managed primarily by the US Army AI Center, Pentagon.

FY 1995 Accomplishments:

- 2233 - Applied AI technology to support the decision making process for command and control systems.
  - Integrated different technologies from multiple data bases by applying the use of AI technology to solve problems not easily solved by conventional programming.
  - Effectively demonstrated how AI technology can significantly improve systems within manufacturing and robotic domains.
  - Demonstrated the integration of hybrid systems for the testing and evaluation of AI systems.

Total 2233

FY 1996 Planned Program:

- 2054 - Demonstrate use of AI technology in integrating vastly different data and technologies to solve highly complex problems.
  - Demonstrate effectiveness of hybrid systems within manufacturing and robotics domains.
  - Investigate integration of hybrid systems within synthetic environments for command and control AI systems.
  - Demonstrate the integration of hybrid systems for the testing and evaluation of AI systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602789A Army Artificial Intelligence Technology
	PROJECT A880

FY 1996 Planned Program: (continued)

•	47	- SBIR/STTR
•	6	- Revised economic assumption not available for execution.
Total	2107	

FY 1997 Planned Program:

•	2226	- Demonstrate use of AI technology in integrating vastly different data and technologies to solve highly complex problems. - Demonstrate effectiveness of hybrid systems within manufacturing and robotics domains. - Investigate integration of hybrid systems within synthetic environments for command and control AI systems. - Demonstrate the integration of hybrid systems for the testing and evaluation of AI systems.
Total	2226	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2356	2166	2185
Appropriated Amount (FY 1995)	2307		
Adjustment to FY 1995	-74		
Appropriated Amount (FY 1996)		2128	
Adjustment to FY 1996		-21	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			41
Current President's Budget Submit	2233	2107	2226

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	16019	37654	23210	33741	37435	46727	29211		Continuing	Continuing
DC07 Joint Service Food Technology Demonstration	1784	1893	1891	1895	2003	2099	2142		Continuing	Continuing
DC44 Tactical Logistics	88	775	0	0	0	0	0		0	1280
DJ28 Test Measurement Technology Development	334	0	251	400	576	765	948		Continuing	Continuing
DJ50 Force XXI Soldier	0	29181	16277	6324	2410	7180	9033		Continuing	Continuing
DXXA Soldier Survivability	6478	0	0	0	4618	6559	7025		Continuing	Continuing
D242 Airdrop Equipment	1554	1272	1249	1247	1260	1911	3220		Continuing	Continuing
D393 Military Operations In Urban Terrain	0	0	0	20311	21199	21030	0		0	62540
D543 Ammunition Logistics	4129	3228	3097	3000	4697	6228	5707		Continuing	Continuing
D544 Cooperative Explosive Safety	796	969	0	0	0	0	0		0	2710
D594 Metrology and Calibration	856	336	445	564	672	955	1136		Continuing	Continuing

Mission Description and Budget Item Justification: This program supports demonstration of technology for the dismounted soldier and materiel essential to support and sustain wartime operations and peacetime readiness, both strategically and tactically. Its purpose is to develop, demonstrate, and transfer affordable technologies to reduce the logistics burden on the battlefield, reduce operation and support (O&S) costs, and improve logistics system performance. This work is necessary because logistics support has been unable to keep pace with weapons systems technology. It includes diverse projects linked by broad applications benefiting whole categories of weapons systems and providing high return on investment. Enhancements to airdrop equipment for rapid deployment are required for dropping cargo from higher altitudes, greater offset distances and at higher speed, increasing survivability of aircraft and crews and increasing the probability that materials delivered will land in a usable condition. The Ammunition Logistics project demonstrates technology that optimizes weapon system rearm, ammunition packaging/palletization, explosives safety, material handling equipment, ammunition throughput/management for improved asset availability and survivability. The Metrology and Calibration project is the only source which funds measurement science research and development within the Army and produces calibration equipment and capabilities essential for all major Army weapons systems and

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Logistics Advanced Technology

integrated digital battlefield communications. The Test Measurement Technology program develops diagnostics and prognostics technology to support a fix-forward capability. By embedding these technologies into weapons systems, maintenance time can be significantly reduced. The Joint Service Food Technology project demonstrates food service systems and food products, processing, preservation, and serving equipment resulting from technology programs jointly approved by the Services and the Defense Logistics Agency. The Tactical Logistics project demonstrates applications of technology for tactical electric power. Soldier Survivability and Force XXI Soldier, develop and demonstrate advanced technology components for insertion into the Land Warrior program and performs the integration of the 21st Century Land Warrior Program focused on improving soldier performance, lethality and survivability. The Cooperative Explosive Safety project is a three year effort resulting from a DoD/Nunn funded cooperative agreement between the United States and the Republic of Korea to mature new underground ammunition storage technologies, design concepts, and hazard area prediction models. Contractors performing the work for this PE include Martin-Marietta, Motorola, Rockwell International, Hughes, Author D. Little, Tecogen, Pioneer Aerospace, Giordano Automation, and InterVision. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. This program adheres to Tri-Service Reliance Agreements on clothing, textiles and food, explosive ordnance disposal, and fuels and lubricants with oversight and coordination provided by the Joint Directors of Laboratories. Work in this program element is related to and fully coordinated with efforts in PE 0602786A (Logistics Technology), Navy's integrated diagnostic support system, Missile Command Infrared (IR) scene generation, Advanced Research Project Agency (ARPA) millimeter/microwave integrated circuit (MMIC), and the Joint Services Calibration Coordination Committee. The Ammunition Logistics project is related to PE 0602624A (Weapons and Munitions Technology) and PE 0603004A (Weapons and Munitions Advanced Development). These efforts contain no unwarranted duplication of effort among the Military Departments. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Logistics Advanced Technology PROJECT DC07

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DC07 Joint Service Food Technology Demonstration	1784	1893	1891	1895	2003	2099	2142		Continuing	Continuing

A. <u>Mission Description and Justification:</u> **Project DC07 - Joint Service Food Technology Demonstrations** - Joint Service Food is a DoD program directed towards demonstrating nutritionally advanced rations and logistically streamlined food delivery systems to sustain DoD personnel in all operations and to enhance their combat performance under diverse battlefield scenarios. The project focuses on demonstrations of advances in food technology, materials, energy utilization, and combination heating technologies to provide extended, simplified field feeding without resupply. It exploits advances in ration formulation and quality, packaging, preservation, and nutritional content to improve morale, extend endurance, and sharpen mental acuity. This project is managed by the U.S. Army Natick Research, Development, and Engineering Center, Natick, MA.

FY 1995 Accomplishments:

•	1081	- Integrated advanced chemical heaters with packaged rations to increase heat transfer efficiency; conducted full scale tech demo of three prototype enhanced self-heating individual meals; continued technology insertion of promising food processing technologies; demonstrated self-heating capabilities for remote site feeding scenarios. - Conducted technical evaluation of prototype heat stable rations formulated to improve acceptability and consumption rates using field troops; quantified ration acceptability and consumption/nutrient intake to ensure nutritional adequacy in thermally abusive environments. - Transitioned to the Navy an automated food service system management tool that will allow modeling of the substitution of convenience foods for prepared from scratch products.
•	703	- Demonstrated producibility of biodegradable laminated cups, plates, and food packaging materials to enhance waste management and reduce disposal burden on ships and in the field. - Completed design and initiated fabrication of the Rapid Deployment Kitchen; prepared for technical demonstrations of thermal fluid heat transfer technology.
Total	1784	

FY 1996 Planned Program:

•	624	- Demonstrate promising technologies (including aseptic processing, horizontal form/fill/seal and high barrier polymeric tray) for potential technology insertion, to expand combat ration variety and improve acceptability and nutrient retention, improving producibility and reducing costs. - Demonstrate under realistic field conditions prototype high heat stable ration components; demonstrate the impact of nutrient content modifications and/or supplements to rations in hot weather feeding scenarios. - Initiate demonstration of the eat-on-the-move characteristics of Mobility Enhancing Ration improvements which exploit advanced in food processing technologies and in ration packaging.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Logistics Advanced Technology
	PROJECT DC07

FY 1996 Planned Program: (continued)

•	1222	- Complete fabrication and conduct technical demonstration of Rapid Deployment Kitchen utilizing an efficient integrated fluid based heat transfer system and transition to advanced development; demonstrate equipment components of a modular field food service system based on advances in a range of alternative heat transfer technologies to minimize fuel and maintenance/repair requirements. - Initiate design and fabrication of thermal powered washer for use in the Food Service Sanitation Center, reducing the field requirement for both fuel and water. - Define operational parameters and tailor PC-based logistics optimization software for Army Class I Logistics decision management tool to improve the efficiency of Class I logistics.
•	42	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	5	- Revised economic assumption not available for execution.
Total	1893	

FY 1997 Planned Program:

•	1022	- Complete demonstration of the Mobility Enhancing Ration Components, which incorporate advances in packaging technologies (i.e., horizontal form/fill/seal), increasing the operational capabilities of warfighters. - Demonstrate improved rations/consumption which will result in a 15-20 percent increase in nutrient bioavailability in high temperature environments. - Conduct human evaluations of selected performance enhancing nutrients and food components (i.e. carbohydrate electrolyte beverages, glycerol, caffeine, tyrosine) in preparation for FY98 technology demonstration of Performance Enhancing Ration Components (PERCs). - Demonstrate under field conditions, a shelf stable/fresh-like ration based on multiple barrier processing of marine products to expand the variety of ration meals.
•	869	- Conduct technical demonstrations of a 60K BTU/hour catalytic-vaporizing burner and a heat driven adsorption refrigerator; integrate heat-driven generator into thermal fluid heater of the Rapid Deployment Kitchen and conduct technical demonstration. - Conduct technical demonstration of a thermal powered washer for the Food Sanitation Center to enhance field sanitation; transition technology to advanced development. - Initiate development of PC-based Army Class I Logistics Optimization decision management model to improve the efficiency of Class I Logistics operations.
Total	1891	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Logistics Advanced Technology PROJECT DC07

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	1875	1946	2003
Appropriated Amount (FY 1995)	1835		
Adjustment to FY 1995	-51		
Appropriated Amount (FY 1996)		1912	
Adjustment to FY 1996		-19	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-112
Current Budget Estimate Submit	1784	1893	1891

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: DC44

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DC44 Tactical Logistics	88	775	0	0	0	0	0		0	1280

A. Mission Description and Justification: **Project DC44 - Tactical Logistics** - This project develops technology and materials to improve tactical electrical power availability for all DoD systems. Current efforts are directed to drastically lowering the size, weight, and number of engines, generators and auxiliary power units needed to power the battlefield. Programs specifically supported include Soldier Individual Power, the Joint Project Office for Unmanned Aerial Vehicles, and Special Operations Forces programs. This project was managed by the U.S. Army Communications-Electronics Command, Ft. Monmouth, NJ.

FY 1995 Accomplishments:

•	88	- Completed demonstration for Soldier Individual Power program.
Total	88	

FY 1996 Planned Program:

•	755	- Complete fuel cell power development for the dismounted soldier.
•	17	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	3	- Revised economic assumption not available for execution.
Total	775	

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	389	796	697
Appropriated Amount (FY 1995)	381		
Adjustment to FY 1995	-293		
Appropriated Amount (FY 1996)		782	
Adjustment to FY 1996		-7	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-697
Current Budget Estimate Submit	88	775	0

Change Summary Explanation: Funding: FY97 Funds reprogrammed to higher priority requirement.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: DJ28

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DJ28 Test Measurement Technology Development	334	0	251	400	576	765	948		Continuing	Continuing

A. <u>Mission Description and Justification:</u> **Project DJ28 - Test Measurement Technology Development** - This program develops diagnostics and prognostics technology to allow weapon systems to anticipate failure or, when failure occurs, self diagnose by means of embedded diagnostics. Embedded diagnostics make possible multicapable maintainers, allowing a reduction in the number of Military Occupational Specialties (MOS) and training times; it also supports the concept of "fix forward" for the purpose of reducing the levels of maintenance. As part of the Louisiana Maneuvers, older systems will be maintained by a wearable, hands-free, intelligent maintenance aid now under development. This technology is currently being applied to the Crusader/Future Armored Resupply Vehicle (FARV), PALADIN, Rapid Prototyping of Application Specific Signal Processors (RASSP), and the Advanced Threat Radar Jammer systems. This project is managed by the U.S. Army Test, Measurement, and Diagnostic Equipment Activity, Redstone Arsenal, AL.

FY 1995 Accomplishments:

•	334	- Developed Test Program Set (TPS) Reuse Library as a means of controlling escalating costs associated with TPS developments. - Conducted research/modeling to optimize the calibration interval of Army test equipment.
Total	334	

FY 1996 Planned Program: Project not funded

FY 1997 Planned Program:

•	251	- Develop plan for remote analysis of embedded diagnostics of Crusader for one-hour mean time to repair. - Complete and demonstrate development of TPS Reuse Library. - Demonstrate open-architecture, diagnostics-driven, electronic maintenance system for elimination of current paper/electronic manuals.
Total	251	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Logistics Advanced Technology PROJECT DJ28

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	341	0	259
Appropriated Amount (FY 1995)	334		
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		0	
Adjustment to FY 1996		0	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			8
Current Budget Estimate Submit	334	0	251

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: DJ50

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DJ50 Force XXI Soldier	0	29181	16277	6324	2410	7180	9033		Continuing	Continuing

A. <u>Mission Description and Justification:</u> **Project DJ50 - Force XXI Soldier** - This project was created as the result of FY 1996 Congressional direction to consolidate the Generation II Soldier and the Land Warrior Program and addresses the critical Army need to enhance the performance, lethality, survivability, and sustainment of the individual soldier. The principle component is the 21st Century Land Warrior (21CLW) project which includes the Land Warrior (LW) science and technology (S&T) program. The LW S&T efforts will focus on technology insertions to the LW backbone, while at the same time perform risk reduction tasks aimed at providing appropriate technologies to the LW program which will enhance the LW system or provide improved capabilities. An Early User Test (EUT) will be performed during FY98 with modified LW systems to assess the performance of the S&T components. These results will be utilized to further reduce the LW fielding risks and to insure that future LW procurements are upgraded with current technological advancements. Another 21CLW component which will form a part of this effort includes the Integrated Sight Module. Other emerging technical base components will also be considered as candidates for technology insertion onto the LW platform through these efforts. These components include combat identification, personnel status monitor, future infantry weapons, mine detection, chemical agent detector, and others. This program will leverage the commercial microelectronics and telecommunications industries to achieve lightweight, miniaturized components. The U.S. Marine Corps is an active participants in this program. In FY 1996, a significant portion of the total program funding will be used to perform work within Budget Activity 5 (Engineering Manufacturing Development (EMD)) in accordance with the FY 1996 Appropriations language which consolidated the funding for both the S&T and non-S&T into a single program and the Engineering Manufacturing Development (EMD) programs. Beginning in FY 1997, the EMD work is separated into the appropriate Budget Activity within PE 0604713A. This project is managed by the U.S. Army Natick Research, Development, and Engineering Center, Natick, MA.

FY 1995 Accomplishments: Work was previously performed in PE/Projects 0603001A/XXA, 0603710/DK70, and 0603772A/D101

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Logistics Advanced Technology
PROJECT DJ50	

FY 1996 Planned Program:

•	28448	- Complete Phase II (bread board components) of the Generation II Soldier ATD. - Perform risk reduction designs/virtual prototyping (e.g. helmet to reduce weight) and develop and build breadboard advanced components (e.g. radio packet relay) in support of the Land Warrior Program. - Procure prototype components of Helmet Mounted Display, Digital Radio, Voice Soldier Radio, and integrate for squad size Early Operational Experimentation (EOE) and conduct EOE for LW EMD Program. - LW EMD program management: scheduling, program controls, program documentation, and review of performance, cost and schedule; Review of LW EMD contractor's performance, to include system analysis, government configuration management, software verification, and logistics support. - Complete LW EMD system hardware/software design and integration; conduct contractor testing of components and technical reviews.
•	651	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992
•	82	- Revised economic assumption not available for execution.
Total	29181	

FY 1997 Planned Program:

•	16277	- Complete risk reduction designs/virtual prototyping in support of Land Warrior. - Develop and fabricate advanced technology components insertion into Land Warrior Systems in preparation for the Early User Test. - Procure long lead items for additional Land Warrior Systems to be used in evaluating advanced technology components. - Identify and initiate development of component enhancements based on the results Early Operational Experimentation.
Total	16277	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	0	0
Appropriated Amount (FY 1995)	0		
Adjustment to FY 1995	0		
Appropriated Amount (FY 1996)		29476	
Adjustment to FY 1996		-295	
Adjustments to Budget Year (FY 1997) since FY 1996			+16277
President's Budget			
Current Budget Estimate Submit	0	29181	16277

Change Summary Explanation:
Funding: FY 96/FY97 Program restructured in compliance with Congressional direction.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: DXXA

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DXXA Soldier Survivability	6478	0	0	0	4618	6559	7025		Continuing	Continuing

A. Mission Description and Justification: **Project DXXA - Soldier Survivability** - This project addresses the critical Army need to enhance the performance, lethality, survivability, and sustainment of the individual soldier. It includes the Generation II (GEN II) Soldier System Advanced Technology Demonstration, which is part of the 21st Century Land Warrior (21CLW) Program. The GEN II Soldier System will integrate several elements including advanced electronics, communications, sensors, individual equipment, weaponry, and hazard protection items, into a functioning, balanced, unified system demonstration. The GEN II Soldier System will demonstrate the enhanced soldier lethality and survivability achieved by linking the modernized and technologically advanced dismounted soldier directly to the battlefield via a digitized command and control network coupled with other specific enhancements (e.g. new weapon/fire control, small arms protection). This will be accomplished by the use of modular subsystems that will provide flexibility and variety in use, and will allow mission tailoring without the burden of wearing/carrying items unnecessary for the mission. The system will provide the flexibility to optimize the balance between soldier/equipment performance and individual protection in responding to varying threats and operational requirements. GEN II will leverage the commercial microelectronics and telecommunications industries to achieve lightweight, miniaturized components. The U.S. Marine Corps and the Special Operations Forces are active participants in this program. In accordance with the FY 1996 Appropriations Conference Report, this effort was consolidated with other funding into a single line in FY 1996 (within this PE to Project DJ50 - Force XXI Soldier). In FY 1997 and FY 1998 the funding in this project was restructured within this PE in a single Project, (DJ50, Force XXI Soldier) to meet the intent of Congress. This program is managed by the U.S. Army Natick Research, Development, and Engineering Center, Natick, MA.

FY 1995 Accomplishments:

- 6478 - Completed Concept Development; completed System Requirements Review; developed Initial Design Plan, developed Draft System Segment Specification, developed Interface Requirements Specification.
  - Evaluated preliminary design concepts; completed and published System/Design Trade Studies Report and Task Performance Analysis Report.
  - Initiated breadboard level designs and fabricated mock-ups of the critical components/system drivers.
  - Initiated Integrated Product and Process Development (IPPD) principles; created Integrated Product Teams, User System Engineering Requirements Panel, and 21CLW Program Integration Working Groups.

Total 6478

FY 1996 Planned Program: In accordance with Congressional direction, FY 1996 work will be performed within this PE in Project DJ50 - Force XXI Soldier.

FY 1997 Planned Program: In accordance with Congressional direction, FY 1996 work will be performed within this PE in Project DJ50 - Force XXI Soldier.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: DXXA

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	4721	4962	5238
Appropriated Amount (FY 1995)	4622		
Adjustment to FY 1995	+1856		
Appropriated Amount (FY 1996)		0	
Adjustment to FY 1996		0	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-5238
Current Budget Estimate Submit	6478	0	0

Change Summary Explanation:

Funding: FY97 Program restructured in compliance with Congressional direction.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: D242

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D242 Airdrop Equipment	1554	1272	1249	1247	1260	1911	3220		Continuing	Continuing

A. Mission Description and Justification: **Project D242 - Airdrop Equipment** - This project focuses on the demonstration and development of innovative techniques and equipment for aerial delivery of cargo, a key capability for rapid force projection, particularly into hostile areas. The goal is precision delivery of heavier payloads from extremely high altitude (up to 25,000 ft) and offset distance. Delivery from high altitudes and offset distance improves cargo/personnel and aircraft survivability. A major effort in FY 1996 is the Advanced Airdrop for the Land Combat advanced technology demonstration which includes offset delivery through the deployment of very large ram-air canopies with automated guidance and control of non-powered gliding decelerators and an automated soft landing capability. The conflict in Bosnia has focused attention on the need for air delivery systems that reduce the vulnerability of personnel and aircraft. This high priority effort will demonstrate precision delivery of 42,000 lb. of cargo (e.g., supplies and equipment) from altitudes of up to 25,000 ft. This project is managed by U.S. Army Natick Research, Development, and Engineering Center, Natick, MA.

FY 1995 Accomplishments:

•	1554	- Conducted instrumented airdrop tests of 42,000 pound capacity Guided Precision Aerial Delivery System - Heavy (GPADS - H). - Conducted testing of 42,000 lb. capacity prototype parafoil system integrated with autonomous Global Positioning System (GPS) Guidance, Navigation and Control (GN&C) to demonstrate precision delivery of load. - Designed and integrated soft landing capability into 15,000 lb. capacity autonomous prototype parafoil and conducted instrumented airdrop tests.
Total	1554	

FY 1996 Planned Program:

•	1240	- Continue testing of 15,000 pound capacity prototype parafoil system autonomous GPS GN&C and soft landing capability (GPADS - Medium). - Conduct Advanced Technology Demonstration (ATD) of complete 15,000 lb. capacity parafoil system. - Define concepts for High Glide Air Delivery (HGAD) system with 5000 lb. payload capacity (goal of 10,000 lbs.) and 6:1 glide ratio.
•	28	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	4	- Revised economic assumption not available for execution.
Total	1272	

FY 1997 Planned Program:

•	1249	- Fabricate High Glide Air Delivery system prototype using high glide wing technology. - Conduct initial technical evaluation of High Glide Air Delivery system.
Total	1249	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Logistics Advanced Technology PROJECT D242

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	1588	1307	1285
Appropriated Amount (FY 1995)	1554		
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		1285	
Adjustment to FY 1996		-13	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-36
Current Budget Estimate Submit	1554	1272	1249

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: D543

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D543 Ammunition Logistics	4129	3228	3097	3000	4697	6228	5707		Continuing	Continuing

A. <u>Mission Description and Justification:</u> **Project D543 - Ammunition Logistics** - This project develops technology that maximizes munitions availability and survivability for the force projection Army. It enhances logistics survivability and force readiness through improvements in explosive safety, materiel handling equipment, ammunition and missile packaging/palletization, and asset throughput/management. It also improves weapon system rearm for artillery, armor, air defense, aviation, and infantry. Emerging technologies and productivity enhancers/cost savers are exploited to provide quantum improvements to the force projection (strategic), in theater (operational), and combat focused (tactical) logistics systems. This project is managed by the U.S. Army Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ. Efforts will transition to weapons and munitions technology/development programs and the Total Distribution System.

FY 1995 Accomplishments:

•	1413	- Designed and fabricated simple transfer mechanism for 155mm Automated Howitzer rearm/resupply system. - Installed the automated Artillery Rearm Module (ARM) on a Heavy Expanded Mobility Tactical Truck (HEMTT) and conducted FASTLOAD demonstration of self-propelled howitzer rearm/resupply. - Completed engineering test and evaluation of Modular Aviation Rearm/Resupply System missile handling device for improved rearm of attack helicopters. - Completed design and miniaturization of a packaging environmental smart sensor for improved ammunition condition assessment.
•	2716	- Established common tri-service Ammunition Packaging Information Center on the Internet and selected concepts for prototype munitions packaging improvements. - Fabricated prototype Insensitive Munitions (IM) containers and conducted IM and hazard classification testing of ammunition packaging safety improvements. - Complete test, evaluation, and report on feasibility of 5.56mm rapid magazine loading system for firearms (Work to be completed in FY 1996). - Completed design and fabrication of an advanced fire extinguishing system for ammunition load plants and depots.
Total	4129	

FY 1996 Planned Program:

•	2019	- Demonstrate advanced munitions packaging technologies in the following areas: advanced materials, adhesives and bonding, vibration damping, cushioning, and "smart" sensors that monitor and record environmental data (temperature, humidity, pressure, shock,, corrosion) throughout the logistics cycle. - Demonstrate a fire extinguishing system for ammunition plants/depots that utilizes advanced fire detection sensor and suppression technology to reduce system response time by 75%.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology / PROJECT: D543

FY 1996 Planned Program: (continued)

		- Upgrade FASTLOAD (artillery rearm module on HEMMT) with digital interface to allow external transfer of inventory and requirements data.
•	1138	- Complete demonstration of prototype IM packaging and transition to item developers. - Develop concepts/investigate modeling and simulation in support of the Munitions Survivability program.
•	62	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	9	- Revised economic assumption not available for execution.
Total	3228	

FY 1997 Planned Program:

•	546	- Complete field demonstration of FASTLOAD resupply system for the lightweight 155mm Automated Howitzer rearm/resupply system. - Select concepts for improved handling and shipping of strategic configured munitions loads.
•	2551	- Complete engineering evaluation of hardware enhancements for emergency "in-stream" resupply of ammunition. - Complete preliminary design concept for ammunition shiploading software to support efficient load/offload. - Demonstrate highly mobile resupply and interactions of logistics in the Distributed Interactive Simulation environment. - Complete preliminary design of software, that will permit planning for mitigation of explosive events in temporary ammunition storage sites during the early stages of forced entry.
Total	3097	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	4294	218	3339
Appropriated Amount (FY 1995)	4226		
Adjustment to FY 1995	-97		
Appropriated Amount (FY 1996)		3260	
Adjustment to FY 1996		-32	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-242
Current Budget Estimate Submit	4129	3228	3097

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: D544

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D544 Cooperative Explosive Safety	796	969	0	0	0	0	0		0	2710

A. <u>Mission Description and Justification:</u> **Project D544 - Cooperative Explosive Safety-** This is a cooperative program with the Republic of Korea (ROK). Efforts are devoted to improving ammunition explosives safety through technology solutions. The effort focuses on the development, testing, and validation of new underground explosives storage techniques which will reduce explosives storage hazards with no reduction in security, operational readiness, or logistical support. Results of the effort are anticipated to produce approved underground storage designs and revised US explosives safety criteria and have the impact of increasing ammunition storage safety throughout the Department of Defense (DoD) ammunition storage complex. This program concludes in December 1996 as specified in the Joint U.S./ROK Memorandum of Agreement. No FY 1997 funds are programmed or required to complete the program. This project is managed by the U.S. Army Technical Center for Explosives Safety, Savanna, IL.

FY 1995 Accomplishments:

•	796	- Developed computer-based procedures for design and hazard prediction for underground magazines. - Completed the final design and construction of large-scale prototype underground magazine for validation testing.
Total	796	

FY 1996 Planned Program:

•	950	- Conduct validation test and evaluate test data. - Integrate test data and logistics considerations into operational full-scale underground facility concept. - Develop and complete technical designs and data packages of full-scale facilities for underground ammunition storage.
•	16	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	3	- Revised economic assumption not available for execution.
Total	969	

FY 1997 Planned Program: Project not funded.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology / PROJECT: D544

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	818	995	0
Appropriated Amount (FY 1995)	801		
Adjustment to FY 1995	-5		
Appropriated Amount (FY 1996)		978	
Adjustment to FY 1996		-9	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			0
Current Budget Estimate Submit	796	969	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603001A Logistics Advanced Technology

PROJECT: D594

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D594 Metrology and Calibration	856	336	445	564	672	955	1136		Continuing	Continuing

A. Mission Description and Justification: **Project D594 - Metrology and Calibration** - This project provides Army weapon systems and technology developers with cost effective, time saving, legally mandated, traceable calibration equipment for microwave, electro-optics, mechanical, and electronic systems. New, high-technology weapons systems cannot be developed, tested, or maintained without matching calibration systems. This is a Joint Logistics Commanders program, closely coordinated with the Navy and Air Force, which directly supports Army research, development, and engineering centers (RDECs), test ranges, and proving grounds. Among the weapons systems directly supported are Search and Destroy Armor (SADARM), Longbow, Military Strategy Tactical and Relay Satellite System (MILSTAR), Integrated Family of Test Equipment (IFTE), and High Power Coherent Radar (HIPCOR). The Intrinsic Standards Voltage Calibrator that stems from this project is an advance of international significance, and was reported at the National Conference of Standards Laboratory Conference in 1994. The United States National Institute for Standards and Technology (NIST) directly participated in this calibrator program and benefited from technology transfer, as has the United States cryogenics industry. The calibrator has improved the Army's calibration program, and the U.S. Navy, Air Force, and NASA are expected to apply this technology to their programs. This project is managed by the U.S. Army Test Measurement and Diagnostic Equipment Activity, Redstone Arsenal, AL.

FY 1995 Accomplishments:

•	856	- Completed development of the helium closed-cycle refrigerated Josephson Junction intrinsic voltage standard into the next generation Calibration Van (CALSETS 2000). - Tested and evaluated the reconfigurable microwave calibration workstation for technology transfer. - Investigated the parameters required to achieve self-calibration of the CALSETS 2000 design to eliminate the logistics associated with calibration. - Developed technology for primary level calibrations for Fourier Transform Infrared (FTIR) non-linearity effects, AM noise and 6-port microwave calibrations.
Total	856	

FY 1996 Planned Program:

•	326	- Complete technology development for Fourier Transform Infrared non-linearity effects. - Begin development of intrinsic voltage for alternating current Josephson Junction effect. - Field Test closed-cycle refrigerated Josephson Junction intrinsic voltage standard.
•	8	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	2	- Revised economic assumption not available for execution.
Total	336	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603001A Logistics Advanced Technology
PROJECT D594	

FY 1997 Planned Program:

•	445	- Downsize the Josephson Junction intrinsic voltage standard for instrument rack operation. - Develop low-voltage calibration workstation for next generation Calibration Van (CALSETS 2000). - Evaluate a self calibration scheme for CALSETS 2000 referenced to the intrinsic voltage standard.
Total	445	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	874	345	458
Appropriated Amount (FY 1995)	856		
Adjustment to FY 1995	0		
Appropriated Amount (FY 1996)		339	
Adjustment to FY 1996		-3	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-13
Current Budget Estimate Submit	856	336	445

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	232721	92926	11601	11706	11120	11196	11348		Continuing	Continuing
D801 Defense Woman's Health Research	36193	0	0	0	0	0	0		0	36193
D804 Prostate Cancer Research	3845	0	0	0	0	0	0		0	3845
D806 Breast Cancer Research	135723	72951	0	0	0	0	0		0	135723
D807 Industrial Base/Medical Biological Defense Vaccines and Drugs	14322	0	0	0	0	0	0		Continuing	Continuing
D810 Industrial Base/Infectious Disease Vaccines and Drugs	8378	9117	9228	9309	8673	8542	8662		Continuing	Continuing
D819 Field Medical Protection and Human Performance Enhancement-Non-Systems Advanced Development	724	1727	0	0	0	192	190		Continuing	Continuing
D840 Combat Injury Management	2359	2322	2373	2397	2447	2462	2496		Continuing	Continuing
D886 Mammography	1704	0	0	0	0	0	0		0	1704
D887 Ovarian Cancer Research	6787	0	0	0	0	0	0		0	6787
D888 Cell Regulation Research	1811	0	0	0	0	0	0		0	1811
D889 Coastal Cancer Control	4524	0	0	0	0	0	0		0	4524
D890 Osteoporosis	4524	0	0	0	0	0	0		0	4524
D891 Lyme Disease	452	0	0	0	0	0	0		0	452
D892 Blood Analyzer	0	1946	0	0	0	0	0		0	1946

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D893 Tissue Replacement	0	4863	0	0	0	0	0		0	0
D995 Medical Chemical Defense Life Support Material-Non-Systems Advanced Development	11375	0	0	0	0	0	0		Continuing	Continuing

Mission Description and Budget Item Justification: This program element funds advanced technology development for the DoD Core Vaccine and Drug Program as well as for development of field medical protective devices and combat injury management. These latter 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 which are effective protectants, treatments, and antidotes against chemical and biological threat agents, and military disease threats. Pilot and standard lots of candidate pharmaceutical-grade drugs, antidotes and vaccines are produced. Medical biological and chemical defense development consists of prophylaxes, pretreatment, antidotes and therapeutics; personnel and patient decontamination; medical management of casualties and sustainment of combat effectiveness. The primary goal of this program is to provide, with minimum adverse effects, maximum soldier survivability and sustainability on the integrated battlefield as well as in military operations other than war. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This program is managed primarily by the US Army Medical Research and Materiel Command. This program is dedicated to conducting proof of principal field demonstrations and tests of non-system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D801

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D801 Defense Woman's Health Research	36193	0	0	0	0	0	0		0	36193

A. **Mission Description and Budget Item Justification:** **Project D801 Defense Woman's Health Research:** By Congressional direction, the purpose of this project is to develop a coordinated tri-service program of multi-disciplinary and multi-institution research on women's health issues related to service in the Armed Forces.

FY 1995 Accomplishments:

- 1725 Developed new comprehensive scientific technical review contract for new proposals received.
- 1565 Perform programmatic review of 1000 expected scientific proposals in accordance with the programmatic structure and goals. (to be accomplished in FY 96).
- 31903 Award grants/contracts deemed scientifically meritorious and programmatically relevant to the service of women in the military (to be accomplished in FY 96).
- 1000 Continued and expanded Defense Women's Health Research Program Clearing House/Database.

Total 36193

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	39460	0	0
Appropriated Value	38632		
Adjustments to Appropriated Value	-2439		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	36193	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D804

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D804 Prostate Cancer Research	3845	0	0	0	0	0	0		0	3845

A. Mission Description and Budget Item Justification: **Project D804-Prostate Cancer Research:** By Congressional direction, the purpose of this project is to establish a prostate cancer research center at the Walter Reed Army Institute of Research.

FY 1995 Accomplishments:

•	3845	Supported prostate cancer research center.
Total	3845	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4192	0	0
Appropriated Value	4104		
Adjustments to Appropriated Value	-259		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	3845	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D806

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D806 Breast Cancer Research	135723	72951	0	0	0	0	0		0	135723

A. Mission Description and Budget Item Justification: **Project D806-Breast Cancer Research:** By Congressional direction, the purpose of this project is to initiate breast cancer research within the Department of Defense.

FY 1995 Accomplishments:

- 4590 Performed a call for scientific research proposals for breast cancer research and training, special mammography efforts and breast cancer centers (accomplished in FY 95), and perform scientific merit review of 3000 expected proposals (to be accomplished in FY 96).
- 3000 Developed a comprehensive programmatic structure and goals per the 1993 Institute of Medicine Report and as directed by Congressional language (accomplished in FY 95), and perform programmatic review of 3000 expected proposals (to be accomplished in FY 96).
- 126133 Award grants/contracts deemed scientifically and programmatically relevant in accordance with the 1993 Institute of Medicine Report (to be accomplished in FY 96).
- 2000 Manage approximately 350 grants and contracts of the FY 95 Breast Cancer Research Program (to be accomplished in FY 96).

Total 135723

FY 1996 Planned Program:

- 71119 Award grants/contracts deemed scientifically and programmatically relevant in accordance with the 1993 Institute of Medicine Report.
- 205 Revised economic assumption not available for execution.
- 1627 SBIR/STTR

Total 72951

FY 1997 Planned Program: Project not funded.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology
	PROJECT D806

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	147976	0	0
Appropriated Amount (FY 1995)	144868		
Adjustments to FY 1995	-9145		
Appropriated Amount (FY 1996)		73689	
Adjustments to FY 1996		-738	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	135723	72951	0

Change Summary Explanation:

Funding: Rescission within the FY 95 Supplemental Appropriation and Rescissions to preserve and enhance the military readiness of the Department of Defense (-9145).

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D807

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D807 Industrial Base/Medical Biological Defense Vaccines and Drugs	14322	0	0	0	0	0	0		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project D807-Industrial Base/Medical Biological Defense:** This project funds research on pre-clinical development of safe and effective prophylaxis and therapy (vaccines and drugs for exposure to biological threat agents). This project also supports the advanced technology development of kits to rapidly diagnose exposure to biological agents in clinical samples. To complete the defensive effort, a broad range of technologies involved in the targeting and delivery of prophylactic and therapeutic medical countermeasures is evaluated to ensure the protection of US forces. Major contractors are Battelle Memorial Institute, Columbus, OH, and Southern Research Institute, Birmingham, AL.

FY 1995 Accomplishments:

•	6902	Screened candidate vaccines for safety and efficacy; successfully transitioned a ricin toxoid vaccine to advanced development.
•	3558	Produced chromatographic hand-held assay providing simple, rapid and specific capability to diagnose selected BW agents in clinical samples.
•	1157	Conducted advanced preclinical prophylaxis studies; demonstrated protective efficacy of Botulinum A heavy chain recombinant vaccine candidate in rodent model.
•	2705	Demonstrated that two immunizations with anthrax vaccine were protective in an aerosol challenge, non-human primate model.
Total	14322	

FY 1996 Planned Program: Project moved to DoD PE 0603384BP, project number 807.

FY 1997 Planned Program: Project moved to DoD PE 0603384BP, project number TB3.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	15670	0	0
Appropriated Value	15341		
Adjustments to Appropriated Value	-1019		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	14322	0	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603002A Medical Advanced Technology; PROJECT: D810

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D810 Industrial Base/Infectious Disease Vaccines and Drugs	8378	9117	9228	9309	8673	8542	8662		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project D810-Industrial Base/Infectious Disease and Drugs:** This project funds development of medical countermeasures for naturally occurring diseases which are militarily significant due to their potential impact on military operations. Development of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalization and evacuations from the theater of operations. Major contractors are the University of California, San Francisco, CA; SRI, Inc., Menlo Park, CA; Starks Associates, Inc., Buffalo, NY; ASH Stevens, Inc., Detroit, MI; Research Triangle Associates, Research Triangle Park, NC; Kenya Medical Research Institute, Nairobi, Kenya.

FY 1995 Accomplishments:

- 1879 Completed work leading to licensure of Hepatitis A vaccine; conducted Phase I clinical trials of malaria multiantigen, campylobacter, *Shigella sonnei*, and Korean hemorrhagic fever vaccines.
- 1168 Completed Phase II safety and immunogenicity field trials of malaria, enterotoxigenic *E. coli* (ETEC), and cholera vaccines at overseas sites.
- 508 Completed safety and efficacy trials of azithromycin for treatment of drug resistant malaria at overseas site.
- 192 Prepared Milestone 0 packages for two antimalarial and one antileishmanial candidate drugs.
- 3442 Prepared pre-clinical and technical data packages to transition antimalarial drug, arteether, to advanced development; completed pre-clinical drug formulation and pharmacokinetic studies of candidate antimalarial and anti-leishmanial drugs.
- 1189 Prepared field sites for large scale trials on vaccines in volunteers naturally infected with endemic diseases; completed pilot vaccine facility meeting FDA standards; produced pilot lots of leismania skin test antigen and vaccine candidate.

Total 8378

FY 1996 Planned Program:

- 729 Conduct Phase I clinical safety trials of candidate *S. sonnei* NPS and LPS, live attenuated *S. flexneri*, and monovalent killed dengue vaccines.
- 2038 Conduct Phase II safety and efficacy trials of candidate malaria NYVAC-Pf7 vaccine; conduct serological analyses of serum specimens from field trials; prepare batch production records for candidate peptide CTL vaccine.
- 142 Conduct Phase II efficacy trial of ribavirin for treatment of viral hemorrhagic fevers.
- 368 Evaluate immunogenicity of dengue 4 vaccine candidate administered after a yellow fever vaccine.
- 413 Evaluate drug treatment regimen using chloroquine with primaquine in areas where chloroquine resistance occurs; prepare field site for testing new antimalarial drug candidates.
- 3585 Transition at Milestone I two antimalarial drugs, one antileishmanial drug, and a leishmania skin test into advanced development.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology
	PROJECT D810

FY 1996 Planned Program: (continued)

•	206	Conduct field efficacy trials of camouflage facepaint repellent product and a combined repellent/sunscreen product; test efficacy of a new repellent effective against flies.
•	1407	Prepare, purify, and bottle multivalent shigella, cholera, multivalent dengue and Norwalk virus candidate vaccines for human safety trials.
•	26	Revised economic assumption not available for execution.
•	203	SBIR/STTR
Total	9117	

FY 1997 Planned Program:

•	1421	Conduct Phase I clinical trials of multivalent adhesin and CFA/II ETEC, monovalent killed dengue, and bivalent *S. sonnei/flexneri* vaccines.
•	382	Conduct Phase II safety and efficacy trials of *S. sonnei* NPS and LPS vaccines.
•	1787	Conduct safety and efficacy trials on an enhanced blood stage malaria vaccine to prevent relapsing malaria; analyze and evaluate immunogenicity data from field trials.
•	498	Conduct site preparation for field testing of antimalarial drug candidates; produce field test kits for determining malaria drug resistance.
•	1631	Prepare, purify, and bottle multivalent shigella, cholera, multivalent dengue, and Norwalk virus candidate vaccines for field safety and efficacy trials.
•	3168	Conduct Phase I clinical safety and efficacy trials on a liposomal formulation of pentamidine as an antileishmanial drug; conduct Phase I clinical trials of an artemisinin analog as a potential treatment for cerebral malaria.
•	137	Conduct minimum dose study of ribavirin for treatment of viral hemorrhagic fevers.
•	204	Produce interactive computer vector identification aides; transition insect repellent/sunscreen product to advanced development.
Total	9228	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	8494	9373	9504
Appropriated Amount (FY 1995)	8316		
Adjustments to FY 1995	62		
Appropriated Amount (FY 1996)		9209	
Adjustments to FY 1996		-92	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-276
Current Budget Estimate Submit For FY 1997	8378	9117	9228

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D819

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D819 Field Medical Protection and Human Performance Enhancement-Non-Systems Advanced Development	724	1727	0	0	0	192	190		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project D819-Field Medical Protection and Human Performance Enhancement-Non-Systems Advanced Development:** This project supports laboratory validation studies and field demonstrations focused on soldier protection, sustainment, and enhancement associated with soldiers operating, wearing and consuming materiel systems in all climatic and operational conditions. Specific support includes medical non-systems advanced development of laser eye protection technologies and laser bioeffects treatment, medical protection against military electromagnetic radiation hazards, environmental health monitoring methods to link soldier physiological status with climatic and environmental conditions, methods to enhance sleep and alertness during continuous/sustained operational scenarios, nutritional strategies to enhance soldier mental and physiological performance, and medical protection from vibration and repeated shock hazards arising from the operation of combat vehicle and aircraft systems. Research efforts are categorized by five major thrust areas: Operational Medicine and Performance; Environmental Extremes; Directed Energy Bioeffects; Toxic Hazards Health effects; and Biodynamic Stresses.

FY 1995 Accomplishments:

•	724	Studied physical and mental performance requirements of combat soldiers and extend performance limits. Evaluated performance effects of various nutrient supplements.
Total	724	

FY 1996 Planned Program:.

•	1683	Study physical and mental performance requirements of combat soldiers and extend performance limits. Evaluated performance effects of various nutrient supplements.
•	5	Revised economic assumption not available for execution.
•	39	SBIR/STTR
Total	1727	

FY 1997 Planned Program: Project not funded.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D819

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	740	0	0
Appropriated Amount (FY 1995)	724		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		1744	
Adjustments to FY 1996		-17	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	724	1727	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology PROJECT D840

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D840 Combat Injury Management	2359	2322	2373	2397	2447	2462	2496		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> **Project A840-Combat Injury Management:** This project funds advanced development prototypes of non-system specific medical material items for far-forward medical management of shock and trauma, and for casualty resuscitation, including pre-clinical 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 1995 Accomplishments:

•	991	Conducted in vitro evaluations of candidate preservatives for refrigerated whole blood.
•	767	Demonstrated protection against ischemia/reperfusion injury by thermal induction of 70 kD heat-shock protein in a rat model.
•	136	Produced cefatriaxone antibiotic macrobeads, and demonstrated superior antibiotic efficacy of cefazolin microspheres over conventional systemic antibiotics in *in vivo* fracture fixation and wound infection models contaminated with S. aureus.
•	83	Demonstrated analgesic efficacy of lecithin-coated bupivacaine in a rat model, and lack of intradermal toxicity.
•	382	Developed user-approved configuration for medical interior of an armored ambulance; implemented new software to enable robotic control and multi-axis inspection capabilities of robotic surgical assistant.
Total	2359	

FY 1996 Planned Program:

•	715	Conduct human studies of candidate preservation systems for eight week refrigerated red blood cell storage.
•	732	Investigate effect of intravenous membrane oxygenation on end organ function and in prevention of respiratory insufficiency to Adult Respiratory Distress Syndrome (ARDS).
•	198	Evaluate efficacy of cefatriaxone macrobead and tobramycin microspheres in the treatment of infection in small mammals, to provide broad spectrum antibiotic capability against a variety of infectious organisms; determine efficacy of cefazolin microspheres against drug-resistant bacterial strains, and evaluate effects on emergence of drug resistance.
•	120	Conduct animal pharmacokinetics and neurotoxicity testing of lecithin-coated bupivacaine to enable transition to advance development; develop prototype field anesthesia machine for inhalational anesthesia.
•	499	Conduct initial prototyping of a ruggedized portable oxygen concentrator for field use.
•	6	Revised economic assumption not available for execution.
•	52	SBIR/STTR
Total	2322	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603002A Medical Advanced Technology
	PROJECT D840

FY 1997 Planned Program:

•	749	Conduct clinical studies to evaluate fibrin-base hemostatic bandage formulation for hemorrhage control.
•	767	Evaluate clinical efficacy of oxygen administration in trauma patients.
•	208	Evaluate efficacy of tobramycin and vancomycin microspheres against antibiotic resistant strains of *P. aeruginosa*; conduct acute toxicological studies of cefazolin microspheres in two animal species to enable transition to advance development.
•	126	Submit Investigational New Drug (IND) exemption for Phase I testing of topical analgesic/anesthetic products; complete animal testing of prototype field anesthesia machine.
•	523	Design prototype omni-directional maneuverable platform for robotic surgical assistant test bed.
Total	2373	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2321	2387	2444
Appropriated Amount (FY 1995)	2273		
Adjustments to FY 1995	86		
Appropriated Amount (FY 1996)		2345	
Adjustments to FY 1996		-23	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			-71
Current Budget Estimate Submit For FY 1997	2359	2322	2373

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D886

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D886 Mammography	1704	0	0	0	0	0	0		0	1704

A. **Mission Description and Budget Item Justification: Project D886-Mammography:** By Congressional direction, this project supports research on mammography.

FY 1995 Accomplishments:

•	1704	Award competitive contracts/grants to initiate research on mammography (to be accomplished in FY 96).
Total	1704	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1974	0	0
Appropriated Value	1933		
Adjustments to Appropriated Value	-229		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	1704	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D887

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D887 Ovarian Cancer Research	6787	0	0	0	0	0	0		0	6787

A. Mission Description and Budget Item Justification: Project D887-Ovarian Cancer Research: By Congressional direction, this project supports research on ovarian cancer.

FY 1995 Accomplishments:

•	6787	Award competitive contracts/grants to initiate research on ovarian cancer. (to be accomplished in FY 96)
Total	6787	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	7399	0	0
Appropriated Value	7244		
Adjustments to Appropriated Value	-457		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	6787	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D888

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D888 Cell Regulation Research	1811	0	0	0	0	0	0		0	1811

A. Mission Description and Budget Item Justification: Project D888-Cell Regulation Research: By Congressional direction, this project supports research on cell regulation.

FY 1995 Accomplishments:

- 1811 Award competitive contracts/grants to initiate research on cell regulation (to be accomplished in FY 96).

Total 1811

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1974	0	0
Appropriated Value	1933		
Adjustments to Appropriated Value	-122		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	1811	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D889

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D889 Coastal Cancer Control	4524	0	0	0	0	0	0		0	4524

A. Mission Description and Budget Item Justification: Project D889-Coastal Cancer Control: By Congressional direction, this project supports research on coastal cancer control.

FY 1995 Accomplishments:

•	4524	Award competitive contracts/grants to initiate research on coastal cancer control (to be accomplished in FY 96).
Total	4524	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4933	0	0
Appropriated Value	4829		
Adjustments to Appropriated Value	-305		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	4524	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D890

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D890 Osteoporosis	4524	0	0	0	0	0	0		0	4524

A. **Mission Description and Budget Item Justification: Project D890-Osteoporosis:** By Congressional direction, this project supports research on osteoporosis.

FY 1995 Accomplishments:

•	4524	Award competitive contracts/grants to initiate research on osteoporosis (to be accomplished in FY 96).
Total	4524	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4933	0	0
Appropriated Value	4829		
Adjustments to Appropriated Value	-305		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	4524	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D891

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D891 Lyme Disease	452	0	0	0	0	0	0		0	452

A. **Mission Description and Budget Item Justification:** **Project D891-Lyme Disease:** By Congressional direction, this project supports research on Lyme Disease.

FY 1995 Accomplishments:

•	452	Award competitive contracts/grants to initiate research on Lyme Disease (to be accomplished in FY 96).
Total	452	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	493	0	0
Appropriated Value	483		
Adjustments to Appropriated Value	-31		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	452	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D892

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D892 Blood Analyzer	0	1946	0	0	0	0	0		0	1946

A. Mission Description and Budget Item Justification: **Project D892-Blood Analyzer:** By Congressional direction, this project supports research on blood analyzers.

FY 1995 Accomplishments: Project not funded.

FY 1996 Planned Program:

•	1895	Award competitive contracts/grants to initiate research on blood analyzers.
•	8	Revised economic assumption not available for execution.
•	43	SBIR/STTR
Total	1946	

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget	0	2000	0
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		1965	
Adjustments to FY 1996		-19	
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Submit/President's Budget	0	1946	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D893

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D893 Tissue Replacement	0	4863	0	0	0	0	0		0	0

A. Mission Description and Budget Item Justification Project D893-Tissue Replacement: By Congressional direction, this project supports tissue replacement.

FY 1995 Accomplishments: Project not funded.

FY 1996 Planned Program:

•	4740	Award competitive contracts/grants to initiate research on tissue replacement.
•	14	Revised economic assumption not available for execution.
•	109	SBIR/STTR
Total	4863	

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget	0	5000	0
Appropriated Amount (FY 1995)			
Adjustments to FY 1995		4912	
Appropriated Amount (FY 1996)		-49	
Adjustments to FY 1996			
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Submit/President's Budget	0	4863	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603002A Medical Advanced Technology

PROJECT: D995

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D995 Medical Chemical Defense Life Support Material-Non-Systems Advanced Development	11375	0	0	0	0	0	0		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project D995-Medical Chemical Defense Life Support Materiel-Non-Systems Specific Advanced Development: This project supports the investigation of new medical countermeasures to include antidotes, pretreatment drugs, and topical skin protectants to protect U.S. forces against known and emerging chemical warfare (CW) threat agents. Capabilities are maintained for reformulation, formulation, and scale-up of candidate compounds using current good laboratory practices (CGLP). Analytical stability studies and safety and efficacy screening, in addition to pre-clinical toxicology studies, are performed prior to full scale development on promising pretreatment or treatment compounds. Some major contractors are Battelle Memorial Institute, Columbus, OH, Rolm and Haas Company, Spring House, PA, Science Application International Corporation, McLean, VA, Research Triangle Institute, Research Triangle, NC, and Ash Stevens, Inc., Detroit, MI.

FY 1995 Accomplishments:

•	2786	Investigated animal models systems for advanced drug screening.
•	3523	Screened 40 candidate antivesicant compounds in cell viability assays and 30 candidate compounds in the NAD+ depletion assay.
•	1616	Using primary cell culture systems demonstrated that anti-seizure and antiparkinsonian compounds protect cell against NAS.
•	1792	Discovered seven novel anticonvulsant analogues of dextramethorphan and carbetapentane.
•	1658	Developed monoclonal antibodies against deglycosylated and glycosylated human butyrylcholinesterase.
Total	11375	

FY 1996 Planned Program: Project moved to DoD PE 0603384BP, project number 995.

FY 1997 Planned Program: Project moved to DoD PE 0603384BP, project number TC3.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	11984	0	0
Appropriated Value	11732		
Adjustments to Appropriated Value	-357		
Adjustments to Budget (FY 1997) Year Since FY 1996 Presidents Budget			
Current Budget Estimate Submit For FY 1997	11375	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	51246	55051	41478	35335	40699	44604	46630		Continuing	Continuing
D313 Advanced Rotary Wing Vehicle Technology	3370	4839	3527	9139	15822	16239	18001		Continuing	Continuing
D368 Improved Cargo Helicopter Technology	0	3892	0	0	0	0	0		0	3892
D391 Tractor Will	9297	6775	5040	962	1439	955	0		0	24939
D435 Aircraft Weapons	3050	2881	0	0	1918	5732	7579		Continuing	Continuing
D436 Rotary-Wing MEP Integration	12227	20650	24647	18261	14672	14514	13945		Continuing	Continuing
D447 Aircraft Demonstration Engines	5785	6963	7780	6588	6608	7164	7105		Continuing	Continuing
DA38 Starstreak	2718	3892	0	0	0	0	0		0	6626
DB38 Tractor Cone	600	582	0	0	0	0	0		0	1184
DB39 Advanced Distributed Simulations	9266	0	0	0	0	0	0		0	9266
DB97 Aircraft Avionics Equipment	4933	4577	484	385	240	0	0		0	10638

Mission Description and Budget Item Justification: The objective of this program element (PE) is to develop aeronautical technology for new and/or upgrades to DoD/Army Vertical Take-off and Landing (VTOL) airmobile systems. Helicopter rotors provide low disc loading as compared to the tilt rotor's intermediate disc loading and vertical lift jet engine's high disc loading. Low disc loading VTOL aircraft offer a practical solution to many of the DoD/Army's operational needs. Such aircraft, with their ability to operate below tree top level for Nap-of-the-Earth (NOE) missions, present significantly different analysis and design challenges from traditional fixed wing aircraft which fly at higher altitudes. The Army Aviation Science and Technology program's functional organization, with assistance from National Aeronautics and Space Administration (NASA) at three co-located activities, is the focal point for US efforts in rotorcraft technology. Technical areas include aeromechanics, aerodynamics, structures, propulsion, reliability and maintainability, safety and survivability, mission support equipment, aircraft system synthesis, aircraft subsystems, advanced helicopter analysis, flight simulation, aircrew-aircraft integration, aircraft weapons, aircraft avionics for command and control, air-to-air/air-to-ground communications, controls and displays, digital avionics and architectures, NOE navigation, mission planning, air traffic management and investigation and selective application of Integrated Product and

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology

Process Development (IPPD) techniques. These technologies are continuously being researched for applications to improve and correct deficiencies in current DoD/Army VTOL aircraft systems, and to improve the capabilities of future rotorcraft. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP) and Army Modernization Plans, and DoD Project Reliance agreements. This program is dedicated to conducting proof-of-principle simulations, field demonstrations, and tests of non-system and system specific technologies to meet specific military needs and is therefore appropriately funded in Budget Activity 3.

Work in this PE is performed by contractors including Georgia Institute of Technology, Atlanta, GA; McDonnell Douglas Helicopter Systems, Mesa, AZ; Boeing Helicopter Company, Philadelphia, PA; Loral Western Development Laboratories, San Jose, CA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Martin Marietta, Atlanta, GA; General Electric, Lynn, MA; Allied Signal Engines, Phoenix, AZ; Honeywell, Minneapolis, MN; Sikorsky, 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 Simulation, Training and Instrumentation Command (STRICOM), Orlando, FL; Aviation and Troop Command (ATCOM), St. Louis, MO; Communications-Electronics Command (CECOM), Ft. Monmouth, NJ; Aeroflightdynamics Directorate, ATCOM, NASA Ames Research Center, Moffett Field, CA; Aviation Applied Technology Directorate, ATCOM, Ft. Eustis, VA; Structures Directorate, Army Research Laboratory (ARL), NASA Langley Research Center, Hampton, VA; and Vehicle Propulsion Directorate, ARL, NASA Lewis Research Center, Cleveland, OH. Related activities are performed by National Aeronautics and Space Administration.

This program adheres to DoD Project Reliance Agreements on Aeropropulsion and Air Vehicles (Rotary) with oversight and coordination provided by the Joint Directors of Laboratories; and Training Systems with oversight and coordination provided by the Training and Personnel Systems Science & Technology Evaluation Management Committee (TAPSTEM). Related concept exploration is conducted under PE 0602211A (Aviation Technology). Efforts under this PE transition and provide risk reduction for and lead into Demonstration/Validation and Engineering Development programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). In addition, this PE's deliverables provide technical support and technology transition to PE 0604223A (RAH-66 Comanche), PE 0604816A (Longbow), and PE 0203744A (Aircraft Modifications/Product Improvement).

The Army participates in and with the following groups, organizations and programs for total coordination: the DoD Tri-Service Joint Technical Coordination Group for Munitions Development and Aircraft Survivability; Acoustical Society of American Standards, Committee on Acoustics Group for Aerospace Research and Development; Aircraft Instruments and Aircrew Station Working Group; the NATO Military Agency for Standardization Air Armament Working Party; the Joint Integrated Avionics Working Group (JIAWG); Integrated High Performance Turbine Engine Technology (IHPTET) Steering Committee; the Air Armament Working Party of NATO; The Army's Combined Arms Weapon System (TACAWS) Executive Steering Committee and the Executive Steering Committee for the Rotorcraft Pilot's Associate (RPA) Program. This participation enables the gathering of technical information and assets in determining the joint use and standardization of airborne weaponization items. The Army Munitions Research and Development Committee, an organization within the Office of the Secretary of Defense, functions to establish Joint Service requirements and the development of air munitions. International related activities are the Technical Cooperation Programs with Australian, Canadian and United Kingdom governments, and Defense Development Share Plans. Formal Memoranda of Understanding (MOUs) and Data Exchange Agreements (DEAs) with various friendly nations are actively pursued to allow technology information exchange. There is no unnecessary duplication of effort within the Army or Department of Defense.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: D313

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D313 Advanced Rotary Wing Vehicle Technology	3370	4839	3527	9139	15822	16239	18001		Continuing	Continuing

A. Mission Description and Budget Item Justification: This project provides for technology demonstration in support of research for advanced rotors/controls, flight controls, airframes/structures, and drive trains. Technologies developed will be executed in four demonstrations: Affordable Structures Technology for Efficient Rotorcraft (ASTER), Advanced Rotorcraft Transmission Phase II (ART-II), Rotorcraft Pilot's Associate (RPA) and Helicopter Active Control Technology (HACT). These will focus the enabling technologies for the Joint Transport Rotorcraft (JTR) to meet the cargo/transport and commuter needs of the military and civilian sectors, as well as technology insertion for other system upgrades. Focus is on technology to allow rotorcraft to meet the challenges from peacekeeping to the future battlefield.

FY 1995 Accomplishments:

•	3370	-Designed and demonstrated the benefits of applying fuzzy logic theory to rotorcraft digital flight control technology. -Performed ground and tethered initial testing of the Autonomous Scout Rotorcraft Testbed (ASRT).
Total	3370	

FY 1996 Planned Program:

•	4718	-Select critical ASTER components for development, testing, and demonstration. -Initiate ART-II preliminary design. -Complete flight testing and conduct ASRT demonstration. -Support hotbench/platform integration of RPA technologies.
•	13	Revised economic assumption not available for execution.
•	108	SBIR/STTR reduction not available for execution.
Total	4839	

FY 1997 Planned Program:

•	3527	-Define ASTER structural configuration and requirements, develop ASTER system architecture and structural concepts, manufacturing approaches, and repair concepts and techniques. -Complete ART-II detailed design and initiate long lead hardware procurement.
Total	3527	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology PROJECT D313

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3453	4975	3632
Appropriated Amount (FY 1995)	3381		
Adjustments to FY 1995	-11		
Appropriated Amount (FY 1996)		4888	
Adjustments to FY 1996		-49	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-105
Current President's Budget Submit	3370	4839	3527

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: D368

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D368 Improved Cargo Helicopter Technology	0	3892	0	0	0	0	0		0	3892

A. Mission Description and Budget Item Justification: This project develops a program to extend the life of the CH-47D cargo helicopter. This funding will assure heavy lift capability into the 21st century. The CH-47D modernization program began in FY 1981 with the modernization on nine aircraft. Delivery of these aircraft began in March 1982. These modified aircraft have now been in use for 14 years with a total of 33 years on the airframe itself. The intent is to study the feasibility of service life extension and correct known deficiencies. This program will study the necessary effort required to sustain the heavy lift capability, decrease operation and support costs as the fleet ages, improve engine power and incorporate an electronic/ architecture system for compatibility with the digital battlefield and replace obsolete equipment. This program will be the basis for establishing an overhaul, modernization, upgrade or retrofit program to meet the readiness needs of the future for heavy lift capability. Funding in this line is related to PE 0203744A Aircraft Modifications/ Product Improvement Program, Project D430 Improved Cargo Helicopter.

FY 1995 Accomplishments: Project not funded.

FY 1996 Planned Program:

•	3794	Perform vibration analysis.
•	87	SBIR/ STTR reduction not available for execution.
•	11	Revised economic assumptions not available for execution.
Total	3892	

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget		0	
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		3931	
Adjustments to FY 1996		-39	
Current President's Budget Submit		3892	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: D435

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D435 Aircraft Weapons	3050	2881	0	0	1918	5732	7579		Continuing	Continuing

A. Mission Description and Budget Item Justification: This project demonstrates rotorcraft weaponization technologies utilizing an integrated system approach. Integration of advanced missile, rocket and gun system fire control, target acquisition and weapon system selection processes are demonstrated. This project supports Rotorcraft Pilot's Associate (RPA) program.

FY 1995 Accomplishments:

•	3050	-Developed specific knowledge of acquisition approaches and techniques for weapons and target acquisition aspects of RPA mission operations. -Continued development of weapons and target acquisition simulation models for RPA. -Completed preliminary design of Attack Planner portion of RPA's Cognitive Decision Aiding Subsystem (CDAS).
Total	3050	

FY 1996 Planned Program:

•	2809	-Complete weapons and target acquisition knowledge development portion of mission operation as part of the RPA detailed design. -Complete development of RPA weapons and target acquisition simulation models. -Conduct detailed design of the CDAS Attack Planner for RPA.
•	8	Revised economic assumption not available for execution.
•	64	SBIR/STTR.
Total	2881	

FY 1997 Planned Program: Project is not funded. Project funds for FY 97 and FY 98 were reprogrammed to D436 to complete higher priority Rotocraft Pilot's Associate ATD. Project D435 restarts in FY 99 to do weapons integration for low-cost precision kill (2.75 rocket with smart seeker).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology PROJECT D435

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3115	2963	0
Appropriated Amount (FY 1995)	3050		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		2911	
Adjustments to FY 1996		-30	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current President's Budget Submit	3050	2881	0

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology PROJECT D436

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D436 Rotary-Wing MEP Integration	12227	20650	24647	18261	14672	14514	13945		Continuing	Continuing

A. **Mission Description and Budget Item Justification:** The objective of this project is to demonstrate man-machine integration, rotors and control technology to provide enhanced helicopter pilotage capability, improved crew workload distribution, increased maneuverability/agility, with reduced vibration and maintenance. This is the primary project for the Rotorcraft Pilot's Associate (RPA) Advanced Technology Demonstration (ATD). It provides for the demonstration of rotorcraft crew stations utilizing knowledge-based information systems to develop Cognitive Decision Aiding (CDA) for crews. Advanced technology in information technology computing methods, sensors, displays, and controls are demonstrated to maximize combat helicopter mission effectiveness and survivability for day/night adverse weather operations. Provides for the demonstration of simulation capability to evaluate combined rotorcraft control and crew performance via virtual prototyping and Battlefield Distributed Simulation-Developmental (BDS-D). Beginning in FY 98, lessons learned from the ASRT will be applied to an effort to define the optimum approach to using an aircraft team of a manned helicopter and unmanned air vehicle (UAV) to perform Army aviation missions. The UAV will be capable of performing scout/reconnaissance assignments and alerting manned helicopters of "just ahead" situations. With state-of-the-art sensors, it will detect and identify targets, report location, and send real-time video to the aircrew and/or ground stations.

FY 1995 Accomplishments:

- 8364 -Completed RPA system hardware and software preliminary design and system build 1.
  -Conducted knowledge acquisition session on scout/attack and Special Operations Forces mission.
  -Developed engineering simulation environment necessary to support the high fidelity interactions between RPA system and the aircraft and its mission equipment.
- 3863 -Continued full mission combined arms simulation development activity to include representation of the RPA baseline "Comanche-Like" system.
  -Conducted critical design of the Simulation Program for Improved Rotorcraft Integration Technology (SPIRIT) 4-axis side-arm controller and preliminary design of the airworthy helmet-mounted display.
  -Performed an initial RPA advanced mission equipment package (MEP) evaluation in the BDS-D simulation network.

Total 12227

FY 1996 Planned Program:

- 14938 -Complete RPA hardware detail design and software system builds 2 and 3, initiate fabrication, modification, and integration activities for the flight test vehicle.
  -Complete high fidelity engineering simulation environment to support development and engineering evaluation of the RPA. Includes full fidelity mission equipment models that interface directly with RPA core architecture.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology
	PROJECT D436

FY 1996 Planned Program: (continued)

		-Continue knowledge acquisition collection and refinement for scout/attack and Special Operations Aviation Forces mission.
•	5193	-Maintain and improve combined arms simulation capabilities through SPIRIT commitments. -Refine operational evaluation techniques and perform RPA system performance evaluations during concurrent software development activities.
•	58	Revised economic assumption not available for execution.
•	461	SBIR/STTR.
Total	20650	

FY 1997 Planned Program:

•	19591	-Complete knowledge acquisition collection activities and software detailed design; perform system builds 5 and 6; conduct software critical design review. -Conduct engineering and full mission simulation System Formal Evaluations I&II. -Perform subsystems integration, ground-based testing, and airborne validation in preparation for the FY 98 RPA system flight evaluation at Fort Hunter-Light.
•	5056	-Maintain and improve combined arms simulation capabilities through SPIRIT commitments. -Refine operational evaluation techniques and perform RPA system performance evaluations during concurrent software development activities in preparation for the FY 98 full system combined arm distributed simulation warfighting evaluations.
Total	24647	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	12557	21230	25655
Appropriated Amount (FY 1995)	12293		
Adjustments to FY 1995	-66		
Appropriated Amount (FY 1996)		20859	
Adjustments to FY 1996		-209	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-1008
Current President's Budget Submit	12227	20650	24647

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology PROJECT D447

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D447 Aircraft Demonstration Engines	5785	6963	7780	6588	6608	7164	7105		Continuing	Continuing

A. **Mission Description and Budget Item 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 aircraft emphasizing Army unique requirements. The current/planned Joint Turbine Advanced Gas Generator (JTAGG) efforts are all fully coordinated/aligned with the phases/goals of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) program and industry. IHPTET/JTAGG goals focus on reducing specific fuel consumption (SFC) and increasing the power to weight (P/W) ratio of turboshaft engines.

FY 1995 Accomplishments:

•	5785	-Completed JTAGG II design. -Procured JTAGG II components. -Initiated JTAGG II component tests.
Total	5785	

FY 1996 Planned Program:

•	6788	-Complete initial JTAGG II component test. -Perform gas generator fabrication and build-up. -Initiate gas generator test.
•	19	-Revised economic assumption not available for execution.
•	156	-SBIR/STTR.
Total	6963	

FY 1997 Planned Program:

•	7780	-Complete final component final design. -Perform final component fabrication. -Perform final component tests. -Initiate JTAGG fabrication and build-up .
Total	7780	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603003A Aviation Advanced Technology PROJECT D447

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5934	7158	8012
Appropriated Amount (FY 1995)	5809		
Adjustments to FY 1995	-24		
Appropriated Amount (FY 1996)		7033	
Adjustments to FY 1996		-70	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-232
Current President's Budget Submit	5785	6963	7780

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: DA38

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DA38 Starstreak	2718	3892	0	0	0	0	0		0	6626

A. Mission Description and Budget Item Justification: The objective of this project is to investigate air-to-air (ATA) applications of the Starstreak missile on rotary wing platforms. Technical feasibility of the Starstreak missile integration on a rotary wing platform will be determined through analysis and flight tests. Missile system cost effectiveness will be performed as part of a preliminary assessment of the military worth of the Starstreak missile as an ATA self defense weapon.

FY 1995 Accomplishments:

•	2718	-Prepared the procurement package, evaluated the proposals and awarded the contract for the Starstreak missile/rotorcraft integration analyses, design of aircraft interfaces, and for the conduct of live firing tests to assess safe launch and separation.
Total	2718	

FY 1996 Planned Program:

•	3793	-Conduct safe separation testing of Starstreak missile firings from an AH-64, complete data analysis and publish findings. -Award Technical Demonstration (TD) contract; Conduct live fire tests from an AH-64 to assess technical feasibility of the Starstreak missile / rotorcraft integration as an ATA self-defense weapon. -Conduct limited live fire tests using the Apache/ Starstreak against stationary and moving targets at Yuma Proving Ground. -Conduct limited simulation evaluations of Apache/ Starstreak warfighting effectiveness in the ATA self-defense role.
•	12	-Revised economic assumption not available for execution.
•	87	-SBIR/STTR.
Total	3892	

FY 1997 Planned Program: Project completed.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: DA38

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2959	0	0
Appropriated Amount (FY 1995)	2897		
Adjustments to FY 1995	-179		
Appropriated Amount (FY 1996)		3931	
Adjustments to FY 1996		-39	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current President's Budget Submit	2718	3892	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: DB39

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DB39 Advanced Distributed Simulations	9266	0	0	0	0	0	0		0	9266

A. Mission Description and Budget Item Justification: This project supports the Battlefield Distributed Simulation-Developmental (BDS-D) program and the Anti Armor (A2) Distributed Interactive Simulation (DIS) program. The BDS-D program simulation capabilities will be used for demonstrating and assessing advancements in distributed large scale, networked real-time, man-in-the-loop, upward compatible simulation architectures, and emerging tri-service/industry standards and methods for representing battlefield behaviors through use of selective levels of simulation fidelity and network participation. In FY 95, the BDS-D program is supported by PE 0602308A, Project AC90. The A2 program is intended to develop and demonstrate a verified, validated and accredited (VV&A) DIS capability to assess anti armor weapon system virtual prototyping, concept formulation, requirements definition, effectiveness evaluation, and mission area analysis on a combined arms battlefield at the Battalion Task Force or Brigade level. The results of this evaluation will support virtual prototyping effectiveness analysis, and make future weapon system improvements more timely, effective and affordable.

FY 1995 Accomplishments:

•	9266	-Linked JANUS Semi-Automated Force model to DIS and performed VV&A for the interface between the JANUS and DIS. -Conducted DIS experiments using M1A2, M2/M3A3+, LOSAT, NLOS, RAH-66, and AH-64D virtual simulators and performed VV&A. -Conducted Rapid Force Projection Initiative DIS experiment using modular semi-automated forces LOSAT, NLOS, HUNTER, RAH-66, AH-64D, and JAVELIN simulations and performed VV&A.
Total	9266	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	9605	0	0
Appropriated Value	9403		
Adjustments to Appropriated Value	-137		
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			
Current Budget Estimate Submit for FY 1997	9266	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology

PROJECT: DB97

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DB97 Aircraft Avionics Equipment	4933	4577	484	385	240	0	0		0	10638

A. Mission Description and Budget Item Justification: This project supports development and demonstration of advanced, integrated avionics equipment in support of aviation integration into the digitized battlefield. Evolving concepts in digital avionics will provide new functional capability in the areas of situational awareness, flight path guidance, position reporting and digital data transfer. Work in this project supports the Rotorcraft Pilot's Associate program.

FY 1995 Accomplishments:

- 829 -Provided RPA mission equipment integration support in the areas of communications, navigation, pilotage, voice recognition, controls and displays, and artificial intelligence.
  -Conducted specific knowledge acquisition sessions on the communications, navigation, pilotage, and information transfer aspects of mission operation.
- 4104 -Continued development of the communications, navigation, and pilotage simulation models.
  -Completed preliminary design of the data fusion approach necessary to develop a digital representation of the available battlefield information.
  -Completed preliminary design of the Communications planner of the Cognitive Decision Aiding Subsystems (CDAS).

Total 4933

FY 1996 Planned Program:

- 1742 -Provide RPA mission equipment integration support in the areas of communication, navigation, pilotage, voice recognition, controls and displays, and artificial intelligence.
  -Complete knowledge acquisition sessions on communications, navigation, and pilotage aspects of mission operation.
  -Complete development of communications, navigation, and pilotage simulation models.
- 2720 -Conduct detail design and evaluation of the data fusion algorithms including direct stimulus from the mission equipment simulation models.
  -Conduct detail design of the CDAS Communications planner.
- 13 Revised economic assumption not available for execution.
- 102 SBIR/STTR.

Total 4577

FY 1997 Planned Program:

- 484 -Provide RPA mission equipment integration support in the areas of communication, navigation, pilotage, voice recognition, controls and displays, and artificial intelligence.

Total 484

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603003A Aviation Advanced Technology — PROJECT: DB97

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5039	4705	498
Appropriated Amount (FY 1995)	4933		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		4623	
Adjustments to FY 1996		-46	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-14
Current President's Budget Submit	4933	4577	484

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	30975	26760	19759	24311	36927	46232	47883		Continuing	Continuing
DL94 Electric Gun Systems Demonstrations	8565	0	0	0	482	5732	5685		Continuing	Continuing
DL95 Landmine Warfare Development	3023	2897	2178	2402	4608	5264	5696		Continuing	Continuing
D43A Advanced Weaponry Technology Demonstration	17658	18763	11809	9862	20263	18649	19540		Continuing	Continuing
D232 Advanced Munitions Demonstration	1729	5100	5772	12047	11574	16587	16962		Continuing	Continuing

Mission Description and Budget Item Justification: The objective of this Program Element (PE) is to demonstrate affordable, advanced weapons and munitions technologies that will increase battlefield lethality and survivability. This PE funds several stand-off, anti-armor weapons demonstrations within the Rapid Force Projection Initiative (RFPI) to significantly increase the capability of Early Entry Forces. The RFPI demonstrations funded within this PE include: the Precision Guided Mortar Munition (PGMM), Autonomous Intelligent Submunition (AIS-Damocles), and more responsive digitized fire control for a towed 155mm Automated Howitzer (AH). A new initiative in response to new threat information, especially against new explosive reactive armors (which may appear as appliqués), is the Direct Fire Lethality Program, the purpose of which is to significantly enhance anti-tank lethality in terms of hit and kill by maximizing warhead/penetrator effectiveness and significantly reducing tank gun error sources under dynamic battlefield conditions. In the area of combat vehicle anti-armor munitions, advanced explosively formed penetrator warheads exploit technologies in explosives, liner materials and modeling, and demonstrate increased armor penetration through advanced warhead concepts. Technologies are being developed to demonstrate an artillery projectile capable of delivering DPICM cargo to ranges in excess of 40 kilometers. Innovative applications for Electro-Rheological (ER) fluids are also being demonstrated for use in next generation artillery recoil mechanisms. Work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armaments Research and Development and Engineering Center, Picatinny Arsenal, NJ. This program adheres to Tri-Service Reliance Agreements on conventional air-surface weaponry with oversight provided by the Joint Directors of Laboratories. Work in this PE is related to and fully coordinated with efforts in PE 0602624A (Weapons and Munitions Technology), PE 0602618A (Ballistics Tech) and PE 0604802A (Weapons and Munitions-Engineering Development). This work is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

PROJECT: DL94

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DL94 Electric Gun Systems Demonstrations	8565	0	0	0	482	5732	5685		Continuing	Continuing

A. Mission Description and Justification: Project DL94 - Electric Gun Systems Demonstration. Recognizing that the feasibility of electric guns depends on overcoming fundamental technical barriers, the Army's electric gun program was restructured to accelerate electronics and hypervelocity physics research thereby understanding the fundamental underpinnings of electric guns. Accordingly, the program was transitioned to the Army Research Laboratory (ARL) in 4th Qtr FY 1995. The Institute for Advanced Technology (PE's 0601104A and 062618A) has been brought into the federated lab structure. The principal contractors for the FY 95 accomplishments were: United Defense, Minneapolis, MN; Center for Electromechanics (CEM), University of Texas at Austin; Loral, Dallas, TX; Kaman Electromagnetics, Hudson, MA; and Science Applications International Corporation, San Diego, CA.

FY 1995 Accomplishments:

•	8565	- Conducted Cannon Caliber Electro-Magnetic Gun component and system design/fabrication/integration/testing. - Conducted proof of principle tests of pulsed power supply concepts of Focused Technology Program. - Completed tests of full scale Electro-Magnetic anti-armor projectiles at Kirkcudbright, UK test range to 1km to verify flight stability and accuracy.
Total	8565	

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program: Project not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	8767	0	0
Appropriated Amount (FY 1995)	8583		
Adjustment to FY 1995	-18		
Appropriated Amount (FY 1996)		0	
Adjustment to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			0
Current President's Budget Submit	8565	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

PROJECT: DL95

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DL95 Landmine Warfare Development	3023	2897	2178	2402	4608	5264	5696		Continuing	Continuing

A. Mission Description and Justification: Project DL95 - Landmine Warfare Development: This project funds the Intelligent Minefield (IMF) demonstration, which is an anti-armor weapon candidate under the Rapid Force Projection Initiative (RFPI) and which provides product improvement opportunities for the Wide Area Munition (WAM). The IMF will demonstrate the flexibility and battlefield effectiveness of coordinated smart mine attack utilizing Artificial Intelligence (AI), decision aids, Automatic Target Recognition (ATR), intermine communication, and extended range command and control. Mines that can defeat targets over a wide area have a tremendous payoff, especially for light forces that are weight and space constrained when they deploy. Additionally, anti-tank features such as a high probability of kill provided by top attack and command and control (e.g., on/off capability) make such mines very effective force multipliers. The IMF will include advanced acoustic sensors to cue mines as well as to provide remote sensors for the RFPI "hunter/stand-off killer" concept. In-house efforts are accomplished by Armament Research Development and Engineering Center, Picatinny Arsenal, NJ.

FY 1995 Accomplishments:

•	3023	- Continued development of and demonstrated component modules which link Wide Area Munitions (WAM) to create IMF. - Designed, developed and conducted initial testing of prototype Distributed Interactive Simulation (DIS) - compatible IMF simulator. - Planned and coordinated for IMF Advanced Technology Demonstration (ATD), Focused Dispatch Advanced Warfighting Experiment (AWE) and Mobile Strike Force AWE, and participated in both AWEs. - Continued development of acoustic sensors and associated communications link for RFPI.
Total	3023	

FY 1996 Planned Program:

•	1903	- Conduct mission, systems analysis and engineering of IMF system. - Design, fabricate and integrate ATD hardware for use with WAM surrogates. - Develop algorithms for improved IMF performance and implement into gateway and IMF simulator.
•	924	- Finalize design for an enhanced DIS compatible IMF simulator. - Complete development of and demonstrate acoustic sensors and associated communications link for RFPI.
•	61	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
•	9	- Revised economic assumptions not available for execution.
Total	2897	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT DL95

FY 1997 Planned Program:

•	2178	- Complete analysis of IMF ATD and issue report. - Support RFPI integrated test planning. - Fabricate prototype hardware to support RFPI and IMF operational experiment.
Total	2178	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	3099	2978	2238
Appropriated Amount (FY 1995)	3034		
Adjustment to FY 1995	-11		
Appropriated Amount (FY 1996)		2926	
Adjustment to FY 1996		-29	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-60
Current President's Budget Submit	3023	2897	2178

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology PROJECT D43A

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D43A Advanced Weaponry Technology Demonstration	17658	18763	11809	9862	20263	18649	19540		Continuing	Continuing

A. Mission Description and Justification: Project D43A - Advanced Weaponry Technology Demonstration: This project includes most of the stand-off weapon candidates for the Rapid Force Projection Initiative (RFPI) and lethality enhancements under the Direct Fire Lethality Program. Weapon demonstrations are vital to assessing new tactics and technologies for Early Entry Forces to defeat armor. Collectively, weapons under RFPI constitute stand-off killer options for a "Hunter/Stand-off Killer" approach. The Precision Guided Mortar Munition (PGMM) demonstration will feature an affordable, extended range, top-attack, anti-armor capability for light forces. It has included assessments of both 81mm and 120mm non-developmental item candidates and will demonstrate a 120mm PGMM. Large footprint, smart munition sensor technologies applicable to the Multiple Launch Rocket System (MLRS) will also be evaluated. Increased sensor footprints are important to provide capabilities to attack moving targets. Towed howitzer fire control enhancements applicable to both Army and Marine Corps artillery requirements are included under the RFPI ACTD. A 105mm guided projectile will be evaluated in FY 97. An extended range artillery projectile (XM982) demonstration will provide required technology for resolving the Army's artillery range deficit. The XM982 is a 155mm artillery cargo projectile that uses both rocket assist and back burn to achieve longer range, up to 47 kilometers with the Crusader solid propellant system. The XM982 program will demonstrate the technical feasibility and operational potential of this projectile, including accuracy enhancements afforded by an autoregistration fuze. The XM982 component technology and autoregistration fuze transitioned from applied research activities funded under PE 0602624A and PE 0602618A. Innovative applications for Electro-Rheological (ER) fluids are also being demonstrated for use in next generation artillery recoil mechanisms. Most of the concepts to be demonstrated are candidates for technology insertions and most provide significant enhancement to Early Entry Forces. In-house efforts are accomplished by Armament Research Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Major contractors include: Alliant Tech Systems, Minneapolis, MN; Science Applications International Corp (SAIC), McLean, VA; LTV Aerospace, Dallas, TX; Textron, Lowell, MA; Ferrulmatic, Inc., Totowa, NJ; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; Olin-Flinchbaugh, Red Lion, PA; Textron, Inc., Willington, MA; Technical Solutions Incorporated (TSI), Mesina Park, NM; Motorola, Scottsdale, AZ; and Lockheed Martin, Sunnyvale, CA.

FY 1995 Accomplishments:

- 10644 - Completed critical component lab testing of seeker components prior to seeker captive flight testing; completed system effectiveness analysis of PGMM system against both armored vehicles and earth and timber bunkers; completed test and evaluation of mortar fire control azimuth reference units; conducted 120mm subsystem development and common seeker flight tests.
  - Completed Laser Detecting and Ranging (LADAR) sensor testing; redirected program to MLRS Smart Tactical Rocket (MSTAR) study candidate, Autonomous Intelligent Submunition (AIS-Damocles); delivered AIS-Damocles end-to-end submunition simulation; completed real time algorithm software; initiated real time captive carry test.
  - Developed towed howitzer advanced fire control unit baseline.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology
	PROJECT D43A

FY 1995 Accomplishments: (continued)

		- Demonstrated insensitive explosive technology for The Army Combined Arms Weapon System (TACAWS)/Javelin warheads.
•	7014	- Developed and initiated validation of E-R fluids system control software. - Increased XM982 loading density through scalloped body manufacture process; demonstrated gun fired imbedded fuze prototype at zone 8 confirming fuze survivability and functionality; manufactured and dynamically tested high energy aluminized and non-aluminized front rocket grains. - Accelerated Alliant contract to develop acoustic sensors and funded work by Penn State University in support of RFPI acoustic sensor effort.
Total	17658	

FY 1996 Planned Program:

•	10292	- Continue contractor effort for PGMM subsystem integration and testing; conduct hi-g testing of seeker, guidance and control and projectile structural components; conduct 120mm PGMM projectile extended range glide test out to eight km; procure mortar fire control lightweight components. - Accelerate the PGMM All Up Round Demonstration Test Series to meet the RFPI ACTD experiments and User Extended Evaluation Milestones; develop a PGMM Mortar Fire Control Simulator for use in RFPI experiments and user exercises. - Fabricate full-scale E-R fluids Proof-of-Principle hardware and integrate into an M198 howitzer for demonstration.
•	8020	Complete AIS-Damocles captive carry test against real time critical targets and incorporate target models for RFPI Advanced Concept Technology Demonstration (ACTD) testing. - Complete XM982 Advanced Development (budget activity 3) design in preparation for transition to PEO-Field Artillery Systems for EMD (budget activity 5). - Procure and fabricate towed howitzer advanced, digitized fire control units for system integration and testing.
•	398	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
•	53	- Revised economic assumption not available for execution.
Total	18763	

FY 1997 Planned Program:

•	11809	- Conduct 105/120mm common seeker captive flight test; develop software for mortar fire control ballistic computer. - Conduct AIS-Damocles captive carry test against RFPI targets and participate in RFPI ACTD simulation as an advanced concept. - Fabricate and test towed howitzer fire control units (six modified howitzers) for RFPI ACTD training.
Total	11809	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

PROJECT: D43A

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	18454	10298	12162
Appropriated Amount (FY 1995)	18067		
Adjustment to FY 1995	-409		
Appropriated Amount (FY 1996)		18953	
Adjustment to FY 1996		-190	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-353
Current President's Budget Submit	17658	18763	11809

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603004A Weapons and Munitions Advanced Technology

PROJECT: D232

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D232 Advanced Munitions Demonstration	1729	5100	5772	12047	11574	16587	16962		Continuing	Continuing

A. Mission Description and Justification: Project D232 - Advanced Munitions Demonstration: The Direct Fire Lethality Program will enhance tank kinetic energy (KE) penetrator lethality, particularly against explosively reactive armor (ERA) appliqué arrays, through use of a precursor defeat mechanism. The program will demonstrate range and lethality enhancements for tank munitions and demonstrate the emerging technologies need to defeat the active protection system (APS) threat. In the near term, this project demonstrates advanced warhead and cartridge concepts, utilizing novel explosively formed penetrators (EFP) and Shaped Charged designs, that can be applied to product improvements to fielded and developmental anti-armor munitions, e.g., Autonomous Intelligent Submunition (AIS-Damocles), Wide Area Munitions (WAM), Smart Target Activated Fire and Forget (STAFF), 120mm Chemical Energy (CE) Cartridge and The Army Combined Arms Weapons System (TACAWS). It advances warhead technology to enhance the lethality of smart projectiles by providing multi-role, multi-effect warheads capable of defeating point and area targets. This project will fund demonstrations of advanced fuzes for near term munitions concepts. Low Cost Competent Munition (LCCM) concepts integrating Global Positioning System (GPS), fuzing, and possibly guidance and control (G&C) technology are being developed for artillery projectiles. The resulting screw-on module will significantly increase a projectile's overall delivery accuracy and also be readily applicable to the existing stockpile of 155mm artillery projectiles. In-house efforts are accomplished by Armament Research Development and Engineering Center, Picatinny Arsenal, NJ and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Major contractors include: Alliant Tech Systems, Minneapolis, MN; Science Applications International Corp (SAIC), McLean, VA; LTV Aerospace, Dallas, TX; Textron Defense Systems, Wilmington, MA; Ferrulmatic, Inc., Totowa, NJ; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; and Olin-Flinchbaugh, Red Lion, PA.

FY 1995 Accomplishments:

•	1729	- Optimized grid design of selectable EFP and dual liner EFP warheads. - Fabricated and conducted static test of selectable EFP warhead. - Designed combined effects warhead.
Total	1729	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603004A Weapons and Munitions Advanced Technology
	PROJECT D232

FY 1996 Planned Program:

•	4980	- Demonstrate 25% increase in armor penetration in a top attack submunition type warhead.
		- Evaluate warhead lethality against reactive range targets.
		- Develop integrated KE precursor penetrator for concept demonstration against explosive reactive armor.
		- Formulate concept advanced dual EFP liner warhead for STAFF lethality upgrade to defeat advanced armors.
•	105	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
•	15	- Revised economic assumption not available for execution
Total	5100	

FY 1997 Planned Program:

•	5772	- Conduct integrated KE precursor concept demonstration for defeat of ERA.
		- Design/develop enhanced STAFF EFP warhead and conduct warhead function demonstrations.
		- Define final prototype LCCM Auto-Registration system design for FY98 flight testing.; refine and test GPS translator components.
Total	5772	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	1802	5242	6158
Appropriated Amount (FY 1995)	1764		
Adjustment to FY 1995	-35		
Appropriated Amount (FY 1996)		5150	
Adjustment to FY 1996		50	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-386
Current President's Budget Submit	1729	5100	5772

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	60381	27401	31552	32104	60243	67210	66282		Continuing	Continuing
DC62 Tractor Union	0	0	3266	18667	26500	17494	12345		Continuing	Continuing
D221 Combat Vehicle Survivability	13755	12090	4758	678	675	1625	949		Continuing	Continuing
D440 Advanced Combat Vehicle Technology	31944	11777	13507	2757	20896	34715	37915		Continuing	Continuing
D441 Combat Vehicle Mobility Technology	2183	2565	4203	3821	4818	4780	5698		Continuing	Continuing
D497 Combat Vehicle Electronics	9785	969	5818	6181	7354	8596	9475		Continuing	Continuing
D502 HAECO II	2714	0	0	0	0	0	0		0	2714

Mission Description and Budget Item Justification: This program demonstrates the feasibility and operational potential of technologies which contribute to upgrades of fielded combat vehicles and more advanced ground combat systems. It places emphasis on solutions to post-Cold War deficiencies, providing opportunities for more affordable, deployable, survivable, horizontally integrated and lethal power projection capabilities than are currently available. The technology areas supported by this program element include: survivability, mobility, digital intra-vehicular electronics, and integration of diverse vehicle technologies developed by the Army, other DoD laboratories and industry. Initiatives conducted under this program element that support land combat on the horizontal battlefield include the introduction of: composite materials to reduce the weight of ground vehicle components, vehicle structures and armor; integrated survivability to increase survivability with less weight burden than ballistic armor and better capabilities against smart or precision guided munitions; combat vehicle crew size reduction through automation of crew functions and better crew/vehicle integration; advanced mobility technologies to improve agility, propulsion system size and weight reduction; and lower operation and support costs by implementation of a low cost, non-developmental advanced combat vehicle electronics and commercially based electronics architecture with digitized vehicle sub-systems. Work in this program element is consistent with the resource constrained Army Science & Technology Master Plan, Science and Technology Objectives and the Army Modernization Plan. This program is managed primarily by the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC). This program adheres to Tri-Service Reliance Agreements on advanced materials, fuels and lubricants, and ground vehicles, with oversight and coordination provided by the Joint Directors of Laboratories. Work in this program element is related to and fully coordinated with PE 0602601A (Combat Vehicle and Automotive Technology) and contains no unwarranted duplication of effort among the Military Departments. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore properly placed in Budget Activity 3.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D221

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D221 Combat Vehicle Survivability	13755	12090	4758	678	675	1625	949		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project D221 - Combat Vehicle Survivability: This project demonstrates near term, advanced technologies for hemispherical protection against smart, precision guided and other munitions threats to ground combat vehicles . A front end battlefield operational effectiveness analysis (Project Guardian) identified the highest payoff sensors and countermeasures to focus the Hit Avoidance (HA) Advanced Technology Demonstrator (ATD). Program emphasis is placed on the HA ATD and rapid transfer of survivability technologies to current systems (i.e., Abrams tank and Bradley fighting vehicle). The ATD's goals are to demonstrate technical feasibility and develop system specifications for a low cost, active protection system for the physical disruption of smart, horizontal attack, chemical energy (CE) threat munitions, field test a vehicle self-protection system capable of close in detection of high velocity, low front-end radar cross-section kinetic energy (KE) threat munitions, provide sensor/countermeasure engineering performance models, and develop and transfer hardware/software of a universal threat resolution module (TRM), which will act as a commander's decision aid, to engineering development for current systems. The TRM will provide the "brains" to interpret and fuse sensor input data, select and activate appropriate countermeasures, manage expendable inventory and increase situational awareness. An ongoing contract for an Integrated Defense System (IDS) is the mechanism for accomplishing these goals. This project will provide hardware performance and modeling predictions for a cost effective, operationally optimal suite of threat sensors and countermeasure devices. Coupled with other combat vehicles assets, force protection and increased situational awareness capabilities could then be realized. This enhanced vehicle survivability will extend the fighting life of the vehicle and result in a force multiplying effect and greater life cycle savings for the vehicle fleet. Survivability technologies that are integrated and demonstrated under this project include those transitioned from the following exploratory developmental programs; active protection countermeasure technology development (PE 0601102A); sensors and countermeasures (PE 0602270A). Alternative fire extinguishing agents that are non-ozone depleting are needed to maintain vehicle survivability. In FY 1995 only this project funds evaluation of non-ozone depletion substances purchased from Dupont Inc., Deepwater, NJ and Great Lakes Chemical, Lafayette, IN. Starting in FY 1996, this activity appears under PE 0602601A, a more appropriate PE for the nature of the work being performed. Major contractors include: United Defense LP. of San Jose, CA and includes Sanders, a Lockheed Martin Company in Nashua, NH., TRW of Los Redondo Beach, CA., and Dynetics, Inc. in Huntsville, AL, Hughes Danbury, Danbury Conn., TASC, Reading, Mass.

FY 1995 Accomplishments:

- 8710 - Awarded a competitive contract for the HA ATD; identified and assessed sensor and countermeasure concepts for low cost active protection system (APS) for protection against smart, horizontal attack, chemical energy (CE) threat munitions; identified threat sensor and countermeasure models for use in the test and development of the TRM decision aid; developed system specifications defining the capabilities and functions of the IDS.
  - Conducted field evaluation to determine applicability of laser countermeasures for combat vehicle applications with Hughes Danbury of Danbury, CT.
  - Continued contract to develop the hardware integration laboratory environment for performance analysis with TASC of Reading, MA.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology
	PROJECT D221

FY 1995 Accomplishments: (continued)

•	5045	- Modified combined arms and support task force evaluation model (CASTFOREM) to better represent smart weapons and electronic warfare (EW) countermeasures. - Conducted integration, crew performance and Tier 1 acute (short term single exposure) toxicity testing on environmentally acceptable non-ozone depleting fire extinguishing agents.
Total	13755	

FY 1996 Planned Program:

•	6572	- Optimize design and initiate fabrication of low cost active protection concept for protection against smart, horizontal attack, chemical energy (CE) threat munitions based on component field test evaluations of radar sensor, countermeasure options, and countermeasure launcher. - Award a competitive contract for the development, testing and analysis of an armored vehicle self-protection system capable of close in detection and destruction of high velocity, low front-end radar cross section KE rounds as directed by Congress. - Complete the development and acquisition of sensor and countermeasure emulators for the evaluation of the TRM.
•	5229	- Develop and integrate sensor fusion algorithms for threat identification and location into a commander's decision aid for automation of crew responses. - Perform cost effectiveness analysis to determine optimal survivability suite approach for the ground combat vehicle fleet through joint User evaluation.
•	255	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
•	34	- Revised Economic Assumption not available for execution.
Total	12090	

FY 1997 Planned Program:

•	4758	- Field demonstration of a low cost active protection system to defeat smart, horizontal attack, chemical energy (CE) threat munitions and develop system specifications for this system. In addition perform a field test on a self-protection system capable of close in detection of high velocity, low front-end radar cross-section kinetic energy (KE) threat munitions. - Demonstrate the commander's decision aid and provide system specifications (including software in standard ADA code and necessary documentation for Engineering Manufacturing Development (EMD) application). - Update operational effectiveness analysis to complete affordability assessment with validated threat sensor and countermeasure performance data.
Total	4758	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology
	PROJECT D221

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	14231	11429	9263
Appropriated Amount (FY 1995)	13932		
Adjustment to FY 1995	-177		
Appropriated Amount (FY 1996)		12212	
Adjustment to FY 1996		122	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-4505
Current President's Budget Submit	13755	12090	4758

Change Summary Explanation:

Funding: FY97: Funds (-4505) reprogrammed for higher priority requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D440

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D440 Advanced Combat Vehicle Technology	31944	11777	13507	2757	20896	34715	37915		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project D440 - Advanced Combat Vehicle Technology: This project demonstrates the operational potential, technical feasibility and maturity of advanced combat vehicle technologies for potential product improvements and for the next generation of 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 simulation and full-scale mock-ups, thereby accomplishing more rapid transition of advanced technologies to systems applications and seamless transition to development. All demonstrations include User and Developer teaming in field and/or laboratory environments. Efforts are focused on ATDs which examine technologies applicable to lighter weight and more survivable systems that offer significantly improved deployability over currently fielded combat vehicles. This project funds one major initiative in the near term, completion of the Composite Armor Vehicle (CAV) ATD to demonstrate use of advanced composite materials for ground vehicles. The CAV ATD will demonstrate a vehicle structure made of composite materials with advanced lightweight armor technology which can significantly reduce weight while improving survivability. Many issues, such as automotive durability, ability to withstand weapon firing shock, manufacturing methods and technology, reparability, ballistic performance, and nondestructive testing, remain to be resolved before composite technology can be transitioned to ground combat vehicle systems. The project also funds a modified, non-developmental item, light vehicle to perform as "hunter" for the Rapid Force Projection Initiative (RFPI) "hunter/stand-off killer" concept. This project provides the mechanism to transition promising ground system technologies to vehicle project managers for development. Vehicles supported with advanced concepts and technologies include Abrams tank upgrades and tank options, the M2/M3 Bradley and other ground vehicles. United Defense, Limited Partnership, San Jose, CA is the prime contractor for the CAV ATD.

FY 1995 Accomplishments:

- 9207 - Initiated government/contractor technology assessment and completed mobility platform baseline concepts; developed CAV Finite Element Analysis (FEA) computer models to predict the global and local structural response to various load cases.
  - Completed preliminary design of demonstrator; analyzed ground combat vehicle structural load cases.
  - Awarded a subcontract for composite manufacturing and producibility assessments; analyzed prospective composite manufacturing techniques using producibility assessments, manufacturing quality analysis and affordability parameters as selection criteria.
- 13939 - Fabricated structural test coupons for process proveout and producibility verification, and selected the best manufacturing techniques for the ATD.
  - Developed primary ballistic solutions through analytical modeling and testing; shipped targets to government test laboratory.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D440

FY 1995 Accomplishments: (continued)

- Performed testing on the proposed composite materials to determine their mechanical, flammability, chemical/environmental, electrical and thermal properties; assessed these properties in structural models to determine the adequacy of the design; designed and performed structural component testing of highly stressed regions of the hull; designed and fabricated all test specimens and test fixturing; correlated the results with computer model predictions.

• 8798	- Designed and fabricated two full-scale subsections of the hull design for structural testing and assembly; procured long lead subsystems for the demonstrator. - Developed designs for all ancillary vehicle subsystems (e.g., propulsion, electrical, suspension, etc.). - Developed multi-spectral appliqué camouflage and constructed initial Rapid Force Projection Initiative (RFPI) force-on-force simulations and delivered a virtual prototype simulator to Dismounted Battlespace Battle Lab.
Total 31944	

FY 1996 Planned Program:

• 11527	- Approve CAV final design; using advanced composite manufacturing techniques, fabricate two composite hull structures, one for the CAV ATD test vehicle, the other for structural load limit testing and system ballistic performance testing. - Demonstrate and validate the composite hull interfaces of the CAV ATD hull sample sections for automotive, crew, and weapon station subsystems. - Fabricate and test integrated composite structure/armor ballistic panels. - Perform a Battle Lab Warfighting Experiment (BLWE) with soldiers to verify battlefield reparability of composites. - Integrate the scout sensor suite on surrogate Hunter vehicle and conduct automotive testing.
• 217	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
• 33	- Revised Economic Assumption not available for execution.
Total 11777	

FY 1997 Planned Program:

• 9507	- Assemble all automotive components on composite hull to complete the CAV ATD test vehicle.
•	- Perform large caliber weapon firing test to confirm hull structural integrity during gun firing.
•	- Perform and document automotive performance to validate the capability of the hull structure to perform over various terrains and obstacles.
• 4000	- Perform and document 6000 mile durability testing to validate the capability of the CAV structure to withstand combat vehicle life cycle fatigue loads and determine the structure's reliability.
•	- Prepare a composite design guide for combat vehicles.
Total 13507	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology PROJECT D440

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	31660	15554	15515
Appropriated Amount (FY 1995)	31067		
Adjustment to FY 1995	877		
Appropriated Amount (FY 1996)		11897	
Adjustment to FY 1996		-120	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-2008
Current President's Budget Submit	31944	11777	13507

Change Summary Explanation:

Funding: FY97: Funds (-2008) reprogrammed for higher priority requirements.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D441

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D441 Combat Vehicle Mobility Technology	2183	2565	4203	3821	4818	4780	5698		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u>: **Project D441 - Combat Vehicle Mobility Technology:** This project demonstrates mobility technology (suspension , track, engines, transmissions, and auxiliaries) vital for lighter, more agile, more deployable ground combat vehicles. It funds an advanced mobility technology demonstration comprised of several independent demonstrations. The principal elements of the mobility demonstration are semi-active suspension, electric drive, and light weight track. Military requirements for vehicle mobility are unique because of (1) a need for a stable, smooth ride at high speeds (greater than 20 mph) over rough, cross country terrain (off-road), (2) a need for the mobility components to be as small and as light as possible in order not to detract from the vehicle's primary, war-fighting mission, and (3) a need for armor and signature management, which complicate the engine air intake and exhaust systems. High speed is required to accomplish the maneuver-dominant warfare envisioned in the Air-Land battle doctrine. A smooth ride is necessary for weapon targeting on the move and for crew comfort and endurance, which are features embedded in the doctrine. The lighter and smaller vehicles are necessary for enhancing deployability and lessening the logistics burden (fuel), but such vehicles will significantly degrade ride performance and mobility limits compared to larger, heavier vehicles without new mobility technology advances. For the next decade, the mobility thrusts required to compensate for smaller and lighter systems are: electric drive (small internal propulsion size and weight), active suspension (increased vehicle stability and higher speed on rough terrain), and light weight track (reduced system weight and track noise). Electric drive offers unique new capabilities, such as high torque and quiet operation; however, it presents new challenges, especially in cooling of electronic components. In-house efforts are accomplished by the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Other Government Agencies include: Waterways Experiment Station, Vicksburg, MS; Army Research Laboratory, Adelphi MD. Major contractors include: Teledyne Vehicle Systems, Muskegon, MI; Pentastar Huntsville, AL; United Defense Limited Partnership, San Jose, CA; Michigan Technological University, Houghton MI.

FY 1995 Accomplishments:

- - Completed the integration of the dynamic track tensioner and external suspension system and conducted initial shake-down testing.
  - Completed installation and initial shake-down testing of the advanced band track on a conventional M113 armored personnel carrier as a cost effective test bed to evaluate mobility and durability characteristics.
  - Completed installation of a band track on the Electric Drive M113 test bed to evaluate signature advantages of band track on a quieter vehicle.

Total 2183

FY 1996 Planned Program:

- 1205 - Initiate joint cooperative program (Army, USMC, ARPA) for integrated electric drive for tracked combat vehicles.
  - Procure semi-active suspension 30 ton weight class combat vehicle.
  - Procure/integrate advanced high wheel travel HMMWV independent suspension for evaluation.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology
	PROJECT D441

FY 1996 Planned Program: (continued)

•	1324	- Perform experimental evaluation on advanced track configurations (band and titanium). - Perform an analysis of high power density tank propulsion packaging. - Conduct mobility analysis of vehicle concepts that have electric drive, advanced suspension, and advanced track components.
•	28	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
•	8	- Revised Economic Assumption not available for execution.
Total	2565	

FY 1997 Planned Program:

•	1163	- Evaluate cooling systems for electric drive electronics. - Test 30 ton weight class combat vehicle semi-active suspension in test vehicle. - Test high wheel travel, heavy vehicle independent suspension system.
•	1085	- Test band track on 30 ton weight class combat vehicle. - Compare concept for high power density propulsion system for advanced tank. - Procure active suspension (electric) component for scout vehicle application.
•	1955	- Contract for 30 ton weight class combat vehicle active suspension. - Test and analyze 30 ton weight class combat vehicle electric drive system. - Contract for electro-mechanical transmission for up to 30 ton weight class combat track vehicle.
Total	4203	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2282	2637	4329
Appropriated Amount (FY 1995)	2234		
Adjustment to FY 1995	-51		
Appropriated Amount (FY 1996)		2591	
Adjustment to FY 1996		-26	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-126
Current President's Budget Submit	2183	2565	4203

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D497

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D497 Combat Vehicle Electronics	9785	969	5818	6181	7354	8596	9475		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project D497 - Combat Vehicle Electronics: This project demonstrates the digital electronic technologies required to integrate advanced computing architectures and control data/power distribution within ground combat vehicles. This project is essential to achieve horizontal technology integration on the digitized battlefield. This project also funds improvements in ground vehicle soldier machine interfaces (SMI) by designing advanced crew station configurations for current combat vehicle upgrades and advanced vehicle designs with a 50% crew workload reduction. This project funds the Crewman's Associate advanced technology demonstration (CA ATD). Using soldier-in-the-loop laboratory experiments and modeling, CA ATD will demonstrate significant crew station performance enhancements over existing combat vehicles through the application of advanced interface technologies (e.g., helmet mounted displays, panoramic displays, voice interfaces). Laboratory experiments will be used to allow the User to continuously influence and evaluate the capabilities of the CA ATD crew station design and to refine overall system requirements prior to building more extensive hardware prototype and vehicles. This effort coordinates the SMI and electronics requirements of several ATDs (Hit Avoidance, Target Acquisition, and Combined Arms Command and Control) to ensure effective integration of their technologies. This project funds the development of the next generation of VETRONICS Open Systems Architecture (VOSA). This will be a nonproprietary open systems electronics integration architecture based on commercially available standards and components. This architecture improves upon the current state-of-the-art ground vehicle integration architectures providing a data transfer rate 100 times greater than the current architecture being used in today's digitized combat vehicles. This improved data rate will be necessary to process the increased amount of data and imagery from advanced digital displays, digital combat identification, advanced sensors and the digitized battlefield. This architecture is critical to the integration of advanced sensors and countermeasures, advanced target acquisition technologies and digital communications into modern combat vehicles. Both CA ATD and VOSA are required to support Program Executive Office Armored Systems Modernization (PEO ASM) preplanned product improvement (P3I) opportunities for the existing fleet (e.g., Abrams, Bradley), contribute to Crusader development, and support other vehicle development programs such as the scout vehicle.

FY 1995 Accomplishments:

•	7535	- Completed advanced crew station design for 50% crew workload reduction.
		- Continued crew station design for Abrams upgrade for improved SMI to digitized battlefield.
		- Initiated fabrication and integration of crew station hardware and software to measure crew workload reduction.
•	2250	- Conducted M1A2 Battle Lab Warfighting Experiment (BLWE) experiments to establish baseline (four-man crew) reference data.
		- Conducted BLWE under dynamic conditions to analyze crew station interfaces under simulated warfighting conditions.
		- Implemented design and development of an open electronics architecture, using commercial standards.
Total	9785	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603005A Combat Vehicle and Automotive Advanced Technology
	PROJECT D497

FY 1996 Planned Program:

•	967	- Conduct laboratory experiments/BLWE's to demonstrate an improved SMI for an upgrade to the Abrams tank and an advanced two-man crew station (50% workload reduction). - Complete Crewman's Associate Final Test/Design Report; CA ATD complete.
•	2	- Revised Economic Assumption not available for execution.
Total	969	

FY 1997 Planned Program:

•	3124	- Initiate VETRONICS Open Systems Architecture (VOSA), based on commercial standards, which provides performance improvements 100 times greater than current combat vehicle architectures. - Demonstrate and validate improvements of VOSA performance in the VETRONICS Systems Integration Laboratory (VSIL) environment. - Integrate appliqué software leveraged from CECOM contract with TRW for command and control functions in the VSIL.
•	2694	- Initiate link between VSIL and CECOM's Digital Integration Laboratory (DIL) to define integrated C4 architecture. - Provide critical support to User community to integrate the crew and architecture performance improvements environment to enable the User to evaluate the warfighting enhancement provided by these improvements. - Initiate development of System Integration Laboratory for advanced vehicle crew station using fieldable hardware and software.
Total	5818	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	10214	996	1991
Appropriated Amount (FY 1995)	10004		
Adjustment to FY 1995	-219		
Appropriated Amount (FY 1996)		979	
Adjustment to FY 1996		-10	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			3827
Current President's Budget Submit	9785	969	5818

Change Summary Explanation:

Funding: FY97: Funds (3827) provided to accelerate development of two man crew stations for heavy combat vehicles.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603005A Combat Vehicle and Automotive Advanced Technology

PROJECT: D502

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D502 HAECO II	2714	0	0	0	0	0	0		0	2714

A. Mission Description and Budget Item Justification: Project D502 - HAECO II: This Congressionally-directed projects calls for the further development and delivery for test of two Hope - Anderson Engine Company (HAECO) engines in the 400 to 600 horsepower range for potential ground or air vehicle use. HAECO II is a hybrid engine that uses both diesel engine and gas turbine elements. The Army will contract with HAECO to complete development of two engines for delivery to the Army for testing at the U.S. Army Tank-Automotive and Armaments Command.

FY 1995 Accomplishments:

•	2714	- Procure and test two HAECO combined cycle engines in the 400 to 600 HP range. (To be accomplished in FY 1996.)
		- Evaluate the contractor's development progress. (To be accomplished in FY 1996.)
Total	2714	

FY 1996 Planned Program: Project completed.

FY 1997 Planned Program: Project completed.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2959	0	0
Appropriated Amount (FY 1995)	2897		
Adjustment to FY 1995	-183		
Appropriated Amount (FY 1996)			
Adjustment to FY 1996		0	0
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current President's Budget Submit	2714	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communication Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	16293	21806	23120	19215	20448	18580	17880		Continuing	Continuing
D247 Tactical C4 Technology Integration	7681	5362	7427	8043	12862	11462	10713		Continuing	Continuing
D257 Digital Battlefield Communications	8381	10579	11981	8660	5371	4776	4841		Continuing	Continuing
D592 Space Applications Technology	231	2947	3712	2512	2215	2342	2326		Continuing	Continuing
D596 Field Laser Radar Demo	0	2918	0	0	0	0	0		0	2918

Mission Description and Budget Item Justification: This program element consists of projects that will advance command, control, and communications (C3) technology to provide the soldier with high quality real-time battlefield information and integrate space technologies into Army tactical applications. The tactical C4 technology integration project provides software application development demonstrations, communications system integration and prototype products for distributed, mobile, secure, fully automated spread spectrum radio networks with measures to enhance the survivability, efficiency and efficacy of Army tactical command, control, communications and computer (C4) systems. This program specifically addresses joint service demonstrations coordinated through the joint directors of laboratories (JDL) technology panel for C4, and provides key demonstrations of systems integration across the Army's battlefield functional areas. The survivable adaptive system (SAS) technology demonstration will provide multimedia inter networked communications while on-the-move (OTM) with commercial standard gateway connectivity to both high-speed and legacy communications assets. This program also tests and evaluates net radio, common user, and distributed communications equipment and automated spectrum management aids which have potential to solve user needs; tests and evaluates equipment deficiencies; and provides critical future capabilities and supports new radio development and evaluation, in conjunction with the Advanced Research Projects Agency (ARPA) and the Air Force (AF). The digital battlefield communications project will support the Army's battlefield digitization effort by demonstrating technology to integrate communications hardware and software capable of providing seamless communications for the digitized battlefield to meet emerging requirements for high-capacity/OTM information exchange and leading to a battlefield information transmission system (BITS) for Force XXI. The space applications technology project will demonstrate novel applications of space assets for Army missions and support space technology integration. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. Work in this program element is related to and fully coordinated with efforts in PE 0602782A (Command, Control and Communications Technology), PE 0203740A (Maneuver Control System), PE 0203726A (Advanced Field Artillery Tactical Data System), PE 0602783A (Computer and Software Technology), PE 0602702E (Tactical Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and PE 0603789F (C3I Technology Development) in accordance with the ongoing Reliance Joint planning process. Efforts under Projects D247 (Tactical C3 Technology Integration) and D257 (Digital Battlefield Communications) are performed

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communication Advanced Technology

primarily by the US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Space and Terrestrial Communications Directorate, Fort Monmouth, NJ. Contractors include: SRI International, Menlo Park, CA; Mitre Corporation and Booze-Allen and Hamilton, Eatontown, NJ; Hazeltine, Greenlawn, NY; Rockwell International, Richardson, TX; and Jet Propulsion Laboratories, Pasadena, CA. Work under D592 (Space Applications Technology) is managed primarily by the U.S. Army Space and Strategic Defense Command (USASSDC), Alexandria, VA. Work in this program element is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is correctly placed in Budget Activity 3.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communication Advanced Technology

PROJECT: D247

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D247 Tactical C4 Technology Integration	7681	5362	7427	8043	12862	11462	10713		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project D247 - Tactical C4 Technology Integration:** This project develops computer and communications technology options using commercial standard hardware and software to support battlefield decision making for the five battlefield functional areas of maneuver. These efforts support evolving Army requirements for automated, real-time, digital information transfer, and the development and demonstration of communication systems needed for the combined arms command and control (CAC2) program. This project also performs development of ultra-high frequency (UHF) satellite communications (SATCOM) on-the-move (OTM), interfaces mobile UHF SATCOM radios to combat net radios (CNR) technology using commercial standard packet data protocols, and is developing multiband, multimode radio (MBMMR) technologies as part of the Joint Service "Speakeasy" program with the Air Force and the Advanced Research Projects Agency (ARPA).

FY 1995 Accomplishments:

- 1897 -Conducted laboratory demonstration of wideband (high capacity) wireless local area network (LAN) to handle Ethernet, voice, and fiber optic data distribution interface for survivable adaptive system (SAS).
- 3404 -Conducted laboratory test of all SAS technologies to demonstrate interoperability and survivability of communication systems. Participated in the joint warfighting interoperability demonstration (JWID 95) using SAS technologies.
- 1780 -Completed phase 1 and initiated phase 2 development of multiband multimode radio (MBMMR) leading to all digital, reprogrammable, vehicular prototypes.
- 600 -Procured commercially available direct broadcast system receivers for laboratory testing and Task Force XXI advanced warfighting experiment (AWE).

Total 7681

FY 1996 Planned Program:

- 1970 -Develop direct broadcast system capability as part of a joint program to demonstrate the potential applications for using the technology with standard Ku-band satellites and ground segments.
  -Investigate the feasibility and benefits of a terrestrial personal communications systems (PCS) by demonstrating the capability with legacy systems, mobile subscriber equipment for Task Force XXI.
  -Develop and demonstrate surrogate digital radio (SDR) technology during TF XXI to determine the effectiveness of passing high-volume digital traffic through a network in a battlefield situation.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communication Advanced Technology PROJECT D247

FY 1996 Planned Program: (continued)

		-Demonstrate internet protocol (IP) tactical end to end encryption devices (TEED), in support of field exercises.
•	3277	-Demonstrate autonomous battlefield satellite PCS capability. -Integrate ATM into legacy communication systems. -Continue development of Speakeasy Phase 2 MBMMR engineering prototypes and test modifications to software/hardware for adequate emulation of waveforms.
•	13	-Revised economic assumption not available for execution.
•	102	- SBIR/STTR.
Total	5362	

FY 1997 Planned Program:

•	2350	-Develop and demonstrate on-the-move surrogate direct broadcast satellite (DBS) capability that will provide DBS-like capability to areas and situations without regard to satellite access limitations for both stationary and moving platforms. -Develop technology options for military use of commercial personal communication systems (PCS) technology for wireless access into the Army's mobile subscriber equipment (MSE). -Conduct field tests of the wideband packet surrogate digital radio in the TF XXI AWE. -Demonstrate wideband high frequency communication technology, with access to the tactical internet, for transmitting maneuver and intelligence data beyond line of sight for long range surveillance units.
•	5077	-Conduct communication experiments with other services over the defense information systems network (DISN)/ leading edge services (LES) interconnection. -Continue the Speakeasy development of an open system architecture for a software reprogrammable simultaneous four-channel multiband multimode radio (MBMMR) which allows rapid change over of wave forms, frequency bands (2-2000 MHz), internetworking protocols (cross channel), voice/data modes, and information security (INFOSEC) algorithms leading to an Army demonstration in a tactical vehicle configuration. -Develop an initial prototype of a conformal phased array antenna for radio access point communications on-the-move requirements. -Develop and demonstrate transponders and antennas (surrogate satellite payloads) for legacy UHF, SHF, EHF satellite communications to overcome limitations of satellite availability for tactical users.
Total	7427	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communication Advanced Technology PROJECT D247

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	7887	5570	8148
Appropriated Value (FY 1995)	7735		
Adjustments to FY 1995	-54		
Appropriated Value (FY 1996)		5417	
Adjustments to FY 1996		-55	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-721
Current President's Budget	7681	5362	7427

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communication Advanced Technology

PROJECT: D257

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D257 Digital Battlefield Communications	8381	10579	11981	8660	5371	4776	4841		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project D257 - Digital Battlefield Communications:** The objective of this project is to integrate communications hardware and software capable of providing seamless, multimedia communications for the digitized battlefield, designed to meet emerging requirements for high capacity, on-the-move (OTM) information exchange. Force projection and evolving doctrine are expected to require significantly more communications bandwidth, drastically altered traffic patterns, new services (e.g. imagery), and higher mobility, especially at echelons brigade and below, than is currently supported by today's communications systems. This project will develop and demonstrate a series of products, through an evolutionary process, capable of transitioning into field units to support the future digitized brigade, division and corps. Through an extensive modeling and simulation activity, the project will build on early system performance models begun under the combined arms command and control (CAC2) program, in order to identify appropriate non-developmental wideband communications systems to supplement the data capacity of existing lower echelon networks. Once data "hot spots" and congestion points are identified in the existing architecture, warfighter demonstrations will be used to demonstrate the warfighter benefit of added capacity at key locations on the digitized battlefield, and to identify and size fieldable deployment packages consisting of wideband digital communications and support devices to supplement existing tactical communications systems. Technology demonstration units of wide-bandwidth digital radios will be required. Laboratory demonstrations and protocol development to permit asynchronous transfer mode (ATM) traffic to interface with tactical radio/satellite equipment will be conducted. A mobile radio access point (RAP) consisting of a high capacity, OTM trunk radio, powerful portable switch (ATM or other) and legacy wide bandwidth digital subscriber networks will be developed and evaluated by troops in the field. The RAP will provide a high bandwidth OTM trunk feed in support of combat net radio, single channel radio access (SCRA), and wideband data subscribers, all communicating OTM. Network planning tools and dynamic internetwork management schemes will be exploited for both pre-battle communications planning and dynamic reconfiguration during deployment. Development of OTM antennas begun in prior years will be extended to provide fieldable, low profile antennas better suited to OTM wideband needs to connect forward mobile elements in split based deployments. Wideband airborne communications relays will be developed and evaluated for warfighter utility in achieving range extension at high data rates. Commercial personal communication systems (PCS) and direct broadcast satellite (DBS) will be evaluated for possible tactical exploitation.

FY 1995 Accomplishments:

- 925 -Developed, linked and networked models, enhanced system performance models and developed trunk radio simulation; evaluated alternative architectures.
- 2327 -Demonstrated tactical radio and satellite communications interface to commercial-off-the-shelf (COTS) asynchronous transfer mode (ATM) products
- 1045 -Developed ultra high frequency (UHF) SATCOM low profile antenna for common ground station
- 1285 -Began specification definition and design of RAP technology demonstrator
- 40 -Began experimentation with direct broadcast satellite
- 759 -Initiated modeling and simulation tools requirement for integration into RAP/HCTR program.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communication Advanced Technology
	PROJECT D257

FY 1995 Accomplishments: (continued)

•	130	-Began program definition of Airborne Relay requirements
•	400	-Participated in Unified Endeavor demonstration using video teleconferencing system.
•	1470	-Initiated requirements for FDR to be integrated as part of overall BITS strategy.
Total	8381	

FY 1996 Planned Program:

•	5020	-Begin integration of ATM service into legacy communications network. -Complete functional definition of RAP. -Complete COTS testing/requirements definition for high capacity trunk radio (HCTR). -Complete demonstration of low profile OTM antennas.
•	3778	-Begin experimentation with wideband airborne communications relays and satellite personal communications services (PCS). -Support Task Force XXI and other user demonstrations. -Demonstrate direct broadcast video for tactical applications. -Integrate field models of the SDR into a brigade in conjunction with the TF XXI AWE. -Determine of emerging satellite technologies that will be required to use the tactical multinet gateway (TMG) as an interface into the Tactical Internet as described in the Tactical Internetwork System Description.
•	1540	-Implement TEED into the Digital Battlefield Communications to provide security technology in a geographically dispersed network. -Begin analysis of criteria imposed by the supported ground segment (HCTR/RAP antenna) and available platforms. -Evaluate of hardware in the Digital Integrated Laboratory (DIL) to ready for TF XXI exercise. -Continue modeling and simulation tools for RAP/HCTR development.
•	7	-Revised economic assumption not available for execution.
•	234	- SBIR/STTR.
Total	10579	

FY 1997 Planned Program:

•	5662	-Begin modification of commercial non developmental hardware for high capacity trunk radio (HCTR) demonstration. -Demonstrate radio access point (RAP) function, integrating mobile internet protocol, and survivable hand-off capability in a multi media laboratory demo using commercial standard (e.g. ATM, IP, narrowband integrated service digital network (ISDN)) protocols. -Demonstrate a wideband, point to point 45 mega bits per second (MBps) airborne communications relay package to link RAP/HCTR back to MSE/TRITAC/Army Common User System. -Develop an initial prototype of a conformal phased array antenna for radio access point communications on-the-move requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603006A Command, Control and Communication Advanced Technology
	PROJECT D257

FY 1997 Planned Program: (continued)

•	3974	-Conduct user tests of DBC ATD products in TF XXI AWE and other user demonstrations. -Demonstrate military unique ATM enhancements (i.e. adaptive forward error correction, ATM signaling over tactical circuits, ATM over wireless networks) over legacy communication systems (e.g. MSE) to allow for better use of available bandwidth. Support and conduct TF XXI AWE ATM multimedia experimentation. -Continue modeling and simulation support for RAP/HCTR development. -Conduct experimentation of the wideband packet surrogate digital radio (SDR) in the TF XXI AWE.
•	2345	-Develop and demonstrate wireless subscriber access (e.g. commercial PCS, wireless ISDN, near term data radio, SDR) into the RAP. -Continue experimentation and support of tactical end-to-end encryption device security requirements for the DBC ATD and TF XXI. -Integrate PCS capability onto an airborne platform and demonstrate with the goal of providing both and interim and adjunct military capability for the upcoming future commercial satellite based PCS.
Total	11981	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	8698	10854	12339
Appropriated Value (FY 1995)	8515		
Adjustments to FY 1995	-134		
Appropriated Value (FY 1996)		10593	
Adjustments to FY 1996		-14	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-358
Current President's Budget	8381	10579	11981

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communication Advanced Technology

PROJECT: D592

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D592 Space Applications Technology	231	2947	3712	2512	2215	2342	2326		Continuing	Continuing

A. Mission Description and Budget Item Justification : Project D592 - Space Application Technology: The objective of this project is to optimize Army utilization of space. The project involves: (a) space technology demonstrations for evaluating technology feasibility, determining Army utility, and refining technology requirements, and (b) technology integration to support Army ground stations utilizing space assets. The project also addresses: defining Army requirements for space platform providers; demonstrating advanced, compact hardware, such as synthetic aperture radar (SAR) processors; and developing algorithms that optimally process space data, i.e., sensor fusion algorithms. Army efforts include: integration of direct downlink weather and terrain data into intelligence preparation of the battlefield (IPB) and integrated meteorological system (IMETS) processes; Army-unique applications of global positioning system (GPS) signals; technologies to apply high data rate, extremely high frequency (EHF) communications capabilities to satellite communications (SATCOM) on-the-move; technologies to make multispectral imagery more suitable to tactical applications, space experiments, and data collection and analysis on ionospheric composition to support imaging and communications.

FY 1995 Accomplishments:

•	183	-Completed restructuring of the Space Application Technology program.
•	48	-Completed refurbishment of extreme ultraviolet imaging photometer (UVIP).
Total	231	

FY 1996 Planned Program:

•	2822	-Demonstrate laser boresight calibration for space based infrared (IR) sensor. -Complete fabrication, lab test and field test of the Acousto-Optical Tunable Filter (AOTF) IR sensor. -Complete study of laser communication utility to Army battlefield requirements. -Complete study of utilizing future planned commercial communication satellite systems to meet the Army's mobile communication requirements.
•	116	SBIR/STTR.
•	9	Revised economic assumption not available for execution.
Total	2947	

FY 1997 Planned Program:

•	3712	-Demonstrate laser boresight calibration for space based infrared (IR) sensors to improve joint tactical ground station performance -Integrate air/space sensor laser communications downlink technologies into theater communication network - Demonstrate acousto-optic tunable filter utility to provide spectral data from space borne platform
Total	3712	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communication Advanced Technology

PROJECT: D592

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	244	498	398
Appropriated Value (FY 1995)	239		
Adjustments to FY 1995	-8		
Appropriated Value (FY 1996)		5401	
Adjustments to FY 1996		-2454	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			3314
Current President's Budget	231	2947	3712

Change Summary Explanation:

Funding: FY 96: A portion of this program has been reduced for an amount which reflects revised economic assumption and/or may be offered for rescission (-2454)

FY97: Additional funds (+3314) reflect restructure of space technology program..

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communication Advanced Technology

PROJECT: D596

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D596 Field Laser Radar Demo	0	2918	0	0	0	0	0		0	2918

A. <u>Mission Description and Budget Item Justification:</u> **Project D596 - Field Laser Radar Demo:** The objective of this Congressional special interest project is to provide data reduction and analysis of field experiments data to demonstrate the tactical utility of the Field Laser Radar. The Field Laser Radar is a light weight, compact, imaging carbon dioxide (CO_2) laser radar (LADAR). This ladar transmits a waveform capable of high resolution measurements in both range and velocity. The equipment is light weight and sufficiently compact to be transported by helicopter or trucks. This means that the laser radar can provide for theater ballistic missile defense or cruise missile defense. In addition, the equipment can provide long range, coherent remote sensing of chemical warfare agents. Depending upon the altitude, the Field Laser Radar hardware can identify chemical warfare agents up to 80 kilometers away.

FY 1995 Accomplishments: Program not funded.

FY 1996 Planned Program:

•	230	- Conduct chemical warfare agent detection experiments.
•	150	- Conduct static ground tests on cruise missiles.
•	310	- Conduct flight tests for unpowered tactical air launched decoy.
•	1450	- Develop algorithms and analyze field data.
•	150	- Analyze helicopter installation requirements.
•	150	- Develop hardware requirements for helicopter LADAR.
•	404	- Fund program management costs, to include salaries and travel.
•	66	- SBIR/STTR
•	8	- Revised Economic Assumption not available for execution.
Total	2918	

FY 1997 Planned Program: Program not funded.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603006A Command, Control and Communication Advanced Technology

PROJECT: D596

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	0	0
Appropriated Amount (FY 1995)			
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		2948	
Adjustment to FY 1996		-30	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current President's Budget Submit	0	2918	0

Change Summary Explanation:

Funding: FY 1996: Congressional special interest project.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603007A Manpower, Personnel and Training Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	4821	4696	4500	5277	6246	7264	7293		Continuing	Continuing
A792 Manpower and Personnel	2616	2204	1418	2035	2482	2982	2989		Continuing	Continuing
A793 Training Systems and Education	2205	2492	3082	3242	3764	4282	4304		Continuing	Continuing

Mission Description and Budget Item Justification: The objective of this program is to demonstrate soldier-oriented technologies to enhance soldier and unit performance. These include: training strategies for simulation-based training; methods that develop the knowledge and skills required for successful battle command on the increasingly digitized battlefield; accurate behavioral models of individual and unit warfighting performance for use in synthetic environments; optimized design of battle command staff groups for improved command and control (C2); and a new selection and assignment technology for better soldier/job matching to maintain warfighting capabilities in a downsized Army. Work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. These projects are dedicated to conducting proof of principal field demonstrations and tests of system-specific technologies to meet specific military needs and are therefore correctly placed in Budget Activity 3. This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Alexandria, VA.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603007A Manpower, Personnel and Training Advanced Technology

PROJECT: A792

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A792 Manpower and Personnel	2616	2204	1418	2035	2482	2982	2989		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project A792 - Manpower and Personnel:** This project demonstrates soldier-oriented technologies that will lead to improved Army personnel utilization, including enlisted, officers, civilians, and families. A major focus of the project is on the human leader and decision maker in evolving digitized, battle command systems. The research will also demonstrate new methods for identifying high quality male and female enlistees, for assigning them to Military Occupational Specialties (MOS) that maximize total force readiness, and for retaining the most effective performers. It also develops and demonstrates behavioral science-based methods to achieve optimized design of Army decision-making staff organizations. Other efforts will develop innovative, simulation-based methods for career-long leader development to ensure that today's lieutenants and captains develop adequate knowledge and skills to become tomorrow's division commanders for the digitized battlefield. This program supports the Manpower and Personnel Defense Technology Area. Work on this element is coordinated with the Training and Doctrine Command (TRADOC) Battle Laboratories, and demonstration projects are integrated into the Battle Labs' Advanced Warfighting Experiments.

FY 1995 Accomplishments:

- 1709 - Prepared comprehensive recommendations for modifications to the selection, classification, reenlistment and promotion systems based on integration of Career Force and cost-effectiveness findings.
- - Integrated the Battle Command Training Program (BCTP) data base and other performance data into the Combat Training Center's Warrior Information Network for analyses on battle command decision making.
- - Developed job structuring guidebooks.
- - Developed improved selection procedures for Special Operations/Low Intensity Conflict forces.
- 907 - Developed tools and techniques to examine issues related to National Guard deployment in the Multinational Force of Observers (MFO) peacekeeping mission.

Total 2616

FY 1996 Planned Program:

- 1534 - Develop improved soldier-job matching procedures by effectively utilizing psychomotor, spatial and temperament measures.
- - Refine Special Forces selection and assignment tests and procedures.
- - Provide preliminary findings on determinants of battle command performance and recommendations for decision aid evaluation methodologies to the Battle Command Battle Lab.
- - Develop methods for improving occupational analysis efficiency and accuracy.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603007A Manpower, Personnel and Training Advanced Technology
	PROJECT A792

FY 1996 Planned Program: (continued)

•		- Validate prototype techniques for developing and training practical thinking skills within tactical units.
•	614	- Determine the relationship between individual soldier characteristics and performance in peacekeeping missions.
•	7	- Revised economic assumption not available for execution.
•	49	- SBIR/STTR
Total	2204	

FY 1997 Planned Program:

•	1418	- Provide guidelines for harnessing available and projected information technologies to support effective battle command on the future digitized battlefield.
•		- Provide recommendations for Battle Command leader development and staff training to Battle Command Battle Lab.
•		- Develop peer and supervisory ratings of Special Forces leadership potential.
•		- Provide findings on the post-deployment effects of peacekeeping on unit readiness, families, and soldier and spouse commitment to the reserves.
Total	1418	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2786	2265	1461
Appropriated Amount (FY 1995)	2727		
Adjustments to FY 1995	-111		
Appropriated Amount (FY 1996)		2226	
Adjustment to FY 1996		-22	
Adjustments to Budget Year (FY 1997) since FY 1996 Presidents Budget			-43
Current President's Budget Submit	2616	2204	1418

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603007A Manpower, Personnel and Training Advanced Technology

PROJECT: A793

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
A793 Training Systems and Education	2205	2492	3082	3242	3764	4282	4304		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project A793 - Training Systems and Education: The objective of this project is to demonstrate empirically-based cost-effective training strategies, with particular emphasis on how to best use distributed interactive simulation (DIS) training environments. This program is predicated on research showing that the effectiveness of training aids, devices, simulations, and simulators (TADSS) is largely a function of how they are used in training, including the adequacy of performance measurement techniques and performance feedback methods. Training strategies will be developed to integrate all three types of simulation (live, virtual and constructive) into a seamless training environment that will enhance training quality, relevancy and efficiency for warfighting missions and for operations other than war (OOTW). In future years, the project will develop training strategies for the evolving digitized battlefield. This research supports the TRADOC Battle Labs and will utilize emerging Battlefield Distributed Simulation-Developmental (BDS-D) capabilities. This program supports the Training Systems Defense Technology Area.

FY 1995 Accomplishments:

•	1363	- Validated front end analysis methodology for determining critical training requirements for stability operations.
•		- Developed prototype automated training analysis and feedback system for generating after action reviews (AARs) for DIS-based training.
•		- Designed a training strategy and prototype training program for the Close Combat Tactical Trainer.
•		- Developed a methodology for designing combined arms training strategies that are compatible with Battalion Level Training Models.
•		- Evaluated effectiveness of intelligent flight trainer for training initial entry rotary wing pilots.
•	842	- Developed prototype longitudinal database for analysis of Reserve Component Armor and Mech Infantry home-station training.
Total	2205	

FY 1996 Planned Program:

•	1282	- Develop device-based tool for predicting tank gunnery performance for Reserve Component (RC).
•		- Validate prototype structured platoon-level training program for Close Combat Tactical Trainer (CCTT).
•		- Develop database for relating training performance in SIMNET to performance at the Combat Training Centers.
•		- Identify Infantry unit training problems caused by transition from combat roles to peacekeeping/stability missions and back.
•		- Design a preliminary aviation training strategy with an emphasis on low-cost, part-task simulators and training devices.
•	1146	- Validate the effectiveness of the Military Language Tutor for foreign language sustainment.
•	8	- Revised economic assumption not available for execution.
•	56	- SBIR/STTR
Total	2492	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603007A Manpower, Personnel and Training Advanced Technology
	PROJECT A793

FY 1997 Planned Program:

- 1809 - Validate brigade-level and multi-service training strategies and performance assessment methodologies.
- - Develop prototype techniques for staff training for stability operations.
- - Deliver frequency of training recommendations for Combined Arms Tactical Trainer training management system.
- - Design prototype, structured company-level CCTT training program.
- - Design and test prototype aviation training strategies with alternative mixes of training devices/simulators/simulations and live training.
- 1273 - Validate RC training device-based tool (AFIST) for predicting live-fire tank gunnery performance.

Total 3082

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	2314	2561	3174
Appropriated Amount (FY 1995)	2266		
Adjustment to FY 1995	-61		
Appropriated Amount (FY 1996)		2516	
Adjustment to FY 1996		-24	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-92
Current President's Budget Submit	2205	2492	3082

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603105A Military Human Immunodeficiency Virus (HIV) Research

PROJECT: DH29

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DH29 Medical Protection Against HIV	28257	2866	2919	3047	3207	3182	3161		Continuing	40689

A. Mission Description and Budget Item Justification: Project DH29- Military HIV Research: This program element supports research to provide concept exploration of candidate prevention and treatment strategies such as vaccines, drugs and behavioral interventions, to include safety and efficacy in model systems to prepare and conduct clinical studies. It funds Congressionally directed Acquired Immune Deficiency Syndrome (AIDS) research to control the infection in military environments, to protect the military blood supply and to protect military personnel from unusual risks associated with infection. AIDS research is focused on the following thrust areas: diagnosis; natural history; epidemiology; vaccine development; and drug therapy. Efforts are directed to answer militarily unique questions affecting manning, mobilization and deployment. This program is managed primarily by the US Army Medical Research and Materiel Command. The major contractor is Henry M. Jackson Foundation for the Advancement of Military Medicine, Rockville, MD. This program is dedicated to conducting proof of principal demonstrations and tests of specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

FY 1995 Accomplishments:

•	4466	Continued Phase II clinical trial of HIV therapeutic vaccine.
•	2327	Completed preparations of field sites for a prophylactic vaccine trial in Thailand.
•	5977	Evaluated well-characterized HIV strains as alternative vaccine candidates.
•	4466	Evaluated the immune response to HIV antigens exposed on liposomes, expressed in bacterial vectors, and to DNA constructs.
•	3150	Completed evaluation of interactive media methods to modify behavior and reduce risk of infection with HIV.
•	4614	Evaluated methods for rapid diagnosis, determination of immune response, and determination of viral load in support of vaccine research.
•	3257	Collected and analyzed data from Thai Army veterans to determine HIV seroconversion rate and suitability as a vaccine test cohort.
Total	28257	

FY 1996 Planned Program:

•	1873	Prepare field site for clinical trials of candidate vaccine.
•	922	Evaluate safety and immunogenicity phase I and phase II of candidate vaccine.
•	8	Revised Economic Assumption not available for execution.
•	63	SBIR/STTR
Total	2866	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603105A Military Human Immunodeficiency Virus (HIV) Research
	PROJECT DH29

FY 1997 Planned Program:

- 1941 Continue field site preparation for candidate vaccine clinical trials.
- 978 Complete safety and immunogenicity phase I and phase II of candidate vaccines.

Total 2919

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	30345	2946	3006
Appropriated Amount (FY 1995)	29708		
Adjustments to FY 1995	-1451		
Appropriated Amount (FY 1996)		2895	
Adjustments to FY 1996		-29	
Adjustments to Budget (FY 1997) year since FY 1996 Presidents Budget			-87
Current Budget Submit For FY 1997	28257	2866	2919

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238A Air Defense/Precision Strike Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	39951	37279	40258	29065	26512	19119	18964		Continuing	Continuing
D177 JT ALS PS DEMO	31258	33173	32046	23198	22659	19119	18964		Continuing	Continuing
D182 Tractor Hole	7826	0	0	0	0	0	0		0	7826
D189 Tractor Hike	867	0	0	0	0	0	0		0	867
D546 STARLOS	0	4106	8212	5867	3853	0	0		0	22038

Mission Description and Budget Item Justification: This program provides for the integration of high-payoff technologies, new technical, architectural and operational concepts, along with existing and emerging systems to demonstrate enhanced precision strike and counterfire capabilities for ground targets at deep and extended ranges. The objective is to address the operational need to locate, identify, and kill high-value, time-critical targets and to assess damage within tactically meaningful timelines. To address this objective, the program is conducting a series of building block demonstrations to identify technical and operational barriers to an adverse weather, day/night, end-to-end sensor-to-shooter precision strike capability and to demonstrate and experiment with candidate solutions to these barriers. The Joint Precision Strike Demonstration (JPSD) Precision/Rapid Counter Multiple Launcher (MRL) Advanced Concept Technology Demonstration (ACTD) will be conducted in Korea to show an enhanced capability to defeat the 240mm MRL threat and provide Commander-in-Chief, United States Forces Korea (CINC USFK), tactical "leave behind" systems for evaluation in FY 1997/1998. In FY 1997, a follow-on candidate ACTD titled Survivable Armed Reconnaissance on the Digital Battlefield (SARDB) will be conducted. Overall JPSD program goals are to reduce timelines from hours to minutes as well as to achieve quantifiable improvements in target location and identification, weapons systems responsiveness and kill capability, and accurate damage assessment through such techniques as near-real-time sensor cueing, near-real-time data dissemination, seamless sensor-to-shooter node communication, dynamic retargeting, improved weapons system accuracy and precision guided munitions. For FY 1997, execution of the SARDB candidate ACTD demonstration will begin and continue with annual demonstrations through FY 1999 with fabrication of a leave behind capability in FY 2000-FY 2002. This program element also funds development activities for a high resolution Synthetic Aperture Radar Target Recognition and Location System (STARLOS) with real time automatic target cueing (ATC). The work in this Program Element is closely coordinated with the combat development community, TRADOC Battle Labs, and appropriate materiel developers to conduct field demonstrations and experiments to assess specific technologies for military needs and is therefore placed in Budget Activity 3. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan, the Army Modernization Plan and Project Reliance. The work also supports Force XXI and the Army Warfighting Experiments (AWEs).

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238A Air Defense/Precision Strike Technology

PROJECT: D177

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D177 JT ALS PS DEMO	31258	33173	32046	23198	22659	19119	18964		Continuing	Continuing

A. Mission Description and Budget Item Justification: The Joint Air Land Sea Precision Strike Demonstration project conducts a series of building block demonstrations to identify barriers to an advanced precision strike capability and to assess candidate solutions to these barriers. In FY 95, execution of the Rapid/Counter-Multiple Rocket Launcher (MRL) Advanced Concept Technology Demonstration (ACTD) was initiated and a Continental United States (CONUS) ACTD demonstration was conducted as a first step towards accomplishing the objective Outside CONUS (OCONUS) ACTD demonstration in FY 96/FY97. The objective OCONUS ACTD demonstration will be conducted in Korea to exhibit an enhanced capability to find, track and defeat the 240mm MRL threat. A set of leave behind capabilities will be delivered during FY97/98. Additionally, two years of in-country follow-on support will provide a residual operational capability to immediately improve the ability of CINC U. S. Forces Korea/Combined Forces Command (USFK/CFC) to defeat the 240mm MRL threat. During FY 96, initial planning for the (candidate) ACTD on Survivable Armed Reconnaissance on the Digital Battlefield (SARDB) will take place. The SARDB objective is to demonstrate the digital interconnectivity enhancements to optimize the interoperability of the RAH-66 Comanche with the OSD family of UAVs, JSTARS, National, Theater and Army Tactical systems. The initial SARDB demonstration will be executed in FY97 with a final demonstration scheduled for FY 99. The program is managed by the Director, Joint Precision Strike Demonstration, Program Executive Officer, Intelligence and Electronic Warfare (PEO-IEW), Falls Church, VA. The prime contractor is Raytheon, Bedford, MA.

FY 1995 Accomplishments:

- 14540 - Prepared and distributed the report of successful FY 94 Surface-to-Surface demonstration.
  - Developed the Precision/Rapid Counter MRL ACTD concept, established distributed interactive simulations at the Integration and Evaluation Center (IEC) to include connectivity to six TRADOC Battle Labs and CINC USFK.
  - Conducted extensive systems engineering/demonstration planning with Army/Navy/AF staffs, III Corps, 2nd Infantry Division (Mechanized) (ID(M)), USFK in support of Army Warfighting Experiments (AWEs).
  - Developed IEC to include integration of models/simulations and expansion of communications connectivity to support FY 1995-1996 demonstrations.
- 16718 - Developed 2nd Generation Forward-Looking Infrared (GEN FLIR)/Line Scanner (LS) and evaluated it in preparation for the FY 1995 demonstration.
  - Conducted the Precision/Rapid Counter-MRL ACTD (CONUS demonstration) with III Corps, 2nd ID(M) and TRADOC Battle Labs.
  - Participated in ARPA War Breaker program and Medium Altitude Endurance/High Altitude Endurance (MAE/HAE) programs. Integrated these technologies/applications into IEC.

Total 31258

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D177

FY 1996 Planned Program:

•	9337	- Formulate the SARDB ACTD program and conduct pre-ACTD activities. - Prepare and staff a SARDB candidate ACTD Implementation Directive and Management Plan. - Enhance surveillance, target acquisition, strike planning and Army and joint weapons delivery assets.
•	18165	- Develop, fabricate and evaluate 2nd GEN FLIR/LS and integrate into a surrogate UAV airframe. - Develop and implement software changes for the Firefinder systems to significantly enhance its capabilities. - Plan, train for and execute the OCONUS portion of the Precision/Rapid Counter MRL ACTD with USFK, 2nd ID (M), III Corps, TRADOC Battle Labs and Air Force/Navy simulation centers. - Participate in ARPA War Breaker, MAE/HAE and Synthetic Theater of War (STOW) programs.
•	4836	- Develop the multimode communications connectivities and architecture of the IEC to support the OCONUS demo and Army AWEs. Integrate models/simulations needed for OCONUS demo. - Complete FY 95 demonstration, gather data and begin analysis.
•	738	- SBIR/STTR reduction not available for execution.
•	97	- Revised Economic Assumption not available for execution.
Total	33173	

FY 1997 Planned Program:

•	26296	- Develop a comprehensive SARDB (Candidate) ACTD Concept Operations Order (CONOPS) and systems engineering approach. - Conduct a fully integrated live and simulated SARDB demonstration. - Acquire enhanced surveillance, target acquisition, strike planning and Army and joint weapons delivery assets. - Develop, fabricate, integrate and provide a UAV 2nd GEN FLIR/LS capability to CINC USFK.
•	5750	- Prepare and distribute a comprehensive report on the FY 1995 ACTD CONUS demonstration. Plan and coordinate the SARDB demonstration for FY 1998. - Expand and upgrade technical capabilities of the IEC to support rapid acquisition process, operational planning for real world contingency operations and participation in Army/Joint war game activities. - Participate in ARPA Dynamic Multi-Uses Information Fusion (DMIF) (formally called War Breaker), MAE/HAE and STOW programs. - Develop and implement transition plan for ACTD leave behind systems. Provide an Integrated Product Team for logistics, maintenance and training support for leave behind systems.
Total	32046	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D177

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	31226	34104	26286
Appropriated Amount (FY 1995)	30570		
Adjustments to FY 1995	+688		
Appropriated Amount (FY 1996)		33508	
Adjustments to FY 1996		-335	
Adjustments to Budget Year (FY 1997) since			+6700
FY 1996 President's Budget			-940
Current President's Budget Submit	31258	33173	32046

Change Summary Explanation:

Funding: FY 95: Rescission within the FY 95 Supplemental Appropriation and Rescissions to preserve and enhance the military readiness of the Department of Defense (-437); Below threshold reprogramming increase for Task Force XXI participation (+1125): net +688.

FY97: Funding restructure to initiate SARDB proposed ACTD (+6700); Non-Pay inflation adjustment (-940).

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238A Air Defense/Precision Strike Technology

PROJECT: D546

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D546 STARLOS	0	4106	8212	5867	3853	0	0		0	22038

A. Mission Description and Budget Item Justification: A technology program to demonstrate the feasibility of locating and identifying high value targets from an Army designated aerial platform. The focus of the program is on Automatic Target Recognition (ATR) of Short Range Ballistic Missiles (SRBM), surface-to-air missile launchers, rocket launchers and Automatic Target Cueing (TAC) of military targets of interest. The targets are located and identified by means of a high resolution Synthetic Aperture Radar (SAR) with a real-time ATR system. Re-evaluation of operationally robust needs and spin-off technological advancements have been accommodated by considering: Automatic Target Cueing (ATC); other than high value targets; ATR/ATC processing in the ground station; Moving Target Indicator (MTI) radar enhancements for SAR/other sensor cueing implementation of ATR algorithms developed under other programs using sensors other than SAR in a common ATR hardware and insertion of ATR/ATC capabilities in other platforms. The program has become a major component of the Joint Precision Strike Demonstration (JPSD) program and was the impetus for the development by industry of a high resolution SAR for onboard the Joint Chiefs of Staff (JCS) Medium Altitude Endurance (MAE) class of unmanned aerial vehicle (UAV). This program is managed by Program Executive Officer-Intelligence and Electronic Warfare, PM Tactical Endurance Synthetic Aperture Radar, with matrix support from Army Research Laboratory, Adelphi, MD and Night Vision and Electronic Sensors Directorate, CECOM RDEC, Fort Monmouth, NJ. This program is dedicated to conducting proof of principle field demonstrations and tests of system-specific technologies to meet specific military needs and is, therefore, correctly placed in Budget Activity 3.

FY 1995 Accomplishments: Project not funded.

FY 1996 Planned Program:

- 2855 - Evaluate industry/government SAR ATR/ATC algorithms for FY97 procurement of Commercial-Off-The-Shelf (COTS) hardware and algorithms of SAR ATR/ATC.
  - Start procurement of a completely COTS SAR ATR/ATC processor.
  - Develop ATR/ATC capability for target cueing, rapid target insertion efforts, and definition of SAR ATR/ATC requirement with the User through the use of User Mini-Experiments.
  - Complete integration of a Multi-Sensor Testbed (MSTB) for the demonstration, on-board, of real time SAR ATR/ATC.
- 1151 - Participate in JTF-1 Exercise with 525th MI Bde and Enhanced Tactical Radar Correlator (ETRAC) with the PM TESAR SAR and the Army Mobile Test Facility (MTF).
  - Procure and integrate MAE UAV SAR in support of JPS UAV ACTD.
- 88 - SIBR/STTR not available for execution.
- 12 - Revised economic assumption not available for execution.

Total 4106

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238A Air Defense/Precision Strike Technology PROJECT D546

FY 1997 Planned Program:

- 5072 - Initiate acquisition of scaleable ATR hardware components to implement algorithms selected by the evaluation study..
  - Continue robustness enhancements of ATC/ATR algorithms and leverage of activities at ARPA and Air Force.
  - Continue evolution of MSTB to serve as a data collection platform, integrate airborne ATR and implement mission planning for cross sensor cueing.
  - Participate in TF XXI, JPSD in SARDB and MAE UAV/STARLOS integration demonstrations and other demonstrations and experiments with the Airborne Recon-Low/UAV Multi-Sensor Test Bed (ARL/UAV MSTB).
- 3140 - Demonstrate real-time ATC capabilities for SAR, Forward Looking Infrared Radar (FLIR), and infrared line scanner (IRLS) using common hardware in ARL/UAV MSTB.
  - Demonstrate cross cueing of SAR, FLIR/IRLS and non-imaging sensors (MTI Radar).
  - Demonstrate rapid target insertion of new targets in support of SAR ATR/ATC.
  - Initiate strap-on integration and A-kit prototype definition for prototype ATR hardware for UAV Ground Control Station (GCS), Common Ground Station (CGS), Airborne Reconnaissance - Low, and Abrams M1A2 Reconnaissance.

Total 8212

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	0	5720	13712
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		4147	
Adjustments to FY 1996		-41	
Adjustment to Budget Year (FY 1997) since FY 1996 President's Budget			-5500
Current President's Budget Submit	0	4106	8212

Change Summary Explanation:

Funding: FY 1997: Adjustment for redirection of funds to higher priority program (-5500).

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270A Electronic Warfare (EW) Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	6518	3912	6794	8181	11768	19120	19916		Continuing	Continuing
DK15 Advanced Communications Electronics Countermeasures Demonstration	2808	2881	2913	2878	3117	9552	9475		Continuing	Continuing
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	3710	1031	3881	5303	8651	9568	10441		Continuing	Continuing

Mission Description and Budget Item Justification: This program element funds two projects that provide technology options for current and future electronic warfare (EW) systems. The Advanced Communications Electronics Countermeasures Demonstration (DK15) provides technology demonstrations in communications countermeasures (CM) and information collection and reporting for transition to Army intelligence and electronic warfare (IEW) systems through the Block Improvement process. The effective use of specific components, software and hardware for multiple applications will enable the Army to collect intelligence from modern modulation threat electronic systems in order to disrupt their operation, denying the enemy use of their command, control and communication (C3) assets. This project also supports demonstrations of automatic fusion of intelligence data from multiple sources. Non-Communications Electronic Countermeasures Technology Demonstration (DK16) demonstrates the feasibility and effectiveness of non-communications electronic warfare hardware and software countermeasures and electronic support/electronic intelligence (ES/ELINT) for self protection from radar, electro-optical, and infrared guided anti-aircraft artillery, surface-to-air missiles, artillery, and top attack weapons, and provides precise targeting information on non-communications emitters. Area protection technology from radar threats is also developed. Work in these projects will lead to technology applications which will significantly contribute to winning the battlefield information war by controlling the electromagnetic spectrum. Work in this program element (PE) supports the multispectral countermeasures advanced technology demonstration, and provides component technology for the hit avoidance technology demonstration. Work in this program element adheres to tri-service reliance agreements on electronic warfare. Work in this program element is related to and fully coordinated with efforts in PE 0602270A (Electronic Warfare Technology), and various Navy and Air Force program elements in accordance with the on-going Reliance joint planning process. Navy developments are conducted in PEs 060455N (Surface Electronic Warfare), 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 advanced research projects agency (ARPA) to eliminate duplication of effort and ensure the interchange of technical data. This program is managed primarily by Communications-Electronics Command Research, Development and Engineering Center (CERDEC), Ft. Monmouth, NJ. It is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270A Electronic Warfare (EW) Technology

PROJECT: DK15

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DK15 Advanced Communications Electronics Countermeasures Demonstration	2808	2881	2913	2878	3117	9552	9475		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u> **Project DK15 - Advanced Communications Electronics Countermeasures Demonstration:** This project demonstrates communication countermeasures technology for the Army to use to exploit, corrupt or destroy an adversary's information system while preserving the integrity of one's own systems during critical periods of tactical transmission. It emphasizes specific components, hardware and software necessary to perform technology demonstrations which will lead to providing flexible systems with the capability of disrupting modern modulations signals which support high mobility forces. This project also demonstrates the technology products that enable, enhance and protect the commander's decision and execution cycle while influencing an opponent's. The fusing of multiple intelligence data inputs with one output will allow the commander to quickly assess the battlefield situation.

FY 1995 Accomplishments:

•	1075	Continued integration of signal processing, control equipment and software techniques to demonstrate a capability to identify and jam digital radio signals
•	1183	Initiated integration of exploitation strategies for type 1 mobile cellular radio signals for demonstration purposes
•	350	Completed demonstration and testing of fusion of sensor inputs for battlefield damage assessment, targeting and situation awareness and sensor asset management for transition to common ground station (CGS), intelligence electronic warfare common sensor (IEWCS), and all source analysis system (ASAS). Sensor asset management capability transitioned to IEWCS and ASAS.
•	200	Demonstrated the tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms. Focus is on the ASAS/WARLORD and CGS interface
Total	2808	

FY 1996 Planned Program:

•	2258	-Complete demonstration and testing of exploitation strategies for type 1 mobile cellular radio signals. Provide technology options for IEWCS -Complete demonstration and testing of signal processing, control equipment and software techniques to demonstrate capability to identify and jam digital radio signals -Initiate integration of exploitation strategies for type 2 mobile cellular radio signals for demonstration purposes -Complete demonstrations of signals intelligence (SIGINT) asset management and automated map based intelligence sensor system (AMBISS). Transition to IEWCS and ASAS
•	550	-Initiate IEW demonstration of asset management, terrain management, and overlay reasoning technologies that were developed in PE 0602270A/A906

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology
	PROJECT DK15

FY 1996 Planned Program: (continued)

-Integrate SIGINT/moving target indicator (MTI) templating, tracking, cross-cueing and situation display techniques.
-Demonstrate the tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms. Focus is on the ASAS/WARLORD and IEWCS interface. Demonstrate capability at Task Force XXI AWE.

•	64	Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992
•	9	Revised economic assumption not available for execution
Total	2881	

FY 1997 Planned Program:

•	1613	-Demonstrate utilization of techniques to exploit type 2 mobile cellular radio signals -Integrate wideband receiver & developments from joint receiver programs for demonstration of receivers used in the exploitation of modern communications signals -Complete IEW asset management, terrain management and overlay reasoning demonstration and provide technology options for ASAS
•	1300	-Conduct field evaluation of SIGINT/MTI templating, tacking, cross-cueing and situation display techniques -Continue consolidation and testing of IEW airborne asset management tools prior to demonstration -Continue demonstration of the tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms. Focus is on the ASAS/WARLORD and IEWCS interface
Total	2913	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	2937	2963	3500
Appropriated Value (FY 1995)	2875		
Adjustments to FY 1995	-67		
Appropriated Value (FY 1996)		2911	
Adjustments to FY 1996		-30	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-579
Current President's Budget	2808	2881	2913

Change Summary Explanation:

Funding: FY 95: Rescission within the FY 95 Supplemental Appropriation and Rescissions to preserve the military readiness of the Department of Defense (17); Below threshold reprogramming (-50); FY 97: Funds transferred to classified program.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270A Electronic Warfare (EW) Technology

PROJECT: DK16

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	3710	1031	3881	5303	8651	9568	10441		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project DK16 - Non-Communication Electronics Countermeasures Technology Demonstrations: This program demonstrates the feasibility and effectiveness of non-communication electronic warfare hardware and software CM technology for self protection against radar, optical, electro-optical and infrared threats. The multispectral countermeasures advanced technology demonstration (MSCM ATD) provides technology options for product improvements to the suite of integrated infrared countermeasures/ common missile warning system (SIIRCM/CMWS), which provides the primary protection to Army helicopters against infrared seeker missiles. Specifically, advancements in laser technology will provide a multiline laser for improved self protection, advancements in fiber optic technology for improved transmission to the SIIRCM jamhead, and the evaluation of infrared (IR) countermeasure (CM) techniques versus IR imaging missiles. It also provides supporting components for the Hit Avoidance (ground vehicle top attack protection) ATD.

FY 1995 Accomplishments:

- 2110 Procured applicable sensors and integrated into ground vehicle and conducted field data collection/experiments to support hit avoidance system design trade-offs
- 1300 Conducted radar deception and jamming (RDJ) Flight Tests
- 300 Transitioned 100% of RDJ ATD software to Program Manager (PM)-Airborne Electronic Combat (AEC) Suite of Integrated RF Countermeasures EMD.

Total 3710

FY 1996 Planned Program:

- 1009 -Develop algorithms for passive missile warning
  -Deliver and integrate ground vehicle top attack missile warning
  -Deliver top attack warning subsystem to hit avoidance ATD
- 18 Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992
- 4 Revised economic assumption not available for execution

Total 1031

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology
	PROJECT DK16

FY 1997 Planned Program:

•	3881	-Perform test and evaluation of candidate fiber optics design approaches for insertion into the MSCM ATD -Evaluate potential IRCM techniques using the simulation integration laboratory; initiate implementation of promising countermeasures to imaging missiles using generic missile seeker hardware -Evaluate experimental diode lasers as low cost alternatives to ARPA multiline lasers Design and begin development of interface from ARPA multiline laser to SIIRCM AD hardware
Total	3881	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3806	1059	2989
Appropriated Value (FY 1995)	3728		
Adjustments to FY 1995	-18		
Appropriated Value (FY 1996)		1041	
Adjustments to FY 1996		-10	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			892
Current President's Budget	3710	1031	3881

Change Summary Explanation:

Funding: FY 95: Rescission within the FY 95 Supplemental Appropriation and Rescissions to preserve and enhance the military readiness of the Department of Defense (18); FY97: Adjustment as a result of PDM 1 (+892);

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	66836	115657	90037	113630	88793	67436	60543		Continuing	Continuing
D206 Missile Simulation	3750	3064	2973	3007	3928	6307	6363		Continuing	Continuing
D263 Future Missile Technology Integration (FMTI)	13782	18615	9020	1029	2948	18216	21867		Continuing	Continuing
D375 Low Cost Autonomous Attack Submunition (LOCAAS)	0	2433	0	0	0	0	0		0	2433
D380 Multi-Platform Launcher	1324	3675	5515	8660	6882	13766	17049		Continuing	Continuing
D387 Multi-Purpose Individual Munition	5458	4450	813	0	0	0	0		0	10870
D486 Rapid Force Projection Simulation	7007	5772	7849	8405	5115	0	0		0	35032
D493 Rapid Force Projection Demonstration	4997	17477	24245	29774	27876	13564	11368		Continuing	Continuing
D496 Enhanced Fiber Optic Guided Missile (EFOG-M)	30518	60171	37680	57920	36745	15105	3896		0	251340
D549 2.75 Inch Anti-Air TD	0	0	0	2901	2890	0	0		0	5791
D550 Counter Active Protection System	0	0	1942	1934	2409	478	0		0	6763

Mission Description and Budget Item Justification: This program element provides advanced missile technologies to enhance U. S. Army force structure. Major objectives for investigation are system deployability, lethality, survivability, flexibility and affordability. Work is 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 missiles and systems using missiles 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 smart, stealthy, smokeless missile propulsion. This program element also provides full integration of battlefield technologies including hunters (forward sensors) and killers

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology

(weapons) integrated through advanced command and control. These components will demonstrate a system of systems approach through the umbrella of the Rapid Force Projection Initiative (RFPI) Early Entry Demonstration, which will provide enhanced survivability and lethality for light, early-entry U.S. forces in a contingency role. The RFPI demonstration supports four of the twelve future joint warfighting capabilities, to promptly engage regional forces in decisive combat on a global basis, and is supported by the Dismounted Battlespace Battle Lab (DBBL), with participation from the 18th Airborne Corps. This program element now contains the only Army demonstration of fiber optic guided missile technology and will support the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD), an OSD priority program. Multiple EFOG-M fire units and missiles (with a limited manrating) will participate in RFPI field tests. 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, PE 0602303A, PE 0603238A, and PE 0603363F in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. These projects include proof of principle field demonstrations and tests of technologies to meet specific military needs and are therefore properly placed in Budget Activity 3.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D206

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D206 Missile Simulation	3750	3064	2973	3007	3928	6307	6363		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project D206 - Missile Simulation:** This project supports three separate, but related tasks: (a) development, expansion, and improvement of hardware-in-the-loop (HWIL) simulation capabilities applicable to the evaluation of tactical missiles guided by signals in radio frequency (RF), millimeter wave (MMW), electro-optical (EO), and infrared (IR) electromagnetic spectral regions. Evaluation by means of HWIL provides cost effective support to missile development throughout weapon system life cycles and permits a reduction in the number of flight tests actually performed. HWIL simulation employs actual missile guidance and control hardware operating in real-time in a non-destructive laboratory environment; (b) Distributed Interactive Simulation (DIS) via a node to the Advanced Research Projects Agency (ARPA) Defense Simulation Internet; and (c) Battlefield Environment Weapon System Simulation (BEWSS), which provides an all-analytical simulation of a weapon system engaging multiple targets in a simulated battlefield environment, including the effects of natural and battle-caused obscurants and disturbances. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command (MICOM), Redstone Arsenal, AL. Major contractors are Boeing Defense and Space Group, Seattle, WA; and Nichols Research Corporation, Huntsville, AL.

FY 1995 Accomplishments:

- 2744 - Completed improvements to signal generation capability in Millimeter Simulation System 1 to support LONGBOW Engineering and Manufacturing Development (EMD).
  - Upgraded radio frequency environment and background generation computers and software in the Radio Frequency Simulation System to support electronic countermeasures evaluation and foreign materiel exploitation.
  - Expanded low cost host processor for SIMSTAR hybrid computers to support Stinger and Army Tactical Missile System (ATACMS) simulation.
  - Developed improvements to the real-time scene generator for target and background scene presentation for electro-optically guided missiles (Brilliant Anti-Tank (BAT), Javelin) and Future Missile Technology Integration (FMTI).
  - Designed and developed incremental improvements to laser-diode based infrared scene projector for applications to BAT, Javelin, and Theater High Altitude Air Defense (THAAD).
- 1006 - Developed DIS implementation for BAT, ATACMS.
  - Conducted warfighting simulation experiments with Battle Labs.
  - Integrated BEWSS simulation into DIS.
  - Evaluated further improvements to obscurant modeling and validation for BEWSS.

Total 3750

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D206

FY 1996 Planned Program:

•	2228	- Upgrade and improve RF hardware-in-the-loop simulation capabilities with new hardware (instrumentation and computers) to support LONGBOW, pre-planned product improvement (P3I) BAT, and PATRIOT Advanced Capability Block 3(PAC-3) development. - Develop new hardware-in-the-loop simulation capabilities to support customers in other services and friendly foreign governments with electronic countermeasure evaluations. - Continue development of an infrared target scene projector for application to JAVELIN, BAT, FMTI (TACAWS), and THAAD development via hardware-in-the-loop simulation. - Configure the Electro-Optical Simulation System for hardware-in-the-loop simulation of EFOG-M and FMTI (TACAWS) by addition of a rotational flight motion simulator, computers and infrared instrumentation..
•	769	- Expand basic Distributed Interactive Simulation Capability at the MICOM Defense Simulation Internet node and local network supporting BRADLEY STINGER Fighting Vehicle (BSFV), Line-of-Sight Anti-Tank (LOSAT), JAVELIN, Army tactical Missile System/BAT (ATACMS/BAT) and Multiple Launch Rocket System (MLRS). - Develop improvements to the BEWSS suite of simulation models.
•	9	- Revised economic assumption not available for execution.
•	58	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
Total	3064	

FY 1997 Planned Program:

•	1823	- Complete the development of computer-controlled precision signal measurement instrumentation for microwave and millimeter wave radar hardware-in-the-loop simulation capabilities. - Initiate development of a hardware-in-the-loop simulation capability for dual-spectrum (infrared and millimeter wave radar) guided and sensor-fuzed tactical missiles and sub-munitions. - Extend infrared target and background scene projector technology by increasing pixel dimensions, frame rates, and spectral bandwidth. - Continue development of hardware/software based on commercial off-the-shelf products for real-time electro-optical scene generation to drive scene projectors.
•	1150	- Continue reconfiguration of the Electro-Optical Simulation System to support EFOG-M, FMTI, and THAAD. - Upgrade MICOM DIS Center real-time data processing and display capability to support essential virtual prototype simulator development and exercise operations. - Upgrade BEWSS Test Bed capabilities to support DIS exercises integrating live, virtual, and constructive forces into a seamless environment.
Total	2973	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D206

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	3825	3150	4044
Appropriated Amount (FY 1995)	3756		
Adjustments to FY 1995	-6		
Appropriated Amount (FY 1996)		3095	
Adjustment to FY 1996		-31	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-1071
Current President's Budget Submit	3750	3064	2973

Change Summary Explanation:
FY 1997 funds (-1071) reprogrammed to higher priority requirement.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D263

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D263 Future Missile Technology Integration (FMTI)	13782	18615	9020	1029	2948	18216	21867		Continuing	Continuing

A. Mission Description and Budget Item Justification: D263 - Future Missile Technology Integration (FMTI): This project provides for the demonstration of advanced tactical missile technologies including seekers, propulsion, airframes, warheads, and guidance and control. The project will demonstrate lightweight multi-role missile technology in support of ground-to-ground, ground-to-air, air-to-air and air-to-ground missions. Combined, flexible capability allows one system or variants of one system to replace many, realizing potential extensive savings in development costs, logistics, training, etc. Particular attention will be given to the development of infrared (IR) seeker technology capable of long range lock-on and defeat of helicopters buried in cluttered backgrounds, variable thrust propulsion allowing system range extension and thus standoff and high survivability, and the innovative use of RF data links for identification friend or foe, and the attack of targets masked from the launch platform. The missile system demonstration includes the integration of guidance, control, propulsion, airframe and warhead technologies capable of performing in high clutter/obscurants, adverse weather environments and under countermeasure conditions. Missile control and guidance system technology will explore capabilities such as lock-on before/lock-on after launch, fire and forget, command guidance, imaging infrared signal and image processing, and wide band secure data links. Multi-mission seeker (M^2S) technology transitioned from the Balanced Technology Initiative program will continue to be evaluated. Demonstrated missile system performance (i.e.; weight, range, kill ratio, speed, lethality) will be optimized to exceed current baseline parameters of ground-to-ground tube launched optically-tracked Wire-guided (TOW) , ground-to-air Stinger, air-to-air Stinger, and Air-to-Ground Missile System (AGMS) in a size compatible with the TOW launcher. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command (MICOM), Redstone Arsenal, AL. Major contractors are Raytheon Company, Electronic Systems, Tewksbury, MA; TRW Space Electronics Group, Redondo Beach, CA; Loral Communications Systems, Salt Lake City, UT.

FY 1995 Accomplishments:

•	9210	- Finalized seeker design to support captive flight test, HWIL simulations, and flight tests. - Fabricated flight test motor hardware components. - Completed design of gunner's station.
•	4572	- Completed design and construction of ground platform prototype reconfigurable simulator gunner's station in support of Battlefield Distributed Simulation - Developmental (BDS-D) virtual and live experiments in a DIS environment. - Conducted hardware build of RF data link in support of flight test.
Total	13782	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology
	PROJECT D263

FY 1996 Planned Program:

•	11892	- Complete integration of flight hardware. - Complete seeker captive flight tests.
•	6281	- Complete HWIL simulation of flight hardware. - Complete Six Degrees of Freedom (6DOF) simulation system evaluation and support missile flight tests.
•	54	- Revised economic assumption not available for execution.
•	388	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
Total	18615	

FY 1997 Planned Program:

•	9020	- Design and fabricate gunner fire control console. - Complete technology demonstration flight tests. - Transition technology to ongoing missile programs (e.g. Follow-On-To-TOW and EFOG-M).
Total	9020	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	14376	19137	9249
Appropriated Amount (FY 1995)	13782		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		18802	
Adjustment to FY 1996		-187	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-229
Current President's Budget Submit	13782	18615	9020

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D375

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D375 Low Cost Autonomous Attack Submunition (LOCAAS)	0	2433	0	0	0	0	0		0	2433

A. Mission Description and Budget Item Justification: Project D375 - Low Cost Autonomous Attack Submunition (LOCAAS): This project provides for the demonstration of the tactical Laser Radar (LADAR) seeker intended for us in powered submunitions. The project will demonstrate the technology in weather and countermeasures. A weather and countermeasures performance data base for the LADAR seeker will be built sufficient for use in the MLRS Smart tactical Rocket (MSTAR) cost, operations, and effectiveness analysis (1996-1997) and other battlefield simulations. Work is performed by the Research, development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. The major contractor is Loral Vaught Systems of Dallas, Texas.

FY 1995 Accomplishments: Program not funded

FY 1996 Planned Program:

•	2378	- Configure LADAR seeker for captive flight testing .
		- Conduct captive flight test of LADAR seeker.
•	1	- Revised economic assumption not available for execution.
•	54	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
Total	2443	

FY 1997 Planned Program: Program not funded

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D375

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)			
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)		2457	
Adjustment to FY 1996		-24	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current President's Budget Submit		2433	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D380

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D380 Multi-Platform Launcher	1324	3675	5515	8660	6882	13766	17049		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project D380 - Multi-Platform Launcher (MPL): This project is part of the Rapid Force Projection Initiative (RFPI) ACTD for our early entry forces and is also tied to the Joint Precision Strike Demonstration (JPSD) Precision/Rapid Counter Multiple Rocket Launcher (MRL) ACTD. The MPL program will explore and implement technologies to improve the deployability and lethality of the MLRS system for counter battery, counter armor, and critical target missions. The first phase of the MPL program (FY 94 to FY 97) will design, develop, and flight test a low cost guidance and control system for the MLRS free-flight rocket, thereby substantially improving its delivery accuracy, reducing the number of rockets required to defeat the target, and expanding the set of MLRS targets to include precision targets. The guidance system will make use of inertial and Global Positioning System (GPS) low cost component technologies. A more accurate rocket results in both a more lethal force and a reduced logistics burden, which is especially important for early entry. The second phase of the program will support the design and testing of the High Mobility Artillery Rocket System (HIMARS), a C-130 transportable MLRS launcher. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. The major contractor is Loral Vought Systems, Dallas, TX.

FY 1995 Accomplishments:

- 852 - Completed design and construction wind tunnel models and performed wind tunnel tests.
  - Selected, tested and qualified the inertial measurement unit (IMU).
  - Performed guidance and control analyses.
  - Designed and tested a prototype flight computer.
- 472 - Designed and tested a prototype control system.
  - Designed airframe modifications.

Total 1324

FY 1996 Planned Program:

- 1746 - Construct flight computers, algorithms and software.
  - Construct control actuation systems.
  - Design global positioning system (GPS) algorithms.
  - Establish GPS antenna and receiver specifications.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D380

FY 1996 Planned Program: (continued)

•	1836	- Develop electronic and power systems. - Develop launcher interfaces. - Perform structural/thermal and aerodynamic analysis. - Develop inertial measurement units.
•	11	- Revised economic assumption not available for execution.
•	82	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
Total	3675	

FY 1997 Planned Program:

•	3615	- Perform software integration and testing. - Perform system integration and hardware-in-the-loop testing. - Perform navigation/autopilot/guidance analysis. - Develop telemetry and flight termination systems.
•	1900	- Develop GPS components. - GPS guidance algorithms, receiver, and antenna.
Total	5515	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	1365	3779	5679
Appropriated Amount (FY 1995)	1337		
Adjustments to FY 1995	-13		
Appropriated Amount (FY 1996)		3712	
Adjustment to FY 1996		-37	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-164
Current President's Budget Submit	1324	3675	5515

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D387

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D387 Multi-Purpose Individual Munition	5458	4450	813	0	0	0	0		0	10870

A. Mission Description and Budget Item Justification: **Project D387 - Multi-Purpose Individual Munition (MPIM):** This project provides for demonstration of a lightweight, shoulder fired, multiple purpose weapon. It provides the Army with one weapon capable of defeating enemy forces in buildings, bunkers, and lightly armored vehicles. The Multiple Purpose Individual Munition/Short Range Anti-tank Weapon (MPIM/SRAW) is capable of being fired from its carrying configuration and can be safely fired from an enclosure for the close battle. The MPIM/SRAW demonstration integrates warhead technology developed by the Army with the United States Marine Corps (USMC) propulsion system developed for SRAW. It will replace the AT4 system, which was only designed to defeat light armor. The system developed will have significantly improved lethality over the AT4, as well as being multiple target capable, which is particularly important in contingency operations. In FY97 producibility efforts will be initiated to reduce the cost of guidance hardware to reduce unit costs of the system. The technology will transition to the MPIM development program in PE 0604802A, Weapons and Munitions Engineering Development, at the end of FY97. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. The major contractor is Loral Aeroneutronic, Rancho Santa Margarita, CA.

FY 1995 Accomplishments:

•	200	- Issued request for proposal (RFP) for demonstration and live fire tests of MPIM/SRAW system to include demonstration of MPIM warhead integration with USMC SRAW propulsion system. - Evaluated proposals and selected contractor to perform demonstration, awarded contract.
•	5258	- Designed and initiated build of subsystem for testing and contractor testing of hardware.
Total	5458	

FY 1996 Planned Program:

•	3168	- Fabricate system hardware and receive delivery for testing.
•	1170	- Conduct technology demonstration. - Conduct accuracy and lethality evaluation. - Conduct milestone review for entry into Engineering and Manufacturing Development (EMD).
•	13	- Revised economic assumption not available for execution.
•	99	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
Total	4450	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology
	PROJECT D387

FY 1997 Planned Program:

•	813	- Issue Request For Proposal (RFP) for low-cost guidance. - Conduct a study to identify high cost items to address producibility.
Total	813	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	5601	4575	837
Appropriated Amount (FY 1995)	5483		
Adjustments to FY 1995	-25		
Appropriated Amount (FY 1996)		4495	
Adjustment to FY 1996		-45	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-24
Current President's Budget Submit	5458	4450	813

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D486

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D486 Rapid Force Projection Simulation	7007	5772	7849	8405	5115	0	0		0	35032

A. Mission Description and Budget Item Justification: Project D486 - Rapid Force Projection Simulation: The RFPI Simulation Support Plan and the RFPI Study Plan provide a detailed description of the simulation and analysis efforts underway to support the RFPI program. Scenario development, force-on-force modeling, and simulation are currently supported by detailed engineering models, preliminary system performance estimates/data, and other system models and simulations provided by the RFPI program and the individual Advanced Technology Demonstrations/ Technology Demonstrations (ATDs/TDs). All simulations and analyses will be performed under the guidance and supervision of the Integrated Battlefield Simulation and Analysis Team (IBSAT). Simulations and analyses will support the determination of value-added proposed technologies for the RFPI ACTD and will be utilized to determine the mix and number of developmental sensors to be used in the Advanced Warfighting Experiment (AWE) and subsequently to determine residual quantities and support requirements. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. Major contractors are Computer Science Corporation, Huntsville, AL; and Nichols Research Corporation, Huntsville, AL.

FY 1995 Accomplishments:

•	4750	- Supported RFPI Early Version Demonstration (EVD) post experiment reviews. - Implemented the HRS 33.7 high resolution scenario in the Combined Arms Support Task Force Evaluation Model (CASTFOREM). - Expanded virtual prototyping and synthetic battlefield capability. - Expanded virtual/live link capabilities.
•	1082	- Developed interface requirements between Battlefield Distributed Simulation - Developmental (BDS-D) and RFPI constructive simulations. - Provided simulation support to early version demonstration of multi-sensor/shooter concept. - Performed sensitivity analyses to identify preferred RFPI element mixes.
•	1175	- Developed specifications for BDS-D interface with candidate ATDs. - Conducted detailed planning and development for experiment 6 in support of Anti-Armor ATD (A2ATD).
Total	7007	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D486

FY 1996 Planned Program:

•	3340	- Perform record runs, document and staff run matrices for BEWSS, JANUS, and CASTFOREM. - Execute EFOG-M Virtual Prototype Demonstration (VPD) AWE.
•	2231	- Integrate follow-on scenarios into BEWSS, JANUS, and CASTFOREM. - Provide real/virtual integration support.
•	72	- Revised economic assumption not available for execution.
•	129	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
Total	5772	

FY 1997 Planned Program:

•	7849	- Document results of BEWSS, CASTFOREM, and JANUS runs. - Perform BEWSS record runs Command and Control (C2) simulations. - Execute ACTD and prepare for BLWE virtual exercise. - Perform final predictions for ACTD Model-Test-Model.
Total	7849	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	7234	5945	8083
Appropriated Amount (FY 1995)	7082		
Adjustments to FY 1995	-75		
Appropriated Amount (FY 1996)		5830	
Adjustment to FY 1996		-58	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-234
Current President's Budget Submit	7007	5772	7849

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D493

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D493 Rapid Force Projection Demonstration	4997	17477	24245	29774	27876	13564	11368		Continuing	Continuing

A. Mission Description and Budget Item Justification: **Project D493 - Rapid Force Projection Demonstration:** The integrated system of systems concept of this ACTD provides lightweight, responsive precision fires to destroy threat armor forces during day, night, and adverse weather. This ACTD will evaluate 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 will consist of forward sensors (hunters), advanced C2, and a suite of standoff killers. The mix of forward sensors used to complement and enhance existing unit assets includes both manned and unmanned air and ground systems. The sensor architecture will be based on the unit equipment, as documented in the U.S. Army Intelligence Master Plan and the U.S. Army Modernization Plan; and will be augmented with other sensors and processors, as required, to ensure forward sensors are properly cued. Tactical sensors (organic and advanced) will receive cueing information from these sensors to rapidly focus them on targets. The mix of standoff killers complements and extends the capabilities of current systems. The EFOG-M, a Brigade asset, is a lightweight, man-in-loop non-line of sight guided missile which is lethal to a variety of high priority targets, including heavy armor. Howitzers are organic to the Division and Corps artillery and operate in direct and general support of the Maneuver Brigade. The exact mix of 105/155 mm howitzers will be determined by the AWE manager in conjunction with the FORSCOM Unit, and the Depth and Simultaneous Attack Battle Lab (D&SA BL). The lightweight and Highly Mobile Artillery Rocket and Missile System (HIMARS) rocket firing platform, which uses a wheeled chassis, will be a Corps asset which is attached to the Maneuver Brigade. The deployability of the Division Ready Brigade Minus (DRB(-)) will not be affected throughout the evaluation of the systems. This ACTD will include both simulation and field demonstration phases, and will encourage 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. Integrated demonstration work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. Major contractors are Nichols Research Corporation, Huntsville, AL; and Computer Sciences Corporation, Huntsville, AL.

FY 1995 Accomplishments:

•	2836	- Initiated development of real-time control system. - Developed interface requirements, specifications, and implementation plan for the RFPI ACTD. - Developed interface specifications for integrating candidate ATDs.
•	2161	- Conducted assessment of new technologies for inclusion into RFPI. - Finalized specification of ACTD configuration/optional elements. - Interfaced with US Army digitization efforts.
Total	4997	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D493

FY 1996 Planned Program:

•	8930	- Provide support equipment for demonstration. - Design HIMARS including Critical Design Review (CDR). - Order long-lead items for HIMARS, including vehicles, launcher components, and raw materials.
•	4087	- Initiate fabrication of HIMARS prototypes/surrogates. - Verify and validate plan for DIS simulators. - Test for all elements. - Integrated technology .program technical support.
•	4030	- Develop of program plans and documentation. - Finalize communications equipment and integration support.
•	40	- Revised Economic Assumption not available for execution.
•	390	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
Total	17477	

FY 1997 Planned Program:

•	8900	- Complete HIMARS design. - Initiate developmental testing of HIMARS. - Continue fabrication of HIMARS prototypes/surrogates. - Initiate safety qualification and man rating evaluations of HIMARS.
•	5480	- Integrate HIMARS into RFPI evaluations. - Integrate ATD/TD systems into RFPI System-of-Systems. - Conduct and complete captive flight tests of sensors.
•	9865	- Perform training and integration elements at test installation. - Procure sensor, communications equipment, and special test equipment. - Conduct producibility and configuration management.
Total	24245	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D493

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4064	17967	24967
Appropriated Amount (FY 1995)	3979		
Adjustments to FY 1995	+1018		
Appropriated Amount (FY 1996)		17653	
Adjustment to FY 1996		-176	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-722
Current President's Budget Submit	4997	17477	24245

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D496

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D496 Enhanced Fiber Optic Guided Missile (EFOG-M)	30518	60171	37680	57920	36745	15105	3896		0	251340

A. Mission Description and Budget Item Justification: Project D496 - Enhanced Fiber Optic Guided Missile (EFOG-M): The Enhanced Fiber Optic Guided Missile (EFOG-M) is the primary "killer" within the "hunter/standoff killer" concept of the Rapid Force Projection Initiative and the OSD approved RFPI ACTD. The EFOG-M system is a multi-purpose, precision kill weapon system. The primary mission of the EFOG-M 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. EFOG-M 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. The system consists of a gunner's station, a tactical missile, and a fiber optic data link. The missile can navigate to the target area, and the gunner can intervene at any time to lock on and engage any detected targets. The gunner views the flightpath and target via a seeker on the missile linked to the gunner's video console. The missile to be demonstrated will incorporate an IR imaging seeker, a variety of advanced targeting functionalities and a global positioning system (GPS)-based inertial measurement unit for accurate targeting. The RFPI ACTD will demonstrate airlift constrained, enhanced power projection capabilities through the development and evaluation of new technologies and tactics for early entry forces. This ACTD will demonstrate a semi-automated target transfer from forward sensors (hunters) to an EFOG-M weapon system (killer) using C3 integration, and will fully explore the capability to expand the brigade level battle space through the use of simulation, TRADOC Battle Lab warfighting experiments and demonstrations. The ACTD will demonstrate the ability to conduct essential targeting and intelligence collection using forward sensors and real-time communications to provide for precision engagements against a variety of high priority targets, including armored vehicles. An integral element of the ACTD concept is allowing the participating unit to retain developmental items from the ACTD to provide residual operational capability.

FY 1995 Accomplishments:

•	13906	- Fabricated Virtual Prototype Experiment hardware.
•	11969	- Initiated design, fabrication and testing of EFOG-M developmental missiles, fire units, and platoon leader vehicles.
•	4643	- Integrated and managed design and fabrication effort.
Total	30518	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603313A Missile and Rocket Advanced Technology PROJECT D496

FY 1996 Planned Program:

•	2085	- Participate in a Virtual Prototype Experiment.
•	38730	- Continue design, fabrication, and testing of EFOG-M missiles, fire units, and platoon leader vehicles.
•	7712	- Initiate manufacturing of EFOG-M missiles, fire units, and platoon leader vehicles to support user conducted field training exercises.
•	10149	- Continue integration and management of design and fabrication effort.
•	170	- Revised Economic Assumptions not available for execution.
•	1325	- Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
Total	60171	

FY 1997 Planned Program:

•	25496	- Continue manufacturing of EFOG-M missiles, fire units, and platoon leader vehicles.
•	12184	- Continue integration and management of design and fabrication effort.
Total	37680	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	40747	69360	58565
Appropriated Amount (FY 1995)	39891		
Adjustments to FY 1995	-9373		
Appropriated Amount (FY 1996)		60779	
Adjustment to FY 1996		-608	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-20885
Current President's Budget Submit	30518	60171	37680

Change Summary Explanation:
FY 1995 funds (-9373) reprogrammed due to program restructure.
FY 1997 funds (-20885) reprogrammed due to program restructure.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D550

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D550 Counter Active Protection System	0	0	1942	1934	2409	478	0		0	6763

A. Mission Description and Budget Item Justification: D550 Counter Active Protection Systems (CAPS): 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: RF Countermeasure (RFCM) technology for jamming or deceiving APS sensors used for detection, acquisition, and tracking; warhead integration and ballistic hardening of ATGW to reduce vulnerability to fragment impact.

FY 1995 Accomplishments: Project not funded.

FY 1996 Planned Program: Project not funded.

FY 1997 Planned Program:

•	1942	Conduct integration of most promising long standoff warheads into missile test bed.
		Develop radar model for evaluating system specific RFCM concepts.
		Design test bed radar and build long lead components for testing RFCM breadboard prototypes.
		Perform fragment penetration testing to validate penetration equations in Missile Ballistic Vulnerability Simulation.
		Evaluate material/structural alternatives for ballistic protection against fragment impact..
Total	1942	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)			2000
Appropriated Amount (FY 1995)			
Adjustments to FY 1995			
Appropriated Amount (FY 1996)			
Adjustment to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-58
Current President's Budget Submit			1942

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603606A Landmine Warfare and Barrier Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	20505	24087	15196	16386	14047	13737	13346		Continuing	Continuing
D608 Countermine & Barrier Development	20505	18251	15196	16386	14047	13737	13346		Continuing	Continuing
D624 Ground Penetrating Radar Technology	0	2918	0	0	0	0	0		0	2918
D660 Humanitarian Demining	0	2918	0	0	0	0	0		0	2918

Mission Description and Budget Item Justification: This program element provides for the development and demonstration of countermine technologies, and a Congressional special interest effort to test and evaluate commercial technologies to support humanitarian demining operations. Advanced technology demonstrations (ATDs), advanced warfighting experiments, and modeling and simulation will be conducted to verify the system of systems approach, providing support for the shallow water/beach/land assault phase (Demo 1) of the Navy, Army, and USMC joint countermine advanced concepts technology demonstration (ACTD). The specific efforts include remote detection of minefields, detection of individual mines from moving vehicles and advanced hand held detectors, all of which must work against both traditional (metallic) mines and mines made from advanced materials. Breaching techniques will be developed for both conventional and electronically activated mines that can act at a distance. Operation Desert Storm and the humanitarian operations in Somalia have highlighted the need for new equipment to detect and neutralize land mines. The Army's highest priority requirements are in-stride detection and breaching, and man-portable stand-off and close-in detection and neutralization of landmines. Close-in man portable mine detectors will use multi-sensor fusion to augment and complement present metal detectors in discriminating mines from clutter. Similarly, multi-sensor fusion will be used in a vehicle-mounted mine detector system to sense surface-laid and buried mines. The Army has focused its resources and is expediting these programs in coordination with the US Marine Corps. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on conventional air/surface weaponry and ground vehicles. Work in this program element is related to and fully coordinated with PE 0602784A (Military Engineering Technology) and PE 0602712A (Countermine Technology). This program is managed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program is dedicated to conducting proof of principle field demonstrations and tests of system specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603606A Landmine Warfare and Barrier Advanced Technology

PROJECT: D608

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D608 Countermine & Barrier Development	20505	18251	15196	16386	14047	13737	13346		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project D608 - Countermine and Barrier Development: This project provides advanced technology demonstrations of countermine capabilities. The specific efforts include remote detection of minefields, detection of individual mines from moving vehicles and advanced hand held detectors, all of which must work against both traditional (metallic) mines and mines made from advanced materials. Close-in man portable mine detectors will use multi-sensor fusion to augment and complement present metal detectors in discriminating mines from clutter. Similarly, multi-sensor fusion will be used in a vehicle-mounted mine detector system to sense surface-laid and buried mines. Advanced signature projection and electronic deception techniques will be developed and demonstrated to defeat off-route, smart mines. These advanced technology demonstrations, along with advanced warfighting experiments, and modeling and simulation represent key elements of the shallow water/beach/land assault phase of the Navy, Army, and USMC joint countermine advanced concepts technology demonstration (ACTD).

FY 1995 Accomplishments:

- 4046 - Field-tested and evaluated performance of vehicle mounted mine detector test beds consisting of ground penetrating radar and electro-optic sensors .
- 1000 - Demonstrated countermeasure techniques in the off-route smart mine clearance (ORSMC) ATD to overcome terminal sensors (infrared (IR), millimeter wave (MMW)) of top and side attack mines using a smart mine emulator developed in PE 0602786A/AH20.
- 3630 - Demonstrated and evaluated performance of close-in man portable mine detector test beds; finalized program management documentation; and transitioned to Hand-Held Standoff Mine Detection System Dem/Val.
- 2485 - Conducted "expand the lodgment" and "beach break through" field simulations as part of the joint countermine ACTD.
- 9344 - Under a Congressional special interest effort, developed and demonstrated technologies specifically appropriate for demining in operations other than war, to include low cost vehicle mounted mine detector, low cost explosive devices for neutralization and destruction of mines in place, and individual components such as demining tool kits.

Total 20505

FY 1996 Planned Program:

- 17787 - Continue demonstration of countermeasure techniques in the ORSMC ATD to overcome terminal sensors of top and side attack mines; finalize program management documentation.
  - Complete sensor fusion algorithms; initiate build and integration of hardware and software for vehicle mounted mine detector demonstration.
  - Conduct "expand the lodgment" and "beach break through" advanced warfighting demonstrations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603606A Landmine Warfare and Barrier Advanced Technology
	PROJECT D608

FY 1996 Planned Program: (continued)

- Complete phase I of joint countermine advanced concept technology demonstration (ACTD) modeling and simulation effort, complete procurement of multiple manportable, vehicle mounted, and airborne mine detection prototypes; define countermine command, control, communications, computers, and intelligence (C4I) requirements and architecture and procure C4I equipment for joint countermine technology demonstrations.

•	407	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992.
•	57	- Revised economic assumption not available for execution.
Total	18251	

FY 1997 Planned Program:

•	15196	- Demonstrate and evaluate performance of vehicle mounted mine detector test bed; finalize program management documentation - Conduct "movement to contact" countermine modeling and simulation studies and small scale countermine field experiments - Complete simulation, analysis, and pre-demonstration exercises of countermine C4I architecture; and conduct ACTD demonstration I at Camp Lejeune, NC in conjunction with United States Atlantic Command (USACOM) forces
Total	15196	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	21612	18820	15649
Appropriated Amount (FY 1995)	21158		
Adjustment to FY 1995	-653		
Appropriated Amount (FY 1996)		18436	
Adjustment to FY 1996		-185	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-453
Current President's Budget Submit	20505	18251	15196

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603606A Landmine Warfare and Barrier Advanced Technology

PROJECT: D624

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D624 Ground Penetrating Radar Technology	0	2918	0	0	0	0	0		0	2918

A. Mission Description and Budget Item Justification Project D624 - Ground Penetrating Radar: This program provides for the development and evaluation of ground penetrating radar technologies for mine detection.

FY 1995 Accomplishments: Program not funded.

FY 1996 Planned Program:

•	2850	- Investigate detection algorithm and waveform improvements to ground penetrating radar technologies for manportable, vehicle, and standoff mine detection applications.
•	66	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992
•	2	- Revised economic assumption not available for execution
Total	2918	

FY 1997 Planned Program: Program not funded.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)		0	
Appropriated Amount (FY 1995)			
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		3000	
Adjustment to FY 1996		-82	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current President's Budget Submit		2918	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603606A Landmine Warfare and Barrier Advanced Technology

PROJECT: D660

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D660 Humanitarian Demining	0	2918	0	0	0	0	0		0	2918

A. Mission Description and Budget Item : Justification D660 - Humanitarian Demining: This program provides for the integration and demonstration of commercial off-the-shelf technologies for use in humanitarian demining. This Congressional special interest program is a continuation of effort funded in FY 1995 under project D608 in PE 0603606A. FY97 funding for humanitarian demining technology is programmed in PE 0603120D.

FY 1995 Accomplishments: Program funded under PE 0603606A, project D608.

FY 1996 Planned Program:

•	2844	- Develop and enhance technologies for humanitarian demining and in operations other than war.
•	66	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992
•	8	- Revised economic assumption not available for execution
Total	2918	

FY 1997 Planned Program: Program funded under PE 0603120D.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)		0	
Appropriated Amount (FY 1995)			
Adjustment to FY 1995			
Appropriated Amount (FY 1996)		3000	
Adjustment to FY 1996		-82	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			
Current President's Budget Submit		2918	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603607A Joint Service Small Arms Program

PROJECT: D627

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D627 Joint Service Small Arms Program (JSSAP)	6908	4365	5243	4756	5152	4986	5620		Continuing	Continuing

A. Mission Description and Budget Item Justification: The objective of this Program Element (PE) is to demonstrate key technologies leading to more effective small arms weapons and munitions for all Services. The Joint Services Small Arms Program (JSSAP) is designed to overcome the technological barriers associated with small arms/munitions/fire control for individual and crew-served weapons. The goal is to achieve substantial improvements in threat defeat under all environmental conditions while reducing the soldier's load. This PE funds several efforts, including the following: (1) Objective Individual Combat Weapon (OICW) Advanced Technology Demonstration (ATD), the lethality portion for the 21st Century Land Warrior (21CLW)/Generation II Soldier System which will provide a 300% to 500% increase in hit probability, the ability to defeat defilade or non-visible targets, and increase effective range to 1000 meters; (2) Objective Crew Served Weapon (OCSW), which will demonstrate the next generation crew-served weapon to replace the M2 machine gun and the MK19 grenade machine gun (GMG), a two-soldier portable system that maintains comparable firepower while featuring a 60-75% weight reduction; (3) Multi-Platform Ballistic Sight (MPBS), for an all weather day/night capability against materiel and personnel, increasing first burst hit probabilities from the present 15% to 90%; (4) 7.62mm long range sniper cartridge with enhanced effective range out to 1000m; (5) Controlled Penetration Ammunition, intended to minimize collateral damage in confined operational environments; (6) Training Ammunition, to yield realistic training with a maximum range of 2700m vs. 6500m for service ammunition; and (7) a new Joint Service Combat Shotgun meeting the requirements of all the Services, increasing versatility, and reducing logistics burden. All JSSAP efforts are based upon approved Joint Service Science and Technology Objectives (JSSTO) and the Joint Service Small Arms Master Plan (JSSAMP), plus Mission Needs Statements and Operational Requirements Documents of the Services. The work in this PE is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armaments Research, Development and Engineering Center, Picatinny Arsenal, NJ. Major contractors include: Olin Corp., East Alton, IL; Contraves USA, Pittsburgh, PA; Alliant Tech Systems, Hopkins, MN; and AAI Corp., Hunt Valley, MD. Work in this PE is related to and fully coordinated with efforts in PE 0602623A (Joint Service Small Arms Program), PE 0602624A (Weapons & Munitions Technology), and transitions to JSSAP efforts conducted in PE 0604802A (Weapons and Munitions-Engineering Development) and PE 0604601A (Objective Crew Served Weapon-Engineering Development). Additional transition paths have been established in coordination with Project Manager (PM) Small Arms, USMC PM Ground Weapons and US Special Operations Command (SOCOM). This program is dedicated to conducting proof of principle field demonstrations and tests of system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

FY 1995 Accomplishments:

- 6044 - Completed fabrication/integration/test/evaluation of a final design for Multi-Platform Ballistic Sight.
  - Initiated technology demonstrations of Multi-Platform Ballistic Sight and prepared for transition.
  - Completed Objective Individual Combat Weapon (OICW) system conceptualization; completed concept technology review and downselected to two contractors based upon projected performance, weight and cost of system; initiated phase II (component design/fabrication/demonstration) fully utilizing integrated product and process development methodology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603607A Joint Service Small Arms Program
	PROJECT D627

FY 1995 Accomplishments: (continued)

•	864	- Finalized Cal .50 Limited Range Training Ammunition (LRTA) design and initiated fabrication of performance verification hardware. - Finalized design of low collateral damage rifle ammunition and initiated fabrication of performance verification hardware. - Completed Joint Combat Shotgun Operational Requirements Document, Milestones I/II and released request for proposal.
•		- Initiated development of a 7.62mm Long Range Sniper Cartridge.
Total	6908	

FY 1996 Planned Program:

•	3684	- Demonstrate critical sub-system component technologies for OICW; downselect to a single approach/contractor; integrate sub-system components for application into a system prototype. - Complete technology demonstrations of Multi-Platform Ballistic Sight and prepare for transition. - Complete fabrication of hardware and verify performance of Cal .50 LRTA.
•	582	- Fabricate/deliver refined low collateral damage rifle ammunition for performance verification. - Complete Joint Combat Shotgun technical tests, downselect, and initiate fabrication of operational test hardware. - Complete 7.62mm Long Range Sniper Cartridge performance verification.
•	86	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization of 1992
•	13	- Revised economic assumption not available for execution.
Total	4365	

FY 1997 Planned Program:

•	3362	- Refine/build/test/qualify/exercise simulator for the OICW. - Complete design and fabrication of OICW demonstrator weapon and conduct technology demonstration. - Initiate OICW hardware build for Generation II Soldier interface.
•	1881	- Verify low collateral rifle ammunition performance. - Complete fabrication, operational tests and milestone decision for Joint Combat Shotgun. - Design, optimize and fabricate a prototype Objective Crew Served Weapon.
Total	5243	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603607A Joint Service Small Arms Program PROJECT D627

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1996)	7163	4487	5381
Appropriated Amount (FY 1995)	7035		
Adjustment to FY 1995	-127		
Appropriated Amount (FY 1996)		4409	
Adjustment to FY 1996		-44	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-138
Current President's Budget Submit	6908	4365	5243

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603654A Line-of-Sight Technology Demonstration

PROJECT: D460

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D460 LOSAT Technology Demonstration	8575	14324	18173	12998	0	0	0		0	191118

A. Mission Description and Budget Item Justification: **Project D460-LOSAT Technology Demonstration:** This program focuses on integration of the LOSAT weapon system into an air mobile configuration in order to help remedy the early entry force lethality shortfall against heavy armor. LOSAT is a mobile, direct fire, antitank system and provides overwhelming lethality with a high rate of kill at long range. The LOSAT weapon system consists of a kinetic energy (KE) missile launcher mounted on an armored combat vehicle chassis. The LOSAT program was restructured to advanced development in FY 1992 in order to complete an evaluation of the fire control system and to study further the utility of the LOSAT technologies on an air mobile system before commitment to the formal acquisition process. The current program provides for the conduct of an early entry force demonstration program which includes the design, fabrication, and integration of a LOSAT system turret into an Armored Gun System (AGS) chassis, conduct of a missile flight test program from the AGS based LOSAT fire unit, and limited user testing. The demonstration program is a cost-effective means to assess the utility of LOSAT to the early entry force as part of the Rapid Force Projection Initiative (RFPI). This project will develop improved technologies for KE missile defeat of robust armor targets and evaluate integration of the LOSAT capability into an air mobile configuration to help remedy the early entry force's lethality shortfall against heavy armors. Project objectives are to position the technology for future acquisition decisions, demonstrate subsystem capabilities in flight tests and dirty battlefield environment, evaluate the utility of the LOSAT technology for the early entry forces, demonstrate an integrated AGS based LOSAT system in flight test and advanced warfighting experiments, and evaluate affordablity issues. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan and Project Reliance. This program is dedicated to conducting proof of principal field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3. Work on this program is conducted through the CCAWS Project Office in Huntsville, AL. The prime contractor is Loral Vought Systems in Dallas, TX.

FY 1995 Accomplishments:

- 2763 - Assembled missiles to support LOSAT/BFV flight test program.
- 1200 - Government/Contractor Test and Evaluation (T&E) support to LOSAT/BFV flight test program.
- 2102 - Completed Fire Control System Test at White Sands Missile Range (WSMR), NM.
- 1510 - Continued design, fabrication/integration of the Weapon System Turret Assembly (WSTA) for an Armored Gun System (AGS) chassis based system .
- 1000 - Supported Distributed Interactive Simulation Crew Station Simulator (DISCSS) activities related to Rapid Force Projection Initiative (RFPI) analysis simulation effort and in Anti-Armor advanced technology demonstration (A^2ATD) experiments .

Total 8575

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603654A Line-of-Sight Technology Demonstration PROJECT D460

FY 1996 Planned Program:

•	2598	- Complete AGS chassis fabrication.
•	9007	- Continue WSTA design and fabrication/start fire unit integration.
•	200	- Support Distributed Interactive Simulation Crew Station Simulator (DISCSS) activities related to Rapid Force Projection Initiative (RFPI) analysis simulation effort and in Anti-Armor advanced technology demonstration (A^2ATD) experiments .
•	2100	- Complete the LOSAT/BFV flight tests.
•	319	- SBIR/STTR.
•	100	- Revised economic assumption not available for execution.
Total	14324	

FY 1997 Planned Program:

•	7500	- Perform system engineering requirements analyses for application of the LOSAT system on the HMMWV configuration.
•	5300	- Conduct technical analyses to establish system error, power, weight, space and timing budgets for the HMMWV configuration.
•	3500	- Establish chassis and crew environment during missile firings including noise, pressure, recoil, exhaust products, and temperature.
•	1473	- Update the LOSAT system simulation for changes associated with the HMMWV configuration.
•	400	- Support Distributed Interactive Simulation Crew Station Simulation (DISCSS) related to Rapid Force Projection Initiative (RFPI) analysis simulation effort and in Anti-Armor advanced technology demonstration (A^2ATD) experiments.
Total	18173	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	4871	14727	18707
Appropriated Amount (FY 1995)	4769		
Adjustments to FY 1995	3806		
Appropriated Amount (FY 1996)		14469	
Adjustments to FY 1996		-145	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-534
Current President's Budget Submit	8575	14324	18173

Change Summary Explanation:
Funding: FY 1995: below threshold reprogramming (+3806).

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	31932	32882	32597	25812	36564	43767	40500		Continuing	Continuing
DK70 Night Vision Advanced Technology	16215	14624	11425	6321	14110	14511	15733		Continuing	Continuing
DK86 Night Vision, Airborne Systems	7608	9128	7766	13365	15327	15819	12380		Continuing	Continuing
DK87 Night Vision, Combat Vehicles	8109	9130	11182	4855	6548	13437	12387		Continuing	Continuing
DC63 Tractor Quake	0	0	2224	1271	579	0	0		0	4205

Mission Description and Budget Item Justification: This program element (PE) develops new and improved tactical night vision and electronic sensor technologies for surveillance, target acquisition, driving, and to meet future requirements of infantry, anti-armor, air defense, combat vehicle, aircraft, and unmanned vehicle applications. This technology will provide the capability to acquire and engage hostile targets at extended ranges during day/night, smoke, obscured weather and battlefield conditions, significantly enhancing the warfighting capability and survivability of US systems. Multisensor target acquisition suites will be demonstrated to provide rapid automatic acquisition of targets and battlefield intelligence data to allow US forces to operate and react well within the operational timelines of threat forces. Efforts are also directed toward technology for wide field-of-view (FOV) sensors to support dismounted soldier mobility and day/night nap-of-the-earth pilotage at high speeds. This PE will provide the target acquisition sensors for the advanced vehicle technologies, Rapid Force Projection Initiative (RFPI), and Force XXI Soldier. Technology advances achieved under this PE have tri-service applications. Work in this program element is consistent with the resource-constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance agreements on sensors and electronic devices with oversight and coordination provided by the Joint Directors of Laboratories. This work is related to and fully coordinated with efforts in program elements 0602709A/DH95, Night Vision Technology; 0602270A, Electronic Warfare Technology; 0603774A, Night Vision Systems Advanced Development; and 0604710A, Night Vision Systems Engineering Development. There is no unnecessary duplication of effort within the Army or DoD. Work in this PE is primarily managed by the US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Ft. Monmouth, NJ. Contractors include: Texas Instruments, Inc., Dallas, TX; Hughes Aircraft Co., El Segundo, CA; Fibertek, Herndon, VA; Questech, Falls Church, VA; Westinghouse, Linthicum, MD; Lockheed-Martin Corp., Orlando, FL; Loral, Lexington, MA; Alliant, Hopkins, MN; EOIR, Spotsylvania, VA; Booze-Allen, McLean, VA; Omar McCall, Beltsville, MD. This project includes proof of principle demonstrations and tests of system-specific technologies to meet specific military needs and is therefore appropriately placed in Budget Activity 3.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY: 3 - Advanced Technology Development	PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology — PROJECT: DK70

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DK70 Night Vision Advanced Technology	16215	14624	11425	6321	14110	14511	15733		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> Project DK70 - Night Vision Advanced Technology: This project will develop and demonstrate high performance, sensor/multisensor technology to meet the target servicing requirement for weapon systems upgrades. Hunter Sensor Suite advanced technology demonstration (ATD) will demonstrate the feasibility of a lightweight, deployable and survivable hunter vehicle platform with an advanced, low observable, long range hunter sensor suite in the Rapid Force Projection Initiative advanced concept technology demonstration (RFPI ACTD). The Hunter Sensor Suite will combine second generation thermal imaging, day TV, eye safe laser rangefinder, embedded aided target recognition, and image compression/transfer technology. Remote Sentry ATD will demonstrate a compact, lightweight, integrated multisensor system capable of being implanted in forward areas and behind enemy lines to provide day/night, adverse weather, unmanned surveillance and targeting information in the Rapid Force Projection Initiative (RFPI) ACTD. Individual soldier technologies previously conducted under this project have been transitioned to PE 603001A beginning in FY 96.

FY 1995 Accomplishments:

•	1100	-Conducted multisensor aided targeting (MSAT)-air field testing and flight demonstration of multi-sensor fusion. Provided tech data package to Comanche.
•	4465	-Delivered equipment and tested remote sentry advanced technology demonstration (ATD) components.
•	338	-Developed display interfaces and integration approach for objective (2K x 2K) Advanced Research Projects Agency (ARPA) high resolution display.
•	1817	-Completed development of integrated sight module critical components.
•	8495	-Packaged and integrated sensors for the hunter sensor suite ATD program in preparation for FY 96 demonstration.
Total	16215	

FY 1996 Planned Program:

•	14294	- Integrate the interim hunter sensor suite (without aided target recognition) on the hunter surrogate vehicle; deliver interim unit for Task Force XXI Army warfighting experiment (AWE); complete aided target recognition system development. - Complete integration and demonstrate remote sentry ATD hardware.
•	287	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization Act of 1992.
•	43	- Revised economic assumption not available for execution.
Total	14624	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology
	PROJECT DK70

FY 1997 Planned Program:

•	11425	- Integrate aided target recognition processor and automated command and control system with baseline hunter sensor suite and vehicle; integrate with remote sentry, rapid force projection initiative (RFPI) C2 network, and RFPI weapons; conduct engineering tests to verify ATR and C2 performance; deliver sensor/vehicle system to RFPI ACTD.
Total	11425	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	16668	19201	18815
Appropriated Amount (FY 1995)	16341		
Adjustment to FY 1995	-126		
Appropriated Amount (FY 1996)		14772	
Adjustment to FY 1996		-86	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-7390
Current President's Budget Submit	16215	14686	11425

Change Summary Explanation: Funding: FY97 funds shifted (-7390) to higher priority requirements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology
	PROJECT DK86

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DK86 Night Vision, Airborne Systems	7608	9128	7766	13365	15327	15819	12380		Continuing	Continuing

A. <u>Mission Description and Budget Item Justification</u> Project DK86 - Night Vision Airborne Systems: This project concentrates on the development and flight evaluation of night pilotage technology, imaging sensor and display technology, and automated obstacle warning technology to meet the requirements of future aviation platforms, and on enhance the operational capabilities and survivability of currently fielded attack, scout, cargo and utility helicopters. This technology will significantly enhance the survivability of Army aviation assets by permitting rotorcraft to fly at NOE altitude and avoid obstacles in day/night/adverse weather conditions; and reduce exposure to air defense artillery, surveillance systems, and smart missiles. Technology includes high-performance multi-sensor pilotage technology and single-sensor advanced image intensification (I2) technology for lower-cost applications. The advanced helicopter pilotage (AHP) demonstration will provide, in both demonstration hardware and flight evaluation, a high-quality dual-spectral pilotage sensor with the field of view and resolution required for advanced aircraft, and the displays needed to provide this imagery to the pilot. The advanced image intensification (AI2) technology demonstration provides an improved night vision goggle capability with higher resolution, larger field of view, and integrated symbology. It will demonstrate technology for applications where an advanced, dual-spectrum sensor is not affordable, but additional capability over existing goggles is needed. These applications include utility and cargo aircraft, and the mounted and dismounted soldier. The aerial scout sensor suite will provide non-line-of-sight targeting for weapons systems in the RFPI ACTD. Air/land enhanced reconnaissance and targeting (ALERT) demonstration builds on the multisensor aided targeting (MSAT)-air program, which demonstrated an aided target recognition (ATR) capability for hovering helicopters. ALERT will demonstrate search on-the-move aided target acquisition using a FLIR/Laser sensor suite for future aviation and ground assets. ALERT will also demonstrate technology which will be evaluated in the survivable armed reconnaissance on the digital battlefield simulation program. Technology developed under Project DK86 is also directly applicable to the night flying requirements of the other services and Special Operations Command's rotary wing aircraft.

FY 1995 Accomplishments:

•	4238	-Demonstrated high bandwidth/resolution standardized advanced dewar assembly (SADA-1) focal plane array and high resolution, helmet mounted image intensified/charge coupled device (CCD) camera with advanced signal processing for Comanche night pilotage risk reduction. Integrated AHP Phase I sensors and processing for Comanche risk reduction. Integrated AHP Phase I sensors and display into AH-64C Apache aircraft and demonstrated to aviation user.
•	2475	-Developed advanced image intensification technology demonstration with higher resolution symbology/graphics integrated.
•	895	-Investigated technology for low-cost aerial sensors for targeting of tactical ground targets, applicable to manned and unmanned aerial platforms.
Total	7608	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology
	PROJECT DK86

FY 1996 Planned Program:

•	8919	- Develop and integrate a wide field of view (FOV) (40 x 80 deg) dual spectrum (FLIR & I2) pilotage sensor technology to provide significant reduction in pilot workload. - Conduct AI2 advanced warfighting demo with the user; provide transition option to program manager. - Design and develop aerial scout sensor technology that will provide non-line of sight targeting, over-the-hill battlefield reconnaissance surveillance and battlefield assessment. Candidate sensors include staring FLIR, MTI radar and wide area infrared (IR) linescanner.
•	182	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization Act of 1992.
•	27	- Revised economic assumption not available for execution.
Total	9128	

FY 1997 Planned Program:

•	7766	- Demonstrate wide-FOV night pilotage system-helmet mounted display system and dual spectrum (FLIR and I2) sensors in a single turret. - Complete evaluation of candidate aerial scout sensors and begin integration on aerial platform. - Initiate ALERT ATD to develop on-the-move aided target recognition.
Total	7766	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	7799	9383	5908
Appropriated Amount (FY 1995)	7638		
Adjustment to FY 1995	-30		
Appropriated Amount (FY 1996)		9219	
Adjustment to FY 1996		-53	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			1858
Current President's Budget Submit	7608	9166	7766

Change Summary Explanation: Funding: FY97 funds reflect program transfer within the program element.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology PROJECT DK87

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DK87 Night Vision, Combat Vehicles	8109	9130	11182	4855	6548	13437	12387		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project DK87 - Night Vision, Combat Vehicles:** This project demonstrates target acquisition sensor technology to meet the stringent target acquisition requirements of future combat vehicles. Target Acquisition ATD will demonstrate an extended range, multisensor target acquisition suite for future tank, cavalry, and scout vehicles. The multisensor suite will consist of a second generation thermal imaging sight with automated wide area search and aided target recognition, a low cost MTI radar (growth to STI), and a multifunction laser. Electronic Integrated Sensor Suite for Air Defense will demonstrate technology for the maneuver force with passive, automated volume search, target detection, tracking and identification, and low probability of intercept laser ranging of fixed wing, rotary, and cruise missile aircraft.

FY 1995 Accomplishments:

•	1960	-Incorporated results of the electronic integrated sensor system (EISS) test bed experiment and trade-off studies into best technical approach for "on-the-move-suite". Evaluated test bed results.
•	1990	-Procured MTI radar demonstrator and integrated into a M1 tank testbed in preparation for user/developer test under the Army's target acquisition ATD.
•	4159	-Established parameters and designed an advanced target acquisition suite for future reduced tank crew applications.
Total	8109	

FY 1996 Planned Program:

•	8928	- Integrate the target acquisition ATD processor and sensor suite. Demonstrate and baseline the target acquisition sensor suite for performance. Demonstrate MTI millimeter wave (MMW) radar and multi-wavelength multi-function laser. - Complete EISS data collection and algorithm enhancements, and single band/single aperture trade studies.
•	175	- Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization Act of 1992.
•	27	- Revised economic assumption not available for execution
Total	9130	

FY 1997 Planned Program:

•	11182	- Integrate and demonstrate the target acquisition ATD sensor suite and processor and radar on surrogate vehicle. - Complete EISS capability demonstrations and transition to masked target kill.
Total	11182	

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603710A Night Vision Advanced Technology

PROJECT: DK87

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	8710	9385	12470
Appropriated Amount (FY 1995)	8528		
Adjustment to FY 1995	-419		
Appropriated Amount (FY 1996)		9221	
Adjustment to FY 1996		-53	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-1288
Current President's Budget Submit	8109	9168	11182

Change Summary Explanation: Funding: FY97 funds reprogrammed (-1288) to higher priority requirements.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	10802	12041	20664	12245	14874	13380	6669		Continuing	Continuing
DT08 Combat Engineering Systems	2079	2834	1456	1654	482	807	6669		Continuing	Continuing
DT10 Total Distribution Advanced Technology Demonstration	8723	9207	9585	0	0	0	0		0	27554
DT12 Rapid Battlefield Visualization	0	0	9623	10591	14392	12573	0		0	47179

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 their missions in support of the commander and the force projection Army. Critical deficiencies exist in the Army's ability to rapidly generate, update, maintain and distribute relevant terrain data in support of both terrain and battlefield visualization, apply physics-based reasoning to planning and executing mobility, countermobility, survivability, and general engineering missions; establishing in-transit visibility of materiel and supplies; management of logistics distribution and logistics automation. These 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 and during either combat operations or operations other than war. Demonstrations are integral components of Army Advanced Warfighting Experiments, Advanced Concepts 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, countermobility, 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 Management Plan, other relevant master plans, the Army Modernization Plan, and Project Reliance. This program is dedicated to conducting proof of principle field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology PROJECT DT08

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DT08 Combat Engineering Systems	2079	2834	1456	1654	482	807	6669		Continuing	Continuing

A. Mission Description and Budget Item Justification Project DT08 - Combat Engineering Systems: This project will demonstrate decision support applications for mobility, countermobility and survivability that support multiple battlefield operating systems, including maneuver, command and control, and mobility and survivability. An integrated obstacle planning and simplified survivability assessment system will be demonstrated in brigade and division level exercises. This software suite will enable the engineer to rapidly generate engineer assessments, conduct course of action analyses, provide engineer force level information to commanders and other staff/functional elements, and provide the engineer with the ability to effectively execute command and control of the complex battlefield missions of countermobility and survivability. This project will also demonstrate capabilities to rapidly generate, update and manage digital topographic data in-the-field to support warfighters in cases where Defense Mapping Agency (DMA) data are not available or need to be modified to reflect current intelligence. The topographic information integration prototype (TIIP) will be used to generate digital terrain elevation data (DTED) and orthophotos from imagery and map sources. The orthophotos will be draped over the DTED and can be annotated with appropriate symbology and used as image maps to provide a 3-D view of the battlefield. Terrain update module (TUM) software will be used for dynamic update of standard digital DMA topographic data. The use of multiple TUMs to shorten database generation times will be demonstrated as will the database management software to process data from multiple TUMs. Transition targets for the software capabilities that will be integrated and demonstrated under this project include the Army battle command system (ABCS) and the digital topographic support system (DTSS). The work is performed by: the Cold Regions Research and Engineering Laboratory, Hanover, NH; the Topographic Engineering Center, Alexandria, VA; and the Waterways Experiment Station, Vicksburg, MS.

FY 1995 Accomplishments:

•	2079	- Completed integration and documentation of terrain data update software for transition to topographic battalions. - Integrated database management capabilities with rapid database generation and update capabilities. - Conducted demonstration of baseline countermobility and survivability battle command capability during Prairie Warrior 95.
Total	2079	

FY 1996 Planned Program:

•	2005	- Demonstrate integrated database generation and update capabilities in support of early entry forces. - Develop and demonstrate version 1.0 of Mobility and Survivability software suite at Prairie Warrior 96.
•	758	- Integrate, demonstrate, and transition task force level decision support applications for countermobility and survivability to the Fort Hood Experimental Force.
•	63	- SBIR/STTR reduction not available for execution.
•	8	- Revised economic assumption not available for execution.
Total	2834	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology
	PROJECT DT08

FY 1997 Planned Program:

•	1456	- Upgrade Mobility and Survivability software to version 1.5 through inclusion of Wide Area Munition effectiveness, military hydrology, and excavation in frozen soils algorithms, and initiate implementation of automated obstacle planning. - Demonstration of Mobility and Survivability version 1.5 at Prairie Warrior 97.
Total	1456	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget (FY 1995)	2184	2913	3642
Appropriated Amount (FY 1995)	2138		
Adjustments to FY 1995	-59		
Appropriated Amount (FY 1996)		2862	
Adjustments to FY 1996		-28	
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			-2186
Current President's Budget Submit	2079	2834	1456

Change Summary Explanation:

Funding: FY97: Funds were redirected in FY97 to Project DT12, Rapid Battlefield Visualization Technology Demonstration and other higher priority efforts.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology

PROJECT: DT10

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DT10 Total Distribution Advanced Technology Demonstration	8723	9207	9585	0	0	0	0		0	27554

A. Mission Description and Budget Item Justification; Project DT10 - Total Distribution Advanced Technology Demonstration (TDATD): Operation Desert Storm showed that the logistics distribution system needed major improvements to increase its efficiency and effectiveness. The TDATD was established to demonstrate potential enhancements in logistics situational awareness and course of action analyses supporting distribution management, in-transit asset visibility and logistics automation and communication. The TDATD will demonstrate automated logistics planning tools, computer simulation and modeling techniques, advanced microelectronics, satellite tracking and communications technology to support an advanced objective logistics supply capability. These tools will be demonstrated within the context of an integrated suite of logistics data management tools, decision support tools, and collaborative planning tools. The work is being performed by: the Communications Electronics Research Development and Engineering Center, Ft. Monmouth, NJ; the Army Research Laboratory, Aberdeen Proving Ground, MD; the Waterways Experimentation Station, Vicksburg, MS; and the Topographic Engineering Center, Alexandria, VA.

FY 1995 Accomplishments:

- 4140 - Developed and integrated simulation and modeling capabilities into logistics Course Of Action (COA) automated systems.
  - Developed Logistics Anchor Desk (LAD) connectivity to real logistics data sources (Total Asset Visibility (TAV) and the Global Transportation Network (GTN)).
  - Developed infrastructure and 3-D terrain visualization capabilities and data for logistics automated systems.
- 4583 - Developed interfaces from COA systems for incorporation into the Combat Service Support Control System (CSSCS) and the Army Global Command and Control System (AGCCS) architecture.
  - Demonstrated enhanced logistics automation capabilities in Prairie Warrior 95, and other exercises, with warfighting CINC (Commander-in-Chief) leave behinds, using LAD.

Total 8723

FY 1996 Planned Program:

- 5095 - Develop expanded LAD connectivity to real logistics data sources (the Standard Army Management Information Systems (STAMIS) and additional classes of supply.
  - Develop and integrate enhanced infrastructure and terrain visualization capabilities and data such as engineer data and road/port data.
  - Develop simulation capabilities for additional COA analysis to include machine learning and knowledge discovery and expanded data visualization in the LAD.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology
	PROJECT DT10

FY 1996 Planned Program: (continued)

•	3882	- Develop interfaces into the CSSCS/AGCCS architecture in a client-server based relationship while providing technology options for these systems. - Develop links and provide the warfighting commanders with enhanced leave-behind logistics automation capabilities through participation in AWEs such as Prairie Warrior and Unified Endeavor.
•	205	- SBIR/STTR reduction not available for execution.
•	25	- Revised economic assumption not available for execution.
Total	9207	

FY 1997 Planned Program:

•	4881	- Complete development of expanded LAD connectivity to real logistics data sources by incorporating automated data management and other data integrity utilities. - Develop enhanced LAD COA and logistics automation and infrastructure assessment capabilities using sensitivity analysis and total COA analysis.
•	4704	- Transition advanced LAD capabilities into the AGCCS/CSSCS architecture to provide these systems improved logistics capabilities. - Insert enhanced LAD COA technology into leave-behind logistics automation capabilities that are fully integrated into the Global Command and Control System (GCCS) and the Army Command and Control systems for the warfighting CINCs. - Demonstrate LAD capabilities integrated within the common architecture in Prairie Warrior and Task Force XXI.
Total	9585	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	10472	9467	10071
Appropriated Value (FY 1995)	10253		
Adjustments to FY 1995	-1530		
Appropriated Amount (FY 1996)		9301	
Adjustments to FY 1996		-94	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-486
Current President's Budget Submit	8723	9207	9585

Change Summary Explanation: FY95 - Rescission (-1500).

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603734A Military Engineering Advanced Technology

PROJECT: DT12

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DT12 Rapid Battlefield Visualization	0	0	9623	10591	14392	12573	0		0	47179

A. <u>Mission Description and Budget Item Justification:</u> **Project DT12 Rapid Battlefield Visualization:** This project will demonstrate the integration of critical battlefield visualization technologies in support of crisis response and force projection missions to enable the Joint Warfighter to successfully plan, rehearse and execute his mission. Digital topographic data (DTD) is the foundation for battlefield visualization and these data are not currently available for most areas where Force XXI units will have to operate. Methods for rapidly producing DTD to support military operations, particularly early entry, and the optimum resolution and density of DTD for both current and notional systems need to be established. The Rapid Battlefield Visualization (RBV) Advanced Concept Technology Demonstration (ACTD) will be conducted to demonstrate capabilities to rapidly collect source data and generate high resolution digital terrain databases to support crisis response and force projection operations within the timelines required by the joint force commander. The RBV ACTD will also demonstrate capabilities for the commander to integrate these terrain databases with current situation data, and manipulate and display the integrated databases to determine how to achieve his objectives, and visualize his desired end state. A capability for rapid collection of high resolution (1m grid spacing) digital terrain elevation data will be demonstrated, and imagery from aircraft and satellite platforms will be used to generate terrain feature data and map backgrounds. The RBV ACTD will provide and leave behind the computer workstations and applications software to generate high resolution terrain databases; and analyze courses of action using mission planning and embedded wargaming software, and conduct mission rehearsals. This ACTD will also provide a tool for further exploration of emerging warfighting concepts and doctrine. The ACTD will leverage the Advanced Research Projects Agency (ARPA) Battlefield Awareness and Data Dissemination ACTD for data dissemination over the global broadcast system and tactical communications, and the Communications and Electronics Command (CECOM) Battlespace Command and Control (BC2) Advanced Technology Demonstration for workstations and applications software. This project will leverage work in progress by the Topographic Engineering Center (TEC), Defense Mapping Agency (DMA), National Reconnaissance Office (NRO), Defense Airborne Reconnaissance Office (DARO), Central Imagery Office (CIO), and Defense Modeling and Simulation Office (DMSO).

Work performed by: This project is managed by the Joint Precision Strike Demonstration (JPSD) Office, Program Executive Officer, Intelligence and Electronic Warfare (PEO-IEW), Falls Church, VA. Contractors include: Raytheon, Bedford, MA; SAIC, Rosslyn, VA; MRJ, Oaken, VA; TASC, McLean, VA; Space Applications Corp, Vienna, VA; and MTC, Shrewsbury, NJ. Participating government laboratories include: Topographic Engineering Center, Alexandria, VA; Army Research Laboratory, Adelphi, MD; Communications and Electronics Research, Development and Engineering Center, Ft. Monmouth, NJ.

FY 1995 Accomplishments: Project not funded.

FY 1996 Planned Program: Project not funded.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603734A Military Engineering Advanced Technology PROJECT DT12

FY 1997 Planned Program:

•	4860	- Exploit advanced technology Interferremetic Synthetic Aperture Radar to generate a digital elevation data set to support an early entry scenario. - Generate semi-automated feature data of same test area using advanced technology terrain feature extraction software. - Generate geometrically controlled imagery coverage of the test area.
•	4763	- Integrate elevations, features and imagery into a common digital terrain data set for the test area. - Integrate Red and Blue force information from Battlefield Awareness and Data Dissemination (BADD) ACTD with the digital terrain data to provide an operational view of the battlefield. - Disseminate to tactical users over high speed communications links. - Provide eight (8) visualization workstations with experimental applications to equip XVIII Abn Corps (ABC) Division Command Posts, and evaluate during XVIII ABC Advanced Warfighting Experiment (AWE).
Total	9623	

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	0	0	0
Appropriated Value (FY 1995)	0		
Adjustments to FY 1995			
Appropriated Amount (FY 1996)			
Adjustments to FY 1996			
Adjustments to Budget Year (FY 1997) since FY 1996 President's Budget			+9623
Current President's Budget Submit	0	0	9623

Change Summary Explanation:

Funding: FY97: This is a new project, Rapid Battlefield Visualization, which will form the Army Science and Technology contribution to a proposed Rapid Battlefield Visualization ACTD.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603759A Chemical/Biological Defense and Smoke Advanced Technology Development

PROJECT: DE83

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DE83 Chemical Biological Defense Systems Adv Tech	189	0	0	0	0	0	0		0	189

A. Mission Description and Budget Item Justification: This program element funds demonstrations of technologies and materiel in support of equipment defeating munitions. These efforts comprise risk-reducing demonstrations conducted in an operational environment with active user and developer participation. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. Efforts under this PE transition and provide risk reduction for Demonstration/Validation, Engineering/Manufacturing Development and Operational Development programs. This program is dedicated to conducting proof of principal field demonstrations and tests of system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

This project demonstrates technology advancements in the areas of smoke and novel effects munitions which will speed maturing of advanced technologies to reduce risk in system-oriented Demonstration and Validation (Dem/Val).

FY 1995 Accomplishments:

•	189	Supported the Multi-Purpose Individual Munition (MPIM) effort by reviewing and providing design guidance for flame payload approaches.
Total	189	

FY 1996 Planned Program: Funded under DoD PE 060384BP.

FY 1997 Planned Program: Funded under DoD PE 060384BP.

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	196	0	0
Appropriated Value	192		
Adjustments to Appropriated Value	-3		
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			
Current Budget Estimate Submit for FY 1997	189	0	0

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603771A Army Industrial Preparedness Manufacturing Technology

PROJECT: DE20

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
DE20 Mfg Science and Technology	31942	0	0	0	0	0	0		Continuing	Continuing

A. Mission Description and Budget Item Justification: This program element supports the Manufacturing Science and Technology Program (MS&T). The goals of the program include: development of advanced manufacturing processes, equipment and systems, enhanced quality and reduced cost of Army materiel, and transfer of this technology to the industrial base. In the current environment, the MS&T program is even more important than in past years because of the large decline in weapon system production investments where much manufacturing technology was accomplished within individual production programs. Beginning in FY 90, the program was restructured to focus resources on a smaller number of technology thrust areas and leverage Army resources with private and other government efforts. The technology areas supported by the program include electronics manufacturing, metals fabrication and processing, composites processing, manufacturing systems, and advanced industrial practices. The technologies selected have the potential for high payoff across the spectrum of Army weapons systems as well as significant impact on national manufacturing issues and the U.S. industrial base. The Army MS&T Strategic Plan definitizes projected requirements, objectives and technical approaches. This program element is assigned to Budget Activity 3 since it includes projects that support development of processes in technological feasibility assessment, advanced technology demonstrations, and nonsystem specific manufacturing development.

FY 1995 Accomplishments:

- 1171 Electronics Manufacturing - Completed development of the Sequential Electrochemical Reduction Analysis (SERA) process for soldering and completed technology transfer to industry; completed process and tool development for laser welding microcircuit devices for hermetic sealing of missile guidance and control microelectronic packages; and continued educational partnerships to advance small business and minority electronics manufacturing technology.
- 1615 Electro-Optics - Initiated, developed and validated selected processes for components of the Compact Class Focal Plane Array Dewar Module and implement into the Low Rate Initial Production (LRIP) of Thermal Weapons Sights (TWS); established flexible manufacturing line for Staring Class FPA (Missile Seeker) Dewar, produced test dewars for analysis and qualification, documented production processes, and documented pilot production line, test equipment design and operation; baselined industry manufacturing practices, developed trade study and began process development for components of the High and Mid to High FPA Cooler; implemented advanced mfr processes in pilot line for High and Mid-to High FPA/Dewar Assembly (SADA), produced SADA's for validation and qualification, and documented process for production; began definition and evaluation of the fiber optic cable assembly termination cell and assessment of current manufacturing capabilities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603771A Army Industrial Preparedness Manufacturing Technology PROJECT DE20

FY 1995 Accomplishments: (continued)

- 4733 Optics - Validated magnetorheological finishing (MRF) process and began assembly of prototype Opticam MRF machine; implemented tooling and processing improvements on the Opticam SX and Opticam PM machines and transitioned to industry; began software development for control of Opticam MRF finishing routines; initiated integration of electrolytic in-process dressing (ELID) and active vibration cancellation (AVC) into Opticam SX machine; began assembly of prototype Opticam micro SX machine for smaller diameter optics; began evaluation of deterministic microgrinding and MRF processes for asphere fabrication; initiated conceptual requirements development for an asphere shaping machine (Opticam AM) and processes required to fabricate aspheric lenses by computer control; began development and evaluation of non-contact in-process methods for inspection and metrology of optical surfaces.
- 3600 Missile Seekers - Demonstrated manufacturing feasibility for 3D optically connected image processor and stacked UV and IR sensors for potential dual-band application; developed both conformal photomask and direct laser writing processes for the application of thin film EMI shielding to missile seeker domes; accumulated data on payout bobbin problems with optical fiber crossover patterns and established techniques to control crossovers; conducted Longbow Integrated Product & Process Development (IPPD) Transceiver Risk Assessment and established bench marking metrics to meet Army mandated and approved cost reduction goals.
- 2885 Advanced Non-Metallic Batteries - Initiated contractual efforts to adapt high volume production techniques/equipment used in production of lithium sulfur dioxide batteries to the maximum extent, investigate industrial practices used in commercial production of lithium ion and other batteries, and expand the use of commercial foil coating processes using a flexible manufacturing philosophy to accommodate various cell sizes.
- 1175 Composites Fabrication - Completed Resin Transfer Molding (RTM) validation trials for Comanche keel beam, including use of invar tooling for baseline design prepared composites; completed review and investigation of toughened epoxy adhesive systems, and validated procedures in microfactory/production line environment; initiated maximum variable flexibility determination for thermoplastic composites; brought microfactory site on-line.
- 1565 Metals and Processing - Completed cluster forging process development for powder metallurgy for turbine engine spacers and disks; continued process development for sputtering deposition of refractory metals; continued development and modification on tooling and electrochemical machining (ECM) process parameters for machining of small caliber gun barrels; completed process definition and gating feed design for casting beryllium aluminum components.
- 5900 Instrumented Factory for Gears (INFAC) - Conducted process optimization and carburization tasks; continued development of improved heat treatment processing; continued development of methods for prediction and control of heat treatment distortion; and initiated efforts to improve grinding, automated deburring and netshape forming of gears.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603771A Army Industrial Preparedness Manufacturing Technology PROJECT DE20

FY 1995 Accomplishments: (continued)

•	1036	Manufacturing Test Technology - Continued refining analysis methods for detection of manufacturing flaws in multilayer printed circuit boards; began development of prototype automated test station for nondestructive testing of large area uncooled focal plane arrays; initiated preliminary design review and development of prototype multiaxis vibration tester; began design of prototype sorption and permeation test apparatus for rapid testing of chemical protection materials; developed hardware and software specifications and high level design for a non-contact measurement system for propulsion system components; and initiated preliminary sensor suite pattern matching algorithm development for non-intrusive in-field engine diagnostic system.
•	1250	Chemical/Biological Defense - Completed process development for heat stable enzymes and toxin and pathogen antibodies; completed bench scale-up process for bioremediation materials; identified substitute for Freon 12 for use in chemical/biological filter leak testing.
•	1960	Propellants and Explosives - Completed continuous processing system upgrades for live processing demonstration; initiated hydroxylammonium nitrate (HAN) process technology demonstration; initiated modeling for computer simulation analysis procedures for munitions load, assemble, pack (LAP) process to enhance low volume production productivity .
•	2050	Advanced Integrated Manufacturing Systems - Began development of missile integrated product development database and product/process models; awarded contract for completion of Quick Turnaround Cell system software; initiated fabrication and testing of selected items using laser forming process for titanium structures without molds; initiated development of rule-oriented software for integration and management of manufacturing information; and initiated development of alternate designs for a Micro-Electro-Mechanical System (MEMS) for low-cost microgyroscope.
•	625	Remanufacturing and Reclamation - Began development and fabrication of an advanced, environmentally compliant process for the cleaning of servo control valves for the AH-64 Apache and Multiple Launch Rocket Systems (MLRS); began the development and fabrication of a supercritical CO2 cleaning process for optical parts/subassemblies; identified and began evaluation of integration technologies for the Battlefield Manufacturing Center.
•	937	Sensors in Manufacturing - Selected initial criteria for sensor data for "Smartweave" in-situ sensors for composite structures; licensed software for generalized adaptive image inspection analyzer; awarded contract for construction of non-destructive detector array tester; initiated development of rules base for inspection of printed wiring assemblies using three dimensional X-ray laminography; analyzed experimental results versus specifications for non-contact laser-based testing of printed circuit boards and electronic modules.
•	440	Soldier Systems - Developed prototype for ceramic body armor plates; established an in-house batch textile printing/coating process capability for camouflage patterns; assessed feasibility of alternate drying techniques for combat rations.
•	1000	Integrated Composites Manufacturing - Initiated development of co-curing process for complex structures; baselined current business practices and policies; and initiated metrics definition.
Total	31942	

FY 1996 Planned Program: Program restructured to PE 0708045A.

FY 1997 Planned Program: Program restructured to PE 0708045A.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603771A Army Industrial Preparedness Manufacturing Technology PROJECT DE20

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	35335	17776	17284
Appropriated Value (FY 1995)	34593		
Adjustments to Appropriated Value (FY 1995)	-2651		
Appropriated Amount (FY 1996)		0	
Adjustments to FY 1996		-17776	
Adjustments to Budget (FY 1997) Year Since FY 1996 President's Budget			-17284
Current Budget Estimate Submit for FY 1997	31942	0	0

Change Summary Explanation:

Funding: :FY 96/FY97: Per Congressional direction, funding for this program has been restructured to PE 0708045A beginning in FY 96.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603772A Advanced Tactical Computer Science and Sensor Technology

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
Total Program Element (PE) Cost	33165	27855	22099	20049	23143	23895	21667		Continuing	Continuing
D101 Tactical Automation	19364	17871	13988	12775	17375	17193	15492		Continuing	Continuing
D243 Sensors and Signal Processing	5889	3200	975	3862	5768	6702	6175		Continuing	Continuing
D281 Ground Combat Identification Demonstrations	7912	6784	7136	3412	0	0	0		25755	25865

Mission Description and Budget Item Justification: This program element supports projects that provide advanced computer science and technology solutions to command and control (C2), data correlation, tactical surveillance, and combat identification problems. Specifically, this program addresses solutions to integration of the battlefield, synchronization of combined arms forces, synchronization of joint forces, C2 on the move, correlation of intelligence data from airborne and space based sensors, integrated situation awareness (SA), battlefield combat identification (CI), point of engagement identification (ID) approaches to reduce fratricide for ground forces, unmanned air vehicle surveillance, and hostile weapons location.. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. It is related to and fully coordinated with efforts in PE 0602783A (Computer & Software Technology), PE 0602782A (Command, Control & Communications Technology), PE 0603006A (Command, Control & Communications Advanced Technology), PE 0602709A (Night Vision Technology), PE 0603710A (Night Vision Advanced Technology), and PE 0602120A (Electronic Surveillance and Fuzing Technology) in accordance with the ongoing Reliance joint planning process. Work is performed primarily by the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Command/Control and Systems Integration Directorate (C2SID), Ft Monmouth, NJ, Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA and Intelligence Electronic Warfare Directorate (IEWD), Vint Hill Farms Station, Warrenton, VA. Project D281 is managed by Project Manager, Combat Identification, Alexandria, VA and Fort Monmouth, NJ. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore properly placed in Budget Activity 3.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology PROJECT D101

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D101 Tactical Automation	19364	17871	13988	12775	17375	17193	15492		Continuing	Continuing

A. Mission Description and Budget Item Justification **Project D101 - Tactical Automation:** This is the Army's major science and technology program to provide the architecture and products to implement the digitized battlefield which is essential to winning the "Information War". It develops advanced computer science and technology for solutions of Army-unique command and control deficiencies in the area of combined arms operations. Specifically, this project addresses solutions for lower echelon digital information transfer and display for horizontal integration of the battlefield, synchronization of Combined and Joint Forces, command and control (C2) on the move, integrated situation awareness, command and control for light force insertion and platform C2. Key technologies utilized include: expert system decision support technology, database architecture development, data compression, man-machine interfacing, information filtering, advanced information display technology, digital terrain display and manipulation and automated navigation/geopositioning. Major program goals include improved force synchronization and fratricide reduction through the development and display of a common battlefield view. The battlespace command and control advanced technology demonstration (ATD) will take technologies for common view of the battlefield from the combined arms command and control (CAC2) ATD and other sources to develop prototype workstations and architectures supporting the Army digital battlestaff requirements for merging situation awareness, battle command, with mission planning/rehearsal and battlefield visualization capabilities. Tri-service interoperability and supporting information architecture will also be determined. Joint developer/user warfighting demonstrations will be conducted in conjunction with the Mounted, Dismounted, and Battle Command Battle Labs. Products will be transitioned to program executive offices (PEOs) (Command, Control and Communications Systems (C3S), Aviation, Armored Systems Modernization (ASM), etc.) for integration within their systems and subsequent fielding. The integration of the key technologies in support of Command and Control, integrated Situation Awareness, data fusion, and information transfer as applied to soldier system platforms for the 21st century land warrior program (21 CLW) and the generation II soldier system ATD is included.

FY 1995 Accomplishments:

- 3892 -Baselined the soldier system configuration utilizing key technologies to support applications including command and control, man-machine interface, and advanced information display technology and transport.
- 2830 -Used distributed interactive simulation (DIS) facilities at Fort Knox in support of the Focused Dispatch advanced warfighting experiment (AWE) to validate and refine user requirements, system architecture and doctrine.
- 2180 -Provided real communications environment to DIS through single channel ground and airborne radio system (SINCGARS) radio model live to virtual device, and virtual to virtual device integration linking real and virtual forces.
- 1100 -Developed and evaluated C3 architectures using systems performance modeling for BattleLab warfighting experiments, AWEs, and Task Force (TF) XXI.
- 3085 -Developed and integrated emerging communications devices, protocols and operational requirements into systems performance modeling (SPM) and characterized performance of network structures.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology
	PROJECT D101

FY 1995 Accomplishments: (continued)

•	1050	-Automated and implemented operational requirements analysis to collect and refine user requirements to support C3 architectures.
•	872	-Developed initial screens for Appliqué and related process for assessing and refining C2 applications.
•	2500	-Developed the initial version of the TF XXI systems architecture and provided to PEO-C3S.
•	922	-Performed and analyzed rapid force projection initiative (RFPI) modeling experiment 2 SPM runs.
•	433	-Completed and released version 1.1 of the RFPI database
•	350	-Established light tactical operations center (TOC) test bed connectivity.
•	150	-Initiated C2 software evaluation and C2 architecture for RFPI.
Total	19364	

FY 1996 Planned Program:

•	15686	Complete joint combined arms command and control (CAC2) demonstration in conjunction with the mounted battlespace battle lab and demonstrate components of a brigade digital force.
•	1750	-Begin battlespace management effort to extend the CAC2 system architecture to joint/multi-national forces and extend the CAC2 database architecture to the complete data element set. -Continue development and evaluation of RFPI C2 architecture and software. -Perform RFPI digital integrated laboratory (DIL) testing to verify system performance. -Design Prototype RFPI Light TOC and fabricate three systems.
•	384	-Funds will be reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992.
•	51	-Revised economic assumption not available for execution.
Total	17871	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology
	PROJECT D101

FY 1997 Planned Program:

- 10407 -Develop battlefield visualization prototype to provide software tools supporting consistent Battlespace understanding; forecasting, planning, and resource allocation; and integrated force management. Demonstrate initial Battlefield Visualization prototype developed under the CAC2 ATD in Task Force XXI AWE. Evaluate the requirements for division and brigade staff C4I system of systems architecture which is interoperable with corps, joint and allied assets.
- 3581 -Complete prototype RFPI light TOC fabrication.
  -Perform RFPI light TOC DIL inter-operability testing.
  -Develop RFPI light TOC training package.
  -Procure support hardware/software for RFPI.
  -Deliver hardware for RFPI advanced concept technology demonstration (ACTD) (three systems).

Total 13988

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	19959	23723	21422
Appropriated Value (FY 1995)	19556		
Adjustments to FY 1995	-192		
Appropriated Value (FY 1996)		18051	
Adjustments to FY 1996		-180	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-7434
Current President's Budget	19364	17871	13988

Change Summary Explanation:

Funding: FY97: Funds reprogrammed (-7434) for higher priority requirements.

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603772A Advanced Tactical Computer Science and Sensor Technology

PROJECT: D243

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D243 Sensors and Signal Processing	5889	3200	975	3862	5768	6702	6175		Continuing	Continuing

A. Mission Description and Budget Item Justification: Project D243 - Sensors and Signal Processing: This project provides for advanced development of new radar and signal processing concepts for bistatic radar and low cost UAV MTI radar and developed technology options for the common ground station (CGS) to support ground station Engineering and Manufacturing Development planned by Program Manager Joint Stars in FY 1996. The CGS technology demonstration focused on the intelligence requirements of the Brigade commander for near-real-time data, but will provide technology options for receiving, processing and displaying multi-spectral intelligence information and dissemination of intelligence products to the maneuver, fire support or intelligence mission areas. The bistatic radar for weapons location (BRWL) technology demonstration provides critical sensor and signal processing technology for real-time, all-weather, automatic detection, classification and identification of fixed or moving high-priority targets for the commander and technology for survivable weapon location radar concepts. The low cost unmanned aerial vehicle (UAV) moving target indicator (MTI) radar will provide wide area surveillance capability in a modular package adaptable to multiple UAV platforms.

FY 1995 Accomplishments:

•	3945	-Conducted data collection and live fire test of bistatic radar for weapons location (BRWL) in field environment. Completed software development and integration.
•	44	-Integrated sensors to airborne test platforms to demonstrate multi-sensor air-to-ground targeting technology applicable for low-cost aerial platforms, including unmanned aerial vehicles.
•	1900	-Conducted CGS brigade proof-of-concept demonstration in conjunction with TRADOC.
Total	5889	

FY 1996 Planned Program:

•	3125	-Complete demonstrations of BRWL in advanced warfighting experiments with depth and simultaneous attack battle laboratory to provide technology to PEO Intelligence and Electronic Warfare (IEW) for the Firefinder pre-planned product improvement (P3I) in FY97.
•	66	-Funds reprogrammed for SBIR/STTR programs in accordance with Small Business Innovative Research Program Reauthorization Act of 1992.
•	9	-Revised economic assumption not available for execution.
Total	3200	

FY 1997 Planned Program:

•	975	-Evaluate MTI radar technologies and complete payload preliminary design trade-offs for common module UAV payload.
Total	975	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology
	PROJECT D243

B. Project Change Summary	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	6092	3290	996
Appropriated Value (FY 1995)	5965		
Adjustments to FY 1995	-76		
Appropriated Value (FY 1996)		3232	
Adjustments to FY 1996		-32	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-21
Current President's Budget	5889	3200	975

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

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603772A Advanced Tactical Computer Science and Sensor Technology

PROJECT: D281

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate		Cost to Complete	Total Cost
D281 Ground Combat Identification Demonstrations	7912	6784	7136	3412	0	0	0		25755	25865

A. Mission Description and Budget Item Justification **Project D281 - Ground Combat Identification Demonstrations:** The objective of this project is to select, develop, and demonstrate techniques that minimize fratricide and increase combat effectiveness during Ground-to-Ground and Air-to-Ground engagements, and to demonstrate integration of advanced target identification (ID) and situational awareness (SA) capabilities into the Digitized, Joint battlefield environment and architecture. Selection of candidate approaches for technical and operational field evaluation are made based on results of architecture investigations for the combined arms battlefield. This advanced development serves as the foundation for a Joint advanced concept technology demonstration (ACTD) for air-to-ground and ground-to-ground combat ID. The ACTD will utilize the Army's Task Force XXI digitized brigade advanced warfighting experiment (AWE) and all services combat identification evaluation team (ASCIET) field experiments as a means to assess operational utility of these new capabilities. Information derived from these field experiments will support specification of follow-on engineering and manufacturing development (EMD) efforts.

FY 1995 Accomplishments:

•	2564	-Completed modifications to the millimeter wave hardware/software test bed and continued experimentation/analytical investigations in support of advanced target ID and SA capabilities applicable to the battlefield combat identification System (BCIS).
•	986	-Completed development of digital data link capability for enhancement of BCIS for ground vehicle application.
•	4362	-Initiated construction of prototype Joint air-to-ground combat identification (CI) alternatives for both rotary/fixed wing applications and supported initial field experiments with the mounted battlespace battle lab and ASCIET.
Total	7912	

FY 1996 Planned Program:

•	3000	-Complete tradeoff experiments and analyses for technology options to improve the target ID capability for BCIS. -Complete experimental analysis of digital data link performance for prototype enhancements to BCIS and complete software design modifications and integration in preparation for Task Force XXI AWE.
•	3624	-Complete technical field experiments with prototype Air-to-Ground CI system alternatives, select and complete development of technologies to be demonstrated in Task Force XXI AWE and ASCIET exercises, and initiate training of operational personnel. -Conduct virtual simulation of BCIS digital data link and Air-to-Ground CI systems alternatives.
•	18	-Revised economic assumption not available for execution.
•	142	-SBIR/STTR.
Total	6784	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603772A Advanced Tactical Computer Science and Sensor Technology
	PROJECT D281

FY 1997 Planned Program:

•	7136	Conduct Joint combat identification ACTD. Complete user training on enhanced BCIS and air-to-ground CI equipment, support Task Force XXI AWE and ASCIET field exercises, and assist in data analysis. -Integrate advanced CI hardware/software with advanced target acquisition (2nd GEN FLIR) and battlefield digitization equipment (Digital Appliqué) from the Army horizontal technology integration (HTI) and technology base programs, and perform initial technical experiments.
Total	7136	

B. Project Change Summary

	FY 1995	FY 1996	FY 1997
Previous President's Budget Request (FY 1996)	8173	6976	7349
Appropriated Value (FY 1995)	8012		
Adjustments to FY 1995	-100		
Appropriated Value (FY 1996)		6854	
Adjustments to FY 1996		-70	
Adjustments to Budget Year (FY 1997) Since FY 1996 President's Budget			-213
Current President's Budget	7912	6784	7136

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
1	USD (Policy), DUSD(R&P), Pentagon, Room 1C469, Washington, DC 20301-2100
2	DOD Compt, MS, DMI, Pentagon, Room 1B728, Washington, DC 20310-1100
2	OSD, ATTN: DOT&E, Pentagon, Room 3E318, Washington, DC 20310
1	ASD(RA), Pentagon, Room 3E325, Washington, DC 20310
12	ASD(C3I), Pentagon, Room 3E209, Washington, DC 20310
1	ASD(ISA), Pentagon, Room 4B938, Washington, DC 20310
2	ASD(LA), Pentagon, Room 3D918, Washington, DC 20310
2	USD(P&R), 4000 Defense Pentagon, Room 3C980, Washington, DC 20310-4000
1	ASD(HA), Pentagon, Room 3E321, Washington, DC 20310
1	ASD(PA&E)/GPP/LFD, Pentagon, Room 2B256, Washington, DC 20310
1	ASD (PA&E), Pentagon, Room 2E313, Washington, DC 20310
16	JCS(J-8), Pentagon, Room 1E963, Washington, DC 20310
1	HQDA, (SAUS-OR), Pentagon, Room 2E600, Washington, DC 20310
1	HQDA (SAIL&E), Pentagon, Room 2E614, Washington, DC 20310
1	HQDA (SARD-DEP), Pentagon, Room 2E673, Washington, DC 20310
1	HQDA (SAFM-CAZ-A), 5611 Columbia Pike, Falls Church, VA 22041-5050
1	HQDA (SFIS-API), Hoffman 1, Room 1012, Alexandria, VA 22331-0302
6	HQDA (DACS-DPD), Pentagon, Room 3C738, Washington, DC 20310
1	HQDA (DACS-DPA), Pentagon, Room 1C460, Washington, DC 20310
7	HQDA (SAIS-PPG), Pentagon, Room 1D679, Washington, DC 20310
4	HQDA (DACS-DPA), Pentagon, Room 3C747, Washington, DC 20310
1	HQDA (DACS-DMC), Pentagon, Room 3D631, Washington, DC 20310
1	HQDA (DACS-TE), Pentagon, Room 3C571, Washington, DC 20310
1	HQDA (DAIM-ZR), Pentagon, Room 2B683, Washington, DC 20310
1	HQDA (DAMI-ZXM)(Mr. Bromwell), Pentagon, Room 2D474, Washington, DC 20310
1	HQDA (DAMI-PBB), Pentagon, Room 2E477, Washington, DC 20310

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
2	HQDA (DAPE-ZXO), Pentagon, Room 2D735, Washington, DC 20310
2	HQDA (DALO-RMP), Pentagon, Room 1E565, Washington, DC 20310
1	HQDA (DALO-ZA), Pentagon, Room 3E560, Washington, DC 20310
2	HQDA (DAMO-ZR), Pentagon, Room 3D526, Washington, DC 20310
12	HQDA (DAMO-FDR), Pentagon, Room 2D570, Washington, DC 20310
1	HQDA (DAAR-CO), Pentagon, Room 1D432, Washington, DC 20310
1	HQDA (NGB-ZA), Pentagon, Room 2E394, Washington, DC 20310
1	HQDA (DASG-ZA), 5111 Leesburg Pike , Room 638, Falls Church, VA 22041-3258
1	HQDA (DASG-RMZ), 5111 Leesburg Pike, Room 554, Falls Church, VA 22041-3258
2	HQDA (DASG-RDZ), Pentagon, Room 3E368, Washington, DC 20310-2300
1	HQDA (DAIM-ED), Pentagon, Room 1E682, Washington, DC 20310
1	HQDA (DAIM) Pentagon, Room 1E665, Washington, DC 20310
1	HQDA (SAPA-), Pentagon, Room 2E641, Washington, DC 20310
2	HQDA (CSSD-RM-W), P.O. Box 15280, Arlington, VA 22215-0150
1	HQDA (SAAG-PRP), Room 1309, 3101 Park Center Drive, Alexandria, VA 22302-1596
1	HQDA (DAMH-ZB), Pulaski Bldg, Room 4229, 20 Massachusetts Avenue, Washington, DC 20314
1	US Army Cost And Economic Analysis Center, ATTN: SFFM-CA-PI, 5611 Columbia Pike, Falls Church, VA 22041-5050
1	BMDO/RM, Pentagon, Room 1E1037, Washington, DC 20310
1	OASN(RES), Pentagon, Room 5E779, Washington, DC 20310
2	HQ, U.S. European Command, ATTN: ECCM-B, APO New York 09128
1	HQDA, (JDRS-PBD), Pentagon, Room 1E610, Washington, DC 20310
2	HQ, PACOM, R&D Requirements (J531), BOX 15, USPACOM Staff, Camp H.M. Smith, HI, 96861
2	Commander, US Army Intelligence and Security Command, ATTN: IARM-PB, Fort Belvoir, VA 22060-5370
1	Commander, US Army Nuclear and Chemical Agnecy, ATTN: MONA-OPS, Bldg 2073, Backlick Road, Springfield, VA 22150
1	Commander, US Army Medical R&D Command, ATTN: SGRD-RMC, Fort Detrick, Frederick, MD 21701-5012
2	Commander, US Army Medical R&D Command, ATTN: SGRD-PR, Fort Detrick, Frederick, MD 21701-5012

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
10	Commander, US Army Training and Doctrine Command, ATTN: ATCD-E, Fort Monroe, VA 23651-5000
1	CMDT, Army Field Artillery School, ATTN: ATSF-CSI-P, ATSF-CBL, Ft. Sill, OK 73503-5600
1	CDR, Army Aviation Ctr & Ft. Rucker, ATTN: ATZS-CDI, Ft. Rucker, AL 36362-5000
1	CDR, Army Intelligence Ctr and FT. Huachucha, ATTN: ATZS-CDI-I, ATZS-CDT, Ft. Huachucha, AZ 85613-7000
1	CMDT, U.S. Army Signal Ctr, ATTN: ATZH-CDM, ATZH-BLT, Ft. Gordan, GA 30905-5000
1	CDR, USACAC, ATTN: ATZL-CDC, Ft. Leavenworth, KS 66027-5300
1	Force Design Directorate, ATTN: ATCD-F (MAJ Ireland), 415 Sherman Ave., Ft. Leavenworth, KS 66027-5000
1	CDR, USACHCS, ATTN: ATSC-CD (SFC Scott), Ft. Monmouth, NJ 07703-5612
1	CDR, U.S. Army Medical Center & School, ATTN: HSMC-FCM, Ft. Sam Houston, TX 78234
1	CMDT, U.S. Army Air Defense Artillery School, ATTN; ATSA-CDM, Ft. Bliss , TX 79916
1	CMDT, U.S. Army Infantry School, ATTN: ATSH-IWC, ATSH-MLS, Ft. Benning, GA 31905-5400
1	CMDT, U.S. Army Armor School, ATTN: ATZK-CD-ML, ATZK-MW, Ft. Knox, KY 40121-5200
1	CMDT, U.S. Army Engineer School, ATTN: ATSE-CD-M, Ft. Leonard Wood, MO 65473-5000
1	CMDT, U.S. Army Chemical School, ATTN: ATZN-CM-CS, Ft. McClellan, AL 36205-5020
1	CMDT, U.S. Army Military Police School, ATTN: ATZN-MP-CM, Ft. McClellan, AL 36205-5020
1	CMDT, Finance School, ATTN: ATZI, Bldg 4000, 8899 E. 56 Street, Indianapolis, IN 46216
1	Commander, US Army Research Institute for the Behavioral and Social Sciences, ATTN: PERI-MB, 5001 Eisenhower Avenue, Alexandria, VA 22333-5600
4	Commander, US Army Operational Test and Evaluation Command, ATTN: CSTE-RMZ, Park Center IV, 4501 Ford Avenue, Alexandria, VA 22302-1458
25	Commander, US Army Materiel Command, ATTN: AMCRD-AB, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001
2	Commander, US Army Materiel Command, ATTN: AMCAE-P, 5001 Eisenhower Avenue, Alexandria,VA 22333
3	Commander, US Army Materiel Command, ATTN: AMCAQ-B-TILO, 5001 Eisenhower Avenue, Alexandria, VA 22333
2	Commander, US Army Armament, Munitions and Chemical Command, ATTN: AMSMC-RT, Rock Island, IL 61299-6000
2	Commander, US Army Communications-Electronics Command, ATTN: AMSEL-CG, Ft. Monmouth, NJ 07703-5000
1	Commander, US Army Communication-Electronics Command, ATTN: AMSEL-ACSB-BT, Ft. Monmouth, NJ 07703-5008
5	Commander, US Army Missile Command, ATTN: AMSMI-AS (Library), Bldg 5250, RMC-147, Redstone Arsenal, AL 35898-5000

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
2	Commander, US Army Test and Evaluation Command, ATTN: AMSTE-RM, Aberdeen Proving Ground, MD 21005-5055
2	Commander, US Army Tank-Automotive Command, ATTN: AMSTA-CG, Warren, MI 48397-5000
2	Commander, US Army Laboratory Command, ATTN: AMSLC-CG, Adelphi, MD 20783-1145
1	Commander, US Army Armament Research, Development and Engineering Center, ATTN: SMCAR-CO, Dover, NJ 07806-5000
1	Commander, Environmental Center, ATTN: SFIM-AEC-RM, Edgewood Area, Aberdeen Proving Ground, MD 21010-5055
2	Commander, US Army Materiel Systems Analysis Activity, ATTN: AMXSY-PB, Aberdeen Proving Ground, MD 21005-5071
1	Commander, US Army Chemical, Biological and Defense Command, ATTN: AMSCB-RR, Aberdeen Proving Ground, MD 21010-5423
1	Commander, US Army Chemical, Biological and Defense Command, ATTN: SCBRD-ASA, Aberdeen Proving Ground, MD 21010-5423
1	Commander, US Army Chemical, Biological and Defense Command, ATTN: AMSCB-EO, Aberdeen Proving Ground, MD 21010-5423
4	Commander, US Army Aviation and Troop Command, ATTN: AMSAT-D-C, 4300 Goodfellow Blvd, St. Louis, MO 63120-1798
2	Program Manager, Instrumentation, Targets and Threat Simulators, ATTN: AMCPM-ITTS, 12350 Research Parkway, Orlando, FL 32826
1	Program Manager, Tank Main Armament Systems, ATTN: AMCPM-TMD PMD, Picatinny Arsenal NJ 07806-5000
2	Program Executive Officer, Missile Defense, ATTN: SFAE-MD-DP-P, Building 5250, Redstone Arsenal, Alabama 35898-5750
2	Program Executive Officer, Field Artillery Systems, ATTN: SFAE-FAS, Building 171, Picatinny Arsenal, Picatinny, NJ 07806-5000
2	Program Executive Officer, Armored Systems Modernization, ATTN: SFAE-HFM-P, Warren, MI 48397-5000
2	Program Executive Officer, Aviation, ATTN: SFAE-AV, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798
2	Program Executive Officer, Tactical Wheeled Vehicles, ATTN: SFAE-TWV, Warren, MI 48397-5000
2	Program Executive Officer, Command and Control Systems, ATTN: SFAE-CC-PMO, Ft. Monmouth, NJ 07703-5000
2	Program Executive Officer, Communication Systems, ATTN: SFAE-COM, Ft. Monmouth, NJ 07703-5000
2	Program Executive Officer, Tactical Missiles, ATTN: SFAE-MSL, Redstone Arsenal, AL 35898-8000
2	Program Executive Officer, Intelligence and Electronic Warfare, ATTN: SFAE-IEW-BM, Ft. Monmouth, NJ 07703
3	Commander, US Army Space and Strategic Defense Command, ATTN: CSSD-RM-BP, P.O. Box 1500, Huntsville, AL 35807-3801
2	Commander, US Army Corps of Engineers, ATTN: CERD-L, Washington, DC 20314
1	Commander, US Army Force Integration support agency, ATTN: MOFI-TRED-O, Building 2588, Fort Belvoir, VA 22060-5587
1	Commander, 902d MI Group, ATTN: IAGPA-OPOP, Ft. Meade, MD 20755-5910
1	Commander, HQ US Army Missile & Space Intelligence Center, ATTN: AIAMS-YCC, Redstone Arsenal, AL 35898-5000

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
1	Commander, US Army Countermeasures/Counter Counter measures Center, ATTN: AMX-CM-RF, 2800 Powder Mill Rd, Adelpi, MD 2078
1	Commander, US Army Belvoir Research, Development & Engineering Center, ATTN: STRBE-Z, Ft. Belvoir, VA 22060-5606
2	Commander, US Army Research Office, ATTN: SLCRO-AO (Security Officer), P.O. Box 12211, Research Triangle Park, NC 27709
1	Director, DMA Aerospance Center, ATTN: STT, 3200 South Secong Street, St. Louis, MO 63118
1	Director, DMA Hydrographic/Topographic Center, ATTN: ST(STT), 6500 Brookes Lane, Washington, DC 20315
3	Director, Harry Diamond Laborabtories, ATTN: DELHD-PO-P, 2800 Powder Mill Rd., Adelphi, MD 20783-1197
2	Director, AIRMICS, 1150 O'Keefe boulevard, Georgia Institute of Technology, Atlanta, GA 30332-0800
1	DOD Explosives Safety Board, Hoffman Building 1, Room 856C, 2461 Eisenhower Avenue, Alexandria,VA 22331-0600
3	Executive Office of the President, Office of Management and Budget, National Security Division, Room 10001, Washington, DC 20503
1	Director, Joint Tactical Command, Control & Communication Agency, ATTN: C3A-PPBA, Ft. Monmouth, NJ 07702
1	Headquarters, Central Intelligence Agency, ATTN: OGI/CTID/DI, Room 3G30, Washington, DC
1	Central Intelligence Agency, ATTN: OSWR/SDT, P.O. Box 1925, Washington, DC 20505
1	DOD Assistant Inspector General for Auditing, AM Division, Room 725, 400 Army-Navy Drive, Arlington, VA 22202
2	Inspector General, ATTN: A&IM/FMD, 400 Army-Navy Drive Arlington, VA 22202-2884
12	US General Accounting Office, ATTN: NSIAD, Room 4103, 441 G Street, N.W., Washington, DC 20548
1	Chief of Naval Operations, Navy Department, ATTN: OP-987, Pentagon, Room 5D760, Washington, Dc 20350-2000
2	Office of Naval Research, Science and Technology Directorate, ATTN: 03B, 800 North Quincy Street, Arlington, VA 22217
2	Commander, Naval Weapons Center, ATTN: Code 128 (R&D Planning Program Director), China Lake, CA 93555
2	Commander, Naval Surface Weapons Center, ATTN: Technical Library E432, White Oad, Silver Spring, MD 20910
1	SAF/AQXR, Pentagon, Room 4C347, Washington, DC 20330-6010
2	HQ USAF/FMBMC, Pentagon, Room 5C129, Washington, DC 20330-5012
4	HQ US Marine Corps, Deputy Chief of Staff for RD&S, Code (MC-RDP-30), Washington, DC 20380
2	Commandant, US Army War College, ATTN: Library, Carlisle Barracks, PA 17013-5050
2	HQ Defense Mapping Agency, ATTN: RE, 8613 Lee Highway, Fairfax, VA 22031-2137
1	Defense Nuclear Agency, ATTN: Comp-2.2, 6801 Telegraph Road, Alexandria, VA 22310
1	Advanced Research Projects Agency, ATTN: Comptroller, 3701 North Fairfax Drive, Arlington, VA 22203-1714

APPENDIX A

RDT&E CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

PRINT	ADDRESS
1	National Defense Headquarters, ATTN: DLPC (TRADOC LO), 101 Colonel By Drive, Ottawa, Ontario, Canada K1A 0K2
1	Institute for Defense Analyses, 1801 North Beauregard Street, Alexandria, VA 22311
1	Headquarters, National Aeronautical and Space Administration, Code ID, ATTN: Deputy DOD Affairs, Washington, DC 20546
1	ACDA/NWC/DPA, Room 5741, 320 21st Street, N.W., Washington, DC 20451
2	Pentagon Library, ATTN: Army Studies, Room 1A518, Washington, DC 20310
2	System Planning Corporation, Technical Library, 1500 Wilson Boulevard, Arlington, VA 22209
1	Director, Defense Finance and Accounting Service-Indianapolis Center, ATTN: DFAS-I-PA, Indinanapolis, IN 46249
2	Defense Technical Information Center (DTIC), ATTN: Ms. Mawby, Cameron Station, Bldg 5, 5010 Duke Street, Alexandria, VA 22304-61
	HAND DELIVERY
1	DOD(C)(P&S), Room 3A862
3	DOD(C)(INV), Room 4B916
1	DOD(C)(MILCON), Room 3D841
27	USD(A) MAILROOM, Room 3D139
13	SAFM-BUL, Room 3A652
2	SAFM-BUC-F, Room 3B663
2	SAFM-BUC-I, Room 3A674
2	SAFM-RB, Room 3A720
33	SALL, Room 2C638
94	SAFM-BUI-A, Room 3D400
480	TOTAL PRINT

Any changes to this distribution list should be provided to HQDA (SAFM-BUI-A), Washington, DC 20310, Autovon, 224-8694.