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Supporting Data FY 2003 President's Budget
Submitted to OSD – February 2002

DESCRIPTIVE SUMMARIES OF THE



RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Army Appropriation, Budget Activities 1, 2, and 3

Department of the Army

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

VOLUME I

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**DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS
OF THE
RESEARCH, DEVELOPMENT, TEST AND
EVALUATION, ARMY
FY 2003
PRESIDENT'S BUDGET SUBMISSION
FEBRUARY 2002**

**VOLUME I
Budget Activities 1, 2 and 3**

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

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**FY 2003 RDT&E, ARMY
PROGRAM ELEMENT DESCRIPTIVE SUMMARIES**

INTRODUCTION AND EXPLANATION OF CONTENTS

1. General. The purpose of this document is to provide summary information concerning the Army Research, Development, Test and Evaluation, Army program. The Descriptive Summaries are comprised of R-2 (Army RDT&E Budget Item Justification – Program Element level), R-2A (Army RDT&E Budget Item Justification – project level) and R-3 (Army RDT&E Cost Analysis) Exhibits, which provide narrative information on all RDT&E program elements and projects for the FY 2001, 2002 and 2003 time period.

2. Relationship of the FY 2003 Budget Submission to the FY 2002/2003 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.

<u>OLD PE/PROJECT</u>	<u>NEW PROJECT TITLE</u>	<u>NEW PE/PROJECT</u>
0603006A/247	TAC C4 Technology Int	0603008A/TR1
0603006A/257	Digital Battlefld Comm	0603008A/TR2
0603308A/989	Mobile Tactical High Energy Laser (MTHHEL)	0603305A/TR3
0603308A/990	Missile Defense Integration	0603305A/TR4
0603308A/997	Missile Defense Battlelab	0603305A/TR5
0603308A/99A	Army Air and Missile Defense	0603305A/TR6
0605604A/670	Army Survivability Analysis & Evaluation Support	0605604A/675
0605604A/671	Army Survivability Analysis & Evaluation Support	0605604A/675
0605604A/672	Army Survivability Analysis & Evaluation Support	0605604A/675
0605604A/677	Army Survivability Analysis & Evaluation Support	0605604A/675
0605604A/678	Army Survivability Analysis & Evaluation Support	0605604A/675
0605712A/62B	Operational Testing Instrumentation Development	0605602A/62B
0605712A/62C	Modeling and Simulation Instrumentation	0605602A/62C

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0605712A/987

Modeling and Simulation Instrumentation

0605602A/62C

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FY 2002/2003 Developmental Transitions.

<u>FROM</u> <u>PE/PROJECT</u>	<u>PROJECT TITLE</u>	<u>TO</u> <u>PE/PROJECT</u>
0603782A/355	WIN-TACTICAL –DEM/VAL	0604782A/360
0604270A/L21	NATO AGS – TIARA	0718040A/C35
0603005A/538	Future Combat System (FCS)	0604645A/470
0602601A/HH7	Future Combat Systems – Applied Research	0603005A/53G
0603854A/505	Crusader	0604854A/503

C. Establishment of New FY 2003 Program Elements/Projects. There are no major system new starts. Minor new initiatives for FY 2003, in addition to Congressionally directed initiatives for FY 2002, are shown below with asterisks. The remaining programs listed are outyear initiatives or restructures beyond FY 2002 or were previously funded from other Defense appropriations.

<u>TITLE</u>	<u>PE/PROJECT</u>
DSCS - TELEPORT	0303610A/25A
Advanced Payload Develop & Spt (JMIP)	0305204A/11A
DTSP DEVELOPMENT (JMIP)	0305204A/11B
PERPETUAL ASSAIL & SECURE INFO SYS, RSCH, TNG & ED	0601102A/HA4
GLOBAL INFORMATION PORTAL	0601104A/HA1
THERMAL FLUID DESIGN TOOL	0601104A/HA2
VIRTUAL PARTS ENGINEERING RESEARCH CENTER	0601104A/HA3
CENTER FOR OPTICS MANUFACTURING	0601104A/HA5
POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	0601104A/J09
ADVANCED SENSORS AND OBSCURANTS	0602120A/SA1
MICROELECTRO MECHANICAL SYSTEMS	0602307A/NA3
RAPID TARGET ACQUISITION & TRACKING SYSTEM	0602307A/NA5
JOINT MODELING & SIMULATION SYSTEM (JMASS)	0602308A/D03
THREE DIMENSIONAL ULTRASOUND IMAGING	0602308A/MC8
BIOTECHNOLOGY	0602622A/BA1
THERMOBARIC WARHEAD DEVELOPMENT	0602622A/CA1
GREEN ARMAMENTS TECHNOLOGY	0602624A/WA2
CORROSION MEASUREMENT AND CONTROL	0602624A/WA3
ARMAMENT SYSTEMS NETWORK IA CENTER	0602624A/WA4

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C. Continuation of Establishment of New FY 2003 Program Elements/Projects.

<u>TITLE</u>	<u>PE/PROJECT</u>
ELECTRONIC DISPLAY RESEARCH	0602705A/EM4
WASTE MINIMIZATION AND POLLUTION RESEARCH	0602720A/EM1
MOLECULAR & COMPUTATIONAL RISK ASSESSMENT	0602720A/EN8
TRANSPORTABLE DETONATION CHAMBER VALIDATION	0602720A/EN9
FT GEORGE MEADE FUEL CELL DEMONSTRATION	0602784A/EM2
CENTER FOR RELIABLE WIRELESS COMM TECH	0602786A/WA1
ARTHROPOD-BORNE INFECTIOUS DISEASE CONTROL	0602787A/MA1
DIABETES PROJECT	0602787A/MA2
MEDICAL AREA NETWORK FOR VIRTUAL TECHNOLOGY	0602787A/MA3
SPEECH CAPABLE PERSONAL DIGITAL ASSISTANT	0602787A/MA4
CENTER FOR INTERNATIONAL REHABILITATION	0602787A/MA5
DERMAL PHASE METER	0602787A/MA6
VCT LUNG SCAN	0602787A/MA7
MONOCLONAL ANTIBODY BASED TECHNOLOGY	0602787A/MA8
OPERATING ROOM OF THE FUTURE	0602787A/MA9
MANUFACTURING RDE CENTER FOR NANOTECHNOLOGIES	0602805A/NA2
FORCE PROJECTION LOGISTICS	0603001A/545
ADV DIAGNOSTICS & THERAPEUTIC DIG TECH	0603002A/MB1
BRAIN, BIOLOGY, AND MACHINE	0603002A/MB2
CENTER FOR INTEGRATION OF MEDICINE & INNOV TECH	0603002A/MB3
CENTER FOR UNTETHERED HEALTHCARE	0603002A/MB4
CONTINUOUS EXPERT CARE NETWORK TELEMEDICINE	0603002A/MB5
FRAGILE X SYNDROME	0603002A/MB6
HEMOGLOBIN BASED OXYGEN CARRIER	0603002A/MB7
HEPATITIS C	0603002A/MB8
JOINT US NORWEGIAN TELEMEDICINE	0603002A/MB9
MEMORIAL HERMANN TELEMED NETWORK	0603002A/MC1
MONOCLONAL ANTIBODIES, MASS BIO LAB	0603002A/MC2
SACCADIC FATIGUE MEASUREMENT	0603002A/MC3
SECURE TELEMEDICINE TECH PROGRAM	0603002A/MC4
SPINE RESEARCH AT WRAMC	0603002A/MC5
TRAUMA RESEARCH CENTER	0603002A/MC6

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C. Continuation of Establishment of New FY 2003 Program Elements/Projects.

<u>TITLE</u>	<u>PE/PROJECT</u>
MEDICAL SIMULATION TRAINING INITIATIVE	0603002A/MC9
EMERGENCY TELEMED RESPONSE & ADV TECH	0603002A/MD1
VETERANS COLLABORATIVE CARE MODEL PROGRAM	0603002A/MD2
FUTURE COMBAT SYSTEMS (FCS)	0603005A/53G
TACOM HYBRID VEHICLE DEMO: LITHIUM ION TECH	0603005A/CA2
CORROSION PREVENTION AND CONTROL PROGRAM	0603005A/CA3
VEHICLE BODY ARMOR SUPPORT SYSTEM	0603005A/CA4
FUEL CATALYST RESEARCH EVALUATION	0603005A/CA5
MISSILE RECYCLING PROGRAM	0603313A/NA4
105MM CONVENTIONAL TANK AMMUNITION	0603639A/64B
FUTURE SCOUT VEHICLE - ADVANCED DEVELOPMENT	0603643A/820
THROUGH WALL SURVEILLANCE RADAR TECHNOLOGY	0603710A/NA1
ENVIRONMENTAL RESTORATION TECHNOLOGY	0603728A/03E
PROTON EXCHANGE MEMBRANE FUEL CELL DEMO	0603728A/EM3
ENVIRONMENTAL RESTORATION TECH VALIDATION	0603779A/04E
CASTING EMISSION REDUCTION PROGRAM (CERP)	0603779A/EN1
ADVANCED PRECISION KILL WEAPON SYSTEM	0604802A/705
FORT ORD CLEANUP DEMONSTRATION PROJECT	0603779A/EN2
MANAGING ARMY TECHNOLOGY ENVIRON ENHANCEMENTS	0603779A/EN3
PORTA BELLA ENVIRONMENTAL CLEANUP	0603779A/EN5
UNEXPLODED ORDNANCE IN SUPPORT OF MILITARY READ	0603779A/EN6
VANADIUM TECHNOLOGY PROGRAM	0603779A/EN7
MORTAR SYSTEMS	0603802A/AS4
FUTURE MEDICAL SHELTER	0603807A/MD4
MEDICAL SIMULATION TRAINING INITIATIVE	0603002A/MC9
EMERGENCY TELEMED RESPONSE & ADV TECH	0603002A/MD1
VETERANS COLLABORATIVE CARE MODEL PROGRAM	0603002A/MD2
FUTURE COMBAT SYSTEMS (FCS)	0603005A/53G
TACOM HYBRID VEHICLE DEMO: LITHIUM ION TECH	0603005A/CA2
CORROSION PREVENTION AND CONTROL PROGRAM	0603005A/CA3
VEHICLE BODY ARMOR SUPPORT SYSTEM	0603005A/CA4
FUEL CATALYST RESEARCH EVALUATION	0603005A/CA5

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C. Continuation of Establishment of New FY 2003 Program Elements/Projects.

<u>TITLE</u>	<u>PE/PROJECT</u>
IMED TOOLS RURAL MOBILE COMMS	0603807A/MD5
INTEGRATED BROADCAST SERVICE (JMIP/DISTP)	0603850A/472
MEDIUM EXTENDED AIR DEFENSE SYSTEM (MEADS)	0603869A/01B
GROUND COMMON MISSILE	0604329A/01A
TARGET DEFEATING SYSTEM	0604609A/198
ARMORED SECURITY VEHICLE	0604642A/E58
STRIKER II	0604645A/426
ENGINEER VEHICLE UPGRADES	0604649A/G29
LIGHTWEIGHT LASER DESIGNATOR RANGEFINDER UPGRADES	0604710A/L76
ALLIANCE EXECUTIVE DEVELOPMENT & INTEGRATION	0604738A/J11
INTELLIGENCE SIMULATION SYSTEMS	0604742A/361
WARFIGHTER SIMULATION	0604742A/362
ARMY DISTRIB COMN GRND STAT (DCGS-A)-TIARA	0604766A/958
WIN-TACTICAL - EMD	0604782A/360
JOINT NETWORK MANAGEMENT SYSTEM	0604783A/363
LOW COST COMPETENT MUNITIONS (LCCM)	0604802A/AS5
CARTLEDGE INFUSER	0604807A/MD3
TRAJECTORY CORRECTABLE MUNITION	0604814A/700
ARMY AIRBORNE COMMAND & CONTROL SYS (A2C2S)	0604818A/C3A
MEDIUM CALIBER AMMUNITION	0603639A/694
PATRIOT ADVANCED CAPABILITY (PAC) - 3	0604865A/01C
SOLDIER-CENTERED ANALYSES FOR THE OBJECTIVE FORCE	0605326A/33B
OBJECTIVE FORCE TASK FORCE	0605801A/F06
TRANSPORTATION BENEFIT PROGRAM	0605801A/M77
ASARC AND CRB ESOH SUPPORT	0605857A/0E6
SPACE & MISSILE DEFENSE COMMAND - REIMBURSABLE	0605898A/R02
VENTURE CAPITAL	0708045A/EA1
HYPERVELOCITY MISSILE TD	0603313A/655

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D. FY 2003 programs for which funding existed in the FY 2002 Amended President's Budget Submit (July 2001), but which are no longer funded beginning in FY 2003.

<u>PE/PROJECT</u>	<u>TITLE</u>	<u>BRIEF EXPLANATION</u>
0603653A/B99	Tank and Medium Calibre Armaments	Program Terminated
0604645A/G25	M1 Breacher Dev	Program Terminated
0203735A/718	Ground Combat Vehicle HTI	Program Terminated
0203761A/394	Force XXI Initiatives	Program Terminated
0203801A/303	Stinger RMP PIP	Program Completed
0203802A/336	TOW PIP	Program Terminated
0602601A/T21	21 st Century Truck (T21)	Perennial Cong Add Dependent Pgm
0602787A/977	Emerging Infectious Diseases	Perennial Cong Add Dependent Pgm
0602805A/105	Dual Use Applications Programs	Program Completed
0603001A/393	MIL OPS In Urban Terrain (MOUT)	Program Completed
0603002A/975	Protection Against Emerging Infectious Diseases	Program Completed
0603804A/G10	Adv TAC PWR Sources AD	Program Completed
0603804A/K39	Environmental Equipment - AD	Program Completed
0603804A/429	Rigidwall Shelter Ed	Program Terminated
0603808A/434	Anti-Personnel Landmine Alternatives (NSD)	Program Terminated
0603808A/443	APL-A (MIXED SYSTEMS)	Program Terminated
0604820A/E10	Sentinel	Program Completed
0605013A/087	Army Distance Learning Program	Pgm Trans to Prod (Blk 3)/Unfunded Threshold Requirements.
0605803A/735	Net Assessment Directorate	Programs Transitions to OSD

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

* 0203735A/DC64	0602786A/AC60	** 0603122A/DB95/D
0203808A/DE11	0603005A/DC66	0603322A/DB92
0301359A	** 0603009A/DB18/DB20/DB31/DB34	0603710A/DC65/ DC67
0602122A/AB72/622	** 0603017A/AB69	0603851A/DC75
* 0602601A/AC84	0603020A/AB77/DB84/DB85	0604328A/DC71

* Funding end in FY02, ** 0603009A/DB20 Funding ends in FY01, DB34 Open for FY02 PBD directed reprogramming,
 ** 0603122A/DB95 Funding ends in FY01

4. Footnotes. This paragraph provides a list of program elements whose Line Item numbers and/or amounts differ from those provided in the previous submitted version of the FY 2003 Budget Submission. These differences are due to system processing synchronization issues. The revised line item numbers and amounts correctly report the Army's budget request and justification material provided herein.

A. Line Item Differences.

<u>Revised</u> <u>PE</u>	<u>TITLE</u>	<u>Previously Submitted</u>	
		<u>Line Item#</u>	<u>Line Item</u>
0605718A	Simulation & Modeling for Acq, Rqts, & TNC (SMART)	-	145
0605801A	Programwide Activities	145	146
0605803A	Technical Information Activities	146	147
0605805A	Munitions Standardization, Effectiveness and Safety	147	148
0605856A	Environmental Compliance	148	149
0605857A	Army Acquisition Pollution Prevention Program	149	150

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0605898A	Management Headquarters (Research and Development)	150	151
0909999A	Financing for Cancelled Account Adjustments	151	152
0603778A	MLRS Product Improvement Program	152	178
0708045A	End Item Industrial Preparedness Activities	178	179
1001018A	NATO Joint Stars	179	180

B. Budget Amount Differences.

Amt	PE	TITLE	Previously	
			Submitted	Revised
			Budget Amt	Budget
			(\$000)	(\$000)
0603005A		Combat Vehicle and Automotive Advanced Technology	229,778	234,978
0603854A		Artillery Systems – Dem/Val	251,665	246,465
0604223A		Comanche	914,932	910,160
0605716A		Army Evaluation Center	41,250	43,950
0605718A		Simulation & Modeling For Acq, Rqts, & Tng (SMART)	0	2,694
0605801A		Programwide Activities	78,452	73,058
0203744A		Aircraft Modifications/Product Improvement Program	196,794	201,566

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 Department of the Army
 FY 2003 RDT&E Program

Exhibit R-1

Summary

01-Feb-2002

Summary Recap of Budget Activities	Thousands of Dollars		
	FY 2001	FY 2002	FY 2003
UNCLASSIFIED Department of the Army FY 2003 RDT&E Program			

Exhibit R-1

Appropriation: 2040 A RDT&E, Army

01-Feb-2002

Line	Program Element	Act	Item	Thousands of Dollars		
				FY 2001	FY 2002	FY 2003
	Basic research			205,184	231,982	237,486
	Applied Research			814,839	909,564	642,251
	Advanced technology development			811,028	910,329	735,652
	Demonstration/validation			897,927	878,491	775,641
	Engineering and manufacturing development			1,784,361	2,200,967	2,796,790
	Management support			890,780	795,316	806,058
	Operational system development			859,043	1,126,020	924,616
Total	RDT&E, Army			6,263,162	7,052,669	6,918,494

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				FY 2001	FY 2002	FY 2003
Basic research						
1	0601101A	01	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	13,983	14,688	22,998
2	0601102A	01	DEFENSE RESEARCH SCIENCES	133,081	144,240	139,633
3	0601104A	01	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	58,120	73,054	74,855
Total: Basic research				205,184	231,982	237,486
Applied Research						
4	0602105A	02	MATERIALS TECHNOLOGY	30,625	20,617	18,659
5	0602120A	02	SENSORS AND ELECTRONIC SURVIVABILITY	22,662	31,934	24,305
6	0602122A	02	TRACTOR HIP	6,991	7,672	6,839
7	0602211A	02	AVIATION TECHNOLOGY	30,216	43,859	43,692
8	0602270A	02	EW TECHNOLOGY	21,624	17,292	19,584
9	0602303A	02	MISSILE TECHNOLOGY	71,056	61,085	31,884
10	0602307A	02	ADVANCED WEAPONS TECHNOLOGY	6,435	26,883	11,208
11	0602308A	02	ADVANCED CONCEPTS AND SIMULATION	35,334	31,333	20,634
12	0602601A	02	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	87,009	112,957	55,763
13	0602618A	02	BALLISTICS TECHNOLOGY	52,245	60,948	74,094
14	0602622A	02	CHEMICAL, SMOKE AND EQUIPMENT DEFEATING TECHNOLOGY	3,840	6,529	3,675
15	0602623A	02	JOINT SERVICE SMALL ARMS PROGRAM	5,223	5,560	5,812
16	0602624A	02	WEAPONS AND MUNITIONS TECHNOLOGY	46,722	65,197	38,090

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Line	Program Element	Act	Item	Thousands of Dollars		
				FY 2001	FY 2002	FY 2003
17	0602705A	02	ELECTRONICS AND ELECTRONIC DEVICES	40,144	49,965	27,448
18	0602709A	02	NIGHT VISION TECHNOLOGY	24,935	22,993	22,333
19	0602712A	02	COUNTERMINE SYSTEMS	17,228	22,889	13,186
20	0602716A	02	HUMAN FACTORS ENGINEERING TECHNOLOGY	17,911	19,791	17,415
21	0602720A	02	ENVIRONMENTAL QUALITY TECHNOLOGY	58,745	23,569	23,018
22	0602782A	02	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	22,987	24,123	21,821
23	0602783A	02	COMPUTER AND SOFTWARE TECHNOLOGY	4,360	4,113	4,354
24	0602784A	02	MILITARY ENGINEERING TECHNOLOGY	54,366	59,354	51,124
25	0602785A	02	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	11,658	15,175	14,335
26	0602786A	02	LOGISTICS TECHNOLOGY	26,529	33,474	25,502
27	0602787A	02	MEDICAL TECHNOLOGY	108,400	128,798	67,476
28	0602789A	02	ARMY ARTIFICIAL INTELLIGENCE TECHNOLOGY	1	0	0
29	0602805A	02	DUAL USE SCIENCE AND TECHNOLOGY	7,593	13,454	0
Total: Applied Research				814,839	909,564	642,251
Advanced technology development						
30	0603001A	03	WARFIGHTER ADVANCED TECHNOLOGY	21,200	62,089	50,262
31	0603002A	03	MEDICAL ADVANCED TECHNOLOGY	216,951	174,042	16,590
32	0603003A	03	AVIATION ADVANCED TECHNOLOGY	26,835	38,496	45,404
33	0603004A	03	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	56,230	35,381	66,514

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Line	Program Element	Act	Item	Thousands of Dollars		
				FY 2001	FY 2002	FY 2003
34	0603005A	03	COMBAT VEHICLE AND AUTOMOTIVE ADVANCED TECHNOLOGY	167,679	225,960	234,978
35	0603006A	03	COMMAND, CONTROL, COMMUNICATIONS ADVANCED TECHNOLO	27,820	33,176	4,826
36	0603007A	03	MANPOWER, PERSONNEL AND TRAINING ADVANCED TECHNOLO	6,844	3,093	3,527
37	0603008A	03	ELECTRONIC WARFARE ADVANCED TECHNOLOGY	0	0	28,254
38	0603009A	03	TRACTOR HIKE	12,391	10,324	18,069
39	0603017A	03	TRACTOR RED	951	0	0
40	0603020A	03	TRACTOR ROSE	10,476	9,212	4,895
41	0603105A	03	MILITARY HIV RESEARCH	5,661	5,885	0
42	0603122A	03	TRACTOR HIP	942	0	0
43	0603238A	03	GLOBAL SURVEILLANCE/AIR DEFENSE/PRECISION STRIKE T	20,997	31,986	31,291
44	0603270A	03	EW TECHNOLOGY	28,825	24,367	11,600
45	0603313A	03	MISSILE AND ROCKET ADVANCED TECHNOLOGY	48,444	75,396	87,890
46	0603322A	03	TRACTOR CAGE	2,963	3,283	3,083
47	0603606A	03	LANDMINE WARFARE AND BARRIER ADVANCED TECHNOLOGY	19,922	25,640	24,104
48	0603607A	03	JOINT SERVICE SMALL ARMS PROGRAM	11,809	4,388	6,013
49	0603654A	03	LINE-OF-SIGHT TECHNOLOGY DEMONSTRATION	50,262	69,859	28,283
50	0603710A	03	NIGHT VISION ADVANCED TECHNOLOGY	41,598	49,389	36,494
51	0603728A	03	ENVIRONMENTAL QUALITY TECHNOLOGY DEMONSTRATIONS	10,685	7,292	8,980
52	0603734A	03	MILITARY ENGINEERING ADVANCED TECHNOLOGY	5,006	4,705	2,921
53	0603772A	03	ADVANCED TACTICAL COMPUTER SCIENCE AND SENSOR TECH	16,537	16,366	21,674

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UNCLASSIFIED Department of the Army FY 2003 RDT&E Program			

Exhibit R-1

Appropriation: 2040 A RDT&E, Army

01-Feb-2002

Line	Program Element	Act	Item	Thousands of Dollars		
				FY 2001	FY 2002	FY 2003
Total: Advanced technology development				811,028	910,329	735,652
Demonstration/validation						
54	0603305A	04	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION	0	0	27,887
55	0603308A	04	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION (DEM/VAL)	93,808	70,021	7,417
56	0603619A	04	LANDMINE WARFARE AND BARRIER - ADV DEV	17,804	19,877	20,286
57	0603627A	04	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ADV DEV	0	0	2,432
58	0603639A	04	TANK AND MEDIUM CALIBER AMMUNITION	46,238	52,074	11,354
59	0603653A	04	ADVANCED TANK ARMAMENT SYSTEM (ATAS)	263,436	100,587	124,108
60	0603713A	04	ARMY DATA DISTRIBUTION SYSTEM	17	0	0
61	0603747A	04	SOLDIER SUPPORT AND SURVIVABILITY	13,117	17,331	20,788
62	0603766A	04	TACTICAL SUPPORT DEVELOPMENT - ADV DEV (TIARA)	0	16,605	16,392
63	0603774A	04	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	14,831	8,675	11,694
64	0603779A	04	ENVIRONMENTAL QUALITY TECHNOLOGY DEM/VAL	12,880	35,030	9,331
65	0603782A	04	WARFIGHTER INFORMATION NETWORK-TACTICAL - DEM/VAL	0	12,464	60,809
66	0603790A	04	NATO RESEARCH AND DEVELOPMENT	1,847	6,375	8,773
67	0603801A	04	AVIATION - ADV DEV	9,506	13,196	8,643
68	0603802A	04	WEAPONS AND MUNITIONS - ADV DEV	27,520	34,197	27,761
69	0603804A	04	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	6,127	6,399	11,419
70	0603805A	04	COMBAT SERVICE SUPPORT CONTROL SYSTEM EVALUATION A	13,627	8,621	8,971

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Summary

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Summary Recap of Budget Activities	Thousands of Dollars		
	FY 2001	FY 2002	FY 2003
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Line	Program Element	Act	Item	Thousands of Dollars		
				FY 2001	FY 2002	FY 2003
71	0603807A	04	MEDICAL SYSTEMS - ADV DEV	14,970	19,872	10,398
72	0603850A	04	INTEGRATED BROADCAST SERVICE (JMIP/DISTP)	0	1,968	1,962
73	0603851A	04	TRACTOR CAGE (DEM/VAL)	941	3,686	0
74	0603854A	04	ARTILLERY SYSTEMS - DEM/VAL	341,765	444,091	246,465
75	0603856A	04	SCAMP BLOCK II	19,493	6,895	21,006
76	0603869A	04	MEADS CONCEPTS - DEM/VAL	0	527	117,745
Total: Demonstration/validation				897,927	878,491	775,641
Engineering and manufacturing development						
77	0604201A	05	AIRCRAFT AVIONICS	40,527	50,838	40,308
78	0604220A	05	ARMED, DEPLOYABLE OH-58D	511	2,326	1,873
79	0604223A	05	COMANCHE	590,771	781,307	910,160
80	0604270A	05	EW DEVELOPMENT	64,241	53,616	22,819
81	0604280A	05	JOINT TACTICAL RADIO SYSTEM	59,814	74,814	65,818
82	0604321A	05	ALL SOURCE ANALYSIS SYSTEM	45,586	44,198	42,322
83	0604328A	05	TRACTOR CAGE	2,820	3,856	9,800
84	0604329A	05	COMMON MISSILE	4,683	16,592	29,919
85	0604601A	05	INFANTRY SUPPORT WEAPONS	2	0	0
86	0604604A	05	MEDIUM TACTICAL VEHICLES	2,014	1,945	1,953
87	0604609A	05	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ENG DEV	3,336	7,854	8,153

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				FY 2001	FY 2002	FY 2003
88	0604611A	05	JAVELIN	471	2,825	489
89	0604619A	05	LANDMINE WARFARE	19,287	18,780	11,913
90	0604622A	05	FAMILY OF HEAVY TACTICAL VEHICLES	0	0	3,990
91	0604633A	05	AIR TRAFFIC CONTROL	1,159	2,179	2,339
92	0604641A	05	TACTICAL UNMANNED GROUND VEHICLE (TUGV)	288	1,490	0
93	0604642A	05	LIGHT TACTICAL WHEELED VEHICLES	9,171	2,501	7,877
94	0604645A	05	ARMORED SYSTEMS MODERNIZATION (ASM)-ENG. DEV.	2,115	0	59,860
95	0604649A	05	ENGINEER MOBILITY EQUIPMENT DEVELOPMENT	0	9,202	8,146
96	0604710A	05	NIGHT VISION SYSTEMS - ENG DEV	28,722	27,376	32,328
97	0604713A	05	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	88,705	90,244	94,474
98	0604715A	05	NON-SYSTEM TRAINING DEVICES - ENG DEV	71,482	28,682	43,650
99	0604716A	05	TERRAIN INFORMATION - ENG DEV	7,027	8,766	8,232
100	0604726A	05	INTEGRATED METEOROLOGICAL SUPPORT SYSTEM	1,755	1,896	3,417
101	0604738A	05	JSIMS CORE PROGRAM	0	30,727	24,230
102	0604739A	05	INTEGRATED BROADCAST SERVICE	6,005	0	0
103	0604741A	05	AIR DEFENSE COMMAND, CONTROL AND INTELLIGENCE - EN	15,857	17,088	26,978
104	0604742A	05	CONSTRUCTIVE SIMULATION SYSTEMS DEVELOPMENT	0	65,613	53,294
105	0604746A	05	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	12,466	13,174	11,839
106	0604760A	05	DISTRIBUTIVE INTERACTIVE SIMULATIONS (DIS) - ENGIN	19,924	20,975	21,487
107	0604766A	05	TACTICAL EXPLOITATION SYSTEM/DCGS (TIARA)	57,867	59,693	56,662
108	0604768A	05	BRILLIANT ANTI-ARMOR SUBMUNITION (BAT)	97,931	122,868	190,293

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				FY 2001	FY 2002	FY 2003
109	0604770A	05	JOINT SURVEILLANCE/TARGET ATTACK RADAR SYSTEM	28,133	8,026	4,740
110	0604778A	05	POSITIONING SYSTEMS DEVELOPMENT (SPACE)	2,327	0	0
111	0604780A	05	COMBINED ARMS TACTICAL TRAINER (CATT)	17,784	13,531	7,579
112	0604783A	05	JOINT NETWORK MANAGEMENT SYSTEM	0	25,912	8,028
113	0604801A	05	AVIATION - ENG DEV	10,698	4,032	3,150
114	0604802A	05	WEAPONS AND MUNITIONS - ENG DEV	17,698	17,146	41,758
115	0604804A	05	LOGISTICS AND ENGINEER EQUIPMENT - ENG DEV	23,595	29,326	65,857
116	0604805A	05	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ENG DEV	62,557	118,643	82,238
117	0604807A	05	MEDICAL MATERIEL/MEDICAL BIOLOGICAL DEFENSE EQUIPM	6,089	9,153	12,625
118	0604808A	05	LANDMINE WARFARE/BARRIER - ENG DEV	84,867	68,550	128,992
119	0604814A	05	SENSE AND DESTROY ARMAMENT MISSILE - ENG DEV	28,596	61,300	70,888
120	0604817A	05	COMBAT IDENTIFICATION	6,705	2,989	1,995
121	0604818A	05	ARMY TACTICAL COMMAND & CONTROL HARDWARE & SOFTWARE	37,849	57,216	80,672
122	0604819A	05	LOSAT	25,364	21,416	14,463
123	0604820A	05	RADAR DEVELOPMENT	12,911	5,119	0
124	0604823A	05	FIREFINDER	45,466	26,732	26,122
125	0604854A	05	ARTILLERY SYSTEMS - EMD	19,006	61,961	251,376
126	0604865A	05	PATRIOT PAC-3 THEATER MISSILE DEFENSE ACQ - EMD	0	0	150,819
127	0605013A	05	INFORMATION TECHNOLOGY DEVELOPMENT	100,179	108,490	50,865
Total: Engineering and manufacturing development				1,784,361	2,200,967	2,796,790

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				FY 2001	FY 2002	FY 2003
	Management support					
128	0604256A	06	THREAT SIMULATOR DEVELOPMENT	20,293	18,857	15,251
129	0604258A	06	TARGET SYSTEMS DEVELOPMENT	14,961	25,003	10,772
130	0604759A	06	MAJOR T&E INVESTMENT	42,380	49,482	53,797
131	0605103A	06	RAND ARROYO CENTER	19,105	19,806	22,148
132	0605301A	06	ARMY KWAJALEIN ATOLL	147,442	148,825	132,831
133	0605326A	06	CONCEPTS EXPERIMENTATION	18,179	31,501	22,627
134	0605502A	06	SMALL BUSINESS INNOVATIVE RESEARCH	144,559	0	0
135	0605601A	06	ARMY TEST RANGES AND FACILITIES	120,277	113,451	144,183
136	0605602A	06	ARMY TECHNICAL TEST INSTRUMENTATION AND TARGETS	39,094	34,719	43,222
137	0605604A	06	SURVIVABILITY/LETHALITY ANALYSIS	38,326	34,514	39,200
138	0605605A	06	DOD HIGH ENERGY LASER TEST FACILITY	36,145	23,188	14,410
139	0605606A	06	AIRCRAFT CERTIFICATION	3,140	3,552	4,062
140	0605702A	06	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	6,719	6,833	7,310
141	0605706A	06	MATERIEL SYSTEMS ANALYSIS	8,683	8,811	10,189
142	0605709A	06	EXPLOITATION OF FOREIGN ITEMS	3,549	3,495	3,490
143	0605712A	06	SUPPORT OF OPERATIONAL TESTING	68,382	90,790	99,375
144	0605716A	06	ARMY EVALUATION CENTER	25,855	44,611	43,950
145	0605718A	06	SIMULATION & MODELING FOR ACQ, RQTS, & TNG (SMART)	0	0	2,694
146	0605801A	06	PROGRAMWIDE ACTIVITIES	67,449	59,584	73,058

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				FY 2001	FY 2002	FY 2003
147	0605803A	06	TECHNICAL INFORMATION ACTIVITIES	32,521	38,930	34,040
148	0605805A	06	MUNITIONS STANDARDIZATION, EFFECTIVENESS AND SAFET	15,961	30,437	16,014
149	0605856A	06	ENVIRONMENTAL COMPLIANCE	2,404	0	0
150	0605857A	06	ARMY ACQUISITION POLLUTION PREVENTION PROGRAM	5,019	1,719	1,902
151	0605898A	06	MANAGEMENT HEADQUARTERS (RESEARCH AND DEVELOPMENT)	8,185	7,208	11,533
152	0909999A	06	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS	2,152	0	0
Total: Management support				890,780	795,316	806,058
Operational system development						
153	0102419A	07	JOINT LAND ATTACK CRUISE MISSILES DEFENSE (JLENS)	25,981	32,130	29,081
154	0203610A	07	DOMESTIC PREPAREDNESS AGAINST WEAPONS OF MASS DEST	2,884	2,581	0
155	0203726A	07	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	35,420	36,650	38,161
156	0203735A	07	COMBAT VEHICLE IMPROVEMENT PROGRAMS	95,689	166,449	54,465
157	0203740A	07	MANEUVER CONTROL SYSTEM	47,071	39,883	44,444
158	0203744A	07	AIRCRAFT MODIFICATIONS/PRODUCT IMPROVEMENT PROGRAM	97,654	145,169	201,566
159	0203752A	07	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	5,658	14,889	3,689
160	0203758A	07	DIGITIZATION	30,820	32,027	28,968
161	0203759A	07	FORCE XXI BATTLE COMMAND, BRIGADE AND BELOW (FBCB2	62,144	56,381	64,915
162	0203761A	07	FORCE XXI WRAP	0	15,446	0
163	0203801A	07	MISSILE/AIR DEFENSE PRODUCT IMPROVEMENT PROGRAM	13,892	13,727	43,738

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				FY 2001	FY 2002	FY 2003
164	0203802A	07	OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS	54,419	68,318	13,018
165	0203808A	07	TRACTOR CARD	3,689	11,457	8,891
166	0208010A	07	JOINT TACTICAL COMMUNICATIONS PROGRAM (TRI-TAC)	35,423	21,428	14,121
167	0208053A	07	JOINT TACTICAL GROUND SYSTEM	6,209	5,176	2,860
168	0301359A	07	SPECIAL ARMY PROGRAM	10,636	7,072	7,031
169	0303028A	07	SECURITY AND INTELLIGENCE ACTIVITIES	0	2,434	5,438
170	0303140A	07	INFORMATION SYSTEMS SECURITY PROGRAM	12,109	13,253	14,844
171	0303141A	07	GLOBAL COMBAT SUPPORT SYSTEM	68,867	84,426	71,864
172	0303142A	07	SATCOM GROUND ENVIRONMENT (SPACE)	38,286	44,647	72,244
173	0303150A	07	WWMCCS/GLOBAL COMMAND AND CONTROL SYSTEM	13,783	13,385	17,895
174	0305114A	07	TRAFFIC CONTROL, APPROACH AND LANDING SYSTEM-FY 19	637	777	977
175	0305204A	07	TACTICAL UNMANNED AERIAL VEHICLES	35,970	37,880	46,479
176	0305206A	07	AIRBORNE RECONNAISSANCE ADV DEVELOPMENT	4,864	10,972	4,882
177	0305208A	07	DISTRIBUTED COMMON GROUND SYSTEMS (JMIP)	7,839	72,095	15,683
178	0603778A	07	MLRS PRODUCT IMPROVEMENT PROGRAM	62,955	99,505	57,825
179	0708045A	07	END ITEM INDUSTRIAL PREPAREDNESS ACTIVITIES	85,644	77,863	61,025
180	1001018A	07	NATO JOINT STARS	500	0	512
Total: Operational system development				859,043	1,126,020	924,616
Total: RDT&E, Army				6,263,162	7,052,669	6,918,494

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Landmine Warfare and Barrier Advanced Technology	0603606A	47	434
Line-Of-Sight Technology Demonstration	0603654A	49	444
LOGISTICS TECHNOLOGY	0602786A	26	292
Manpower, Personnel and Training Advanced Technolo	0603007A	36	397
Manpower/Personnel/Training Technology	0602785A	25	288
MATERIALS TECHNOLOGY	0602105A	4	100
MEDICAL ADVANCED TECHNOLOGY	0603002A	31	344
MEDICAL TECHNOLOGY	0602787A	27	305
Military Engineering Advanced Technology	0603734A	52	463
MILITARY ENGINEERING TECHNOLOGY	0602784A	24	268
MILITARY HIV RESEARCH	0603105A	41	407
Missile and Rocket Advanced Technology	0603313A	45	421
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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

February 2002

BUDGET ACTIVITY
1 - Basic research

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	13983	14688	22998	26886	27271	28450	29057
91A ILIR-AMC	9710	10206	17853	21427	21741	22699	23209
91C ILIR-MED R&D CMD	3562	3743	3849	3910	3980	4104	4185
91D ILIR-CORPS OF ENGR	711	739	1296	1549	1550	1647	1663

A. Mission Description and Budget Item Justification: Established by DoD Directive number 3201.4, dated October 8, 1993, the Army's In-House Laboratory Independent Research (ILIR) program has supported and will continue to promote the 1987 Defense Science Board Study on Technology Base Management's recommendation to attract and retain top flight science and engineering PhDs in the Army's research organizations. The ILIR program provides a source of competitive funds to technical directors to stimulate high quality, innovative research with significant opportunity for payoff in Army warfighting capability. The ILIR program serves as a catalyst for major technology breakthroughs by giving laboratory directors flexibility in implementing novel research ideas and nurturing promising young scientists and engineers. Successful ILIR projects are typically transitioned to start-up projects under 6.1 or 6.2 mission funding within an organization. Many past and current ILIR projects have supported or are currently supporting developmental efforts in support of the Objective Force. ILIR funding allocations are based on past program performance as judged by a panel of leading scientists and engineers from the National Academy of Sciences, the Army Science Board, and Army Secretariat. The work in this program is performed by the Army Materiel Command, Army Medical Research and Materiel Command and Army Corps of Engineers Engineer Research and Development Center. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance, and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	14326	14815	15035
Appropriated Value	14459	14815	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-127	0
b. SBIR / STTR	-343	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-133	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	7963
Current Budget Submit (FY 2003 PB)	13983	14688	22998

Change Summary Explanation:

FY03 (+\$7963) - Project 91A (+\$7415), Project 91D (+\$544), and Project 91C (+\$4) increased to enhance investment in innovative research at Research Development and Engineering Centers to address commodity-focused fundamental phenomenology and support recruitment and retention of high quality junior scientists to refresh the science and engineering workforce.

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601101A - In-House Laboratory Independent Research	PROJECT 91A					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
91A ILIR-AMC	9710	10206	17853	21427	21741	22699	23209

A. Mission Description and Budget Item Justification: This project provides funding for ILIR research in the Army Materiel Command's seven Research, Development and Engineering Centers (RDECs). This basic research lays the foundation for future developmental efforts by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge. Past and current ILIR efforts have had and are having significant impacts on technology development efforts supporting the Army Transformation to the Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance, and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). The work in this program is performed by the Army Materiel Command. This program element contains no duplication with any effort within the Military Departments. This project supports the Objective Force transition path of the Transformation Campaign Plan.

FY 2001 Accomplishments:

- 9710 - Missile RDEC - Validated gel propellant additive technology to extend missile propellant shelf life to 20 years; investigated the use of extended capillary electrophoresis to analyze missile propellant formulations and their synthetic by-products to reduce the amount of waste produced during explosives production by 90%; investigated the ignition criteria and chemical/particulate formulation for neutralization of chemical/biological missile warheads and determine concept feasibility; analyzed and modeled the driving potential physics for the fluctuating control force on interceptor sensor performance and compare results with experimental data, to enable possible electro-optical guidance techniques for hypervelocity missiles; investigated ablation models for hypervelocity missiles components (nose cone, IR dome, nozzles); investigated the control of high frequency chaos in diode lasers testbed for possible application to high efficiency/lower cost diode lasers; analyzed photonic band gap materials to provide sensor protection of missile guidance systems against optical countermeasures.
- Armaments RDEC - Characterized metastable intermolecular composites for more powerful explosives development. Examined the areas of high pressure loading of composite materials for increasing gun components life. Developed smart materials to provide in flight course corrections of ballistic projectiles.
- Tank-Automotive RDEC - Evaluated and validated the accuracy and sensitivity of warfighting requirements simulation models for advanced propulsion, non-linear multibody dynamics, signature management and nontraditional material stress analysis to support development of vehicles for the Objective Force that are lighter, more mobile, and highly survivable.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
91A

FY 2001 Accomplishments: (Continued)

- Natick Soldier Center - Researched biotechnology-based sensor to improve ration safety and to provide more serviceable chemical protective fabrics.
- Edgewood Chemical Biological Center - Demonstrated that organisms may transfer pathogenesis from one to another depending on the specific chemical compounds they secrete. This may offer methods of identifying those organisms. Investigated computationally, the stabilizing effect of substituents on the conformation of a series of large basket shaped molecules being designed as potential agent traps/detectors.
- Aviation RDEC - Validated concepts for smart materials and/or microelectromechanical systems (MEMS) to alleviate dynamic stall and improve rotor blade aerodynamics.
- Communications-Electronics RDEC - Upgraded battlefield visualization tools, transitioned newly developed antenna technologies, improved power sources technology, and advanced sensor technology base to provide greater communications and sensors capabilities for the warfighter.

Total 9710

FY 2002 Planned Program

- 10206 - Missile RDEC - Transition long shelf lifetime gel propellant technology to the Compact Kinetic Energy Missile (CKEM) development effort for Objective Force applications; validate and transition methods to reduce the propellant synthesis waste by 90%; transition analytical and Computational Fluid Dynamics models and new designs into current and future missile systems for both chemical/biological warhead neutralization and guidance sensor improvement; validate improved heatshield designs for hypervelocity missiles nose cones, IR domes, and reduction of nozzle throat erosion to advance capabilities of Army missiles; validate chaos control techniques for diode lasers to enable advanced laser systems development; transition photonic bandgap sensor protection technology to current and evolving missile programs.
 - Armaments RDEC - Develop new metastable intermolecular composites for explosives applications; develop new composite materials that will extend the operational life of gun components; develop new smart materials to enable in-flight course corrections of ballistic projectiles.
 - Tank-Automotive RDEC - Refine warfighting requirements simulation models for advanced propulsion, non-linear multibody dynamics, signature management and nontraditional material stress analysis to support development of vehicles for the Objective Force that are lighter, more mobile, and highly survivable.
 - Natick Soldier Center - Evaluate nanomaterials for potential broad range uses in soldier survivability/sustainability equipment. Model effects of air gaps in clothing on heat transfer. Visualize/quantify air mass trapped by a parafoil and apply to airdrop modeling and simulation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
**0601101A - In-House Laboratory Independent
Research**PROJECT
91A**FY 2002 Planned Program (Continued)**

- Edgewood Chemical Biological Center - Complete the development of a method to study the transfer of pathogenesis between organisms and propose transition of the investigative tools to the core Joint Service CB Defense program. Begin detailed computational study of the conformation of the most promising basket shaped model compounds predicted by last year's work and begin to develop synthetic routes to those compounds.
- Aviation RDEC - Conduct buildup of Background Oriented Stereoscopic Schlieren, Doppler Global Velocimetry, and Particle Imaging Velocimetry technique for full-scale vortex and wake applications to increase rotor blade performance.
- Communications-Electronics RDEC - Evaluate concepts for new electronics materials for more powerful, reliable and lighter weight battlefield visualization tools, communications systems, power sources technology, and sensors.

Total 10206

FY 2003 Planned Program

- 17853 - Missile RDEC - Examine concepts for improved sensors, propulsion, guidance and control, and structural components for missiles and transition these components and concepts to weapons systems.
 - Armaments RDEC - Evaluate metastable intermolecular composites developed for explosives applications. Evaluate composite materials developed for extending gun components operational life. Evaluate smart material designed to provide in flight course corrections of ballistic projectiles.
 - Tank-Automotive RDEC - Evaluate/validate the accuracy and sensitivity of revised warfighting requirements simulation models for advanced propulsion, non-linear multibody dynamics, signature management and nontraditional material stress analysis to support development of vehicles for the Objective Force that are lighter, more mobile, and highly survivable.
 - Natick Soldier Center - Screen promising nanomaterials for performance improvements. Validate experimental technique and airdrop equipment design data collection and extend understanding of parachute dynamics with emphasis on opening forces generated during parachute inflation.
 - Edgewood Chemical Biological Center - Begin synthesis of model basket shaped compounds and initiate evaluation of their ability to trap and bind simulants for a classical chemical and a classical biological agent. Begin work on the development of a novel CB decontaminant and on investigations leading to the generation of new protective mask/helmet concepts.
 - Aviation RDEC - Apply Stereoscopic Schlieren technique to full-scale helicopter vortex to improve rotor blade performance; conduct low Reynolds Number airfoil tests for Unmanned Aerial Vehicle (UAV) applications.
 - Communications-Electronics RDEC - Investigate novel new electronics materials for more powerful, reliable and lighter weight battlefield visualization tools, communications systems, power sources technology, and sensors.

Total 17853

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
91C

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
91C ILIR-MED R&D CMD	3562	3743	3849	3910	3980	4104	4185

A. Mission Description and Budget Item Justification: This project covers ILIR research to address medical and force protection needs at the six Medical Research and Materiel Command laboratories; the Aeromedical Research Laboratory, the Institute of Surgical Research, the Research Institute of Environmental Medicine, the Medical Research Institute of Chemical Defense, the Medical Research Institute of Infectious Diseases, and Walter Reed Army Institute of Research. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance, and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments.

FY 2001 Accomplishments:

- 3562 -Conducted basic research on countermeasures against militarily relevant infectious diseases to include development of drugs and vaccines against malaria, diarrheal diseases, and viral hemorrhagic fever.
- Conducted basic research on defenses against environmental extremes and operational hazards to health and performance as well as development of models to predict physiological responses to these hazards; mechanisms of combat trauma; and development of innovative treatment and surgical procedures.

Total 3562

FY 2002 Planned Program

- 3743 -Explore opportunities for identification of new countermeasures against militarily relevant infectious diseases using state-of-the-art techniques such as DNA microarray technology to facilitate identification of candidate genes for drug and vaccine development.
- Investigate new methods of testing for infection.
- Study new vaccine delivery mechanisms including needle-less delivery.
- Pursue modeling to predict physiological, operational stressors on the battlefield.
- Study the use of gene therapy to reverse early tissue damage in organs.

Total 3743

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
**0601101A - In-House Laboratory Independent
Research**PROJECT
91C**FY 2003 Planned Program**

- 3849 -Exploit candidate countermeasures against militarily relevant infectious diseases identified through application of microarray technology.
 - Refine candidate methods of testing for infection.
 - Refine models to predict physiological, operational stressors on the battlefield.
 - Exploit use of promising gene therapies to reverse early tissue damage in organs.

Total 3849

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
91D

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
91D ILIR-CORPS OF ENGR	711	739	1296	1549	1550	1647	1663

A. Mission Description and Budget Item Justification: This basic research lays the foundation for future developmental efforts by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge. This project encompasses ILIR research funds allocated to the seven Corps of Engineers laboratories. Past and current ILIR efforts have had and are having significant impacts on technology development efforts supporting the Army Transformation to the Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The work under this program element is performed by the U.S. Army Engineer Research and Development Center. This program element contains no duplication with any effort within the Military Departments. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

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

Total 711

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
91D

FY 2002 Planned Program

- 739 - Investigate the effects of soils on the strengths of ground and air surface waves as input to the design of a short-range ground communications system for networked battlefield sensors.
 - Assess the effectiveness of using wavelet-based variograms in classifying hyperspectral data for use in terrain analysis.
 - Develop a method of mathematically creating a virtual reference image required for the Phase Profilometry optical technique being employed to measure surface topography and objects for use in robotics.
 - Analyze NASA aircraft data and other field data to define realistic in-cloud icing conditions for investigating the rate of ice accumulation on the main wing of the Hunter unmanned aerial vehicle.
 - Determine the mortality of potential pathogens added to soils, prerequisite to developing a future combat system chemical-biological (CB) defense strategy for endospore pathogens and application to diverse environmental conditions.

Total 739

FY 2003 Planned Program

- 1296 - Explore the chemical phenomena needed to ultimately develop highly selective and sensitive DNA biosensors for detection of explosives, including vapor signatures of landmines and unexploded ordinance.
 - Model selected geosynthetic materials for pavement applications.
 - Investigate fluorescence signatures as a means of detecting and monitoring biological hazards in water and soil.
 - Develop a technique that enables researchers to map the processes of cracking in construction materials while under dynamic loading conditions, as in blast and projectile penetration, which is essential in preparing hardened materials for use on the battlefield.
 - Exploit phase profilometry, an optical technique, to accurately measure surface topography and objects, a capability that is critical to the development of robots and robotic vehicles.

Total 1296

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	133081	144240	139633	140230	143306	148831	152021
305 ATR RESEARCH	1174	1226	1305	1317	1345	1414	1446
31B INFRARED OPTICS RSCH	2247	2482	2659	2671	2725	2866	2934
52C MAPPING & REMOTE SENS	2258	2348	2554	2586	2646	2727	2785
53A BATTLEFIELD ENV & SIG	3780	3912	4284	4317	4439	4705	4821
74A HUMAN ENGINEERING	2633	2741	2974	2996	3057	3227	3303
74F PERS PERF & TRAINING	2600	2830	2923	2957	3036	3139	3200
F20 ADV PROPULSION RSCH	2472	2589	2834	2885	2942	3115	3192
F22 RSCH IN VEH MOBILITY	471	490	528	533	541	563	575
H42 MATERIALS & MECHANICS	1955	2026	2162	2229	2274	2400	2458
H43 RESEARCH IN BALLISTICS	4023	4200	5945	4489	4585	4818	4927
H44 ADV SENSORS RESEARCH	4023	4206	4371	4453	4550	4761	4867
H45 AIR MOBILITY	1965	9018	2193	2236	2276	2354	2405
H47 APPLIED PHYSICS RSCH	3125	3246	3557	3579	3653	3860	3951
H48 BATTLESPACE INFO & COMM RSC	6690	7057	7429	7597	7805	8206	8378
H52 EQUIP FOR THE SOLDIER	973	1005	1177	1179	1196	1262	1292
H57 SCI PROB W/ MIL APPLIC	49784	52612	54699	55463	56747	58386	59578
H66 ADV STRUCTURES RSCH	1445	1495	1678	1684	1715	1817	1862
H67 ENVIRONMENTAL RESEARCH	3451	3613	3777	3833	3899	4033	4115
H68 PROC POLLUT ABMT TECH	359	378	385	390	396	409	418
HA4 PERPETUAL ASSAIL & SECURE INFO SYS, RSCH, TNG & ED	0	3800	0	0	0	0	0
S04 MIL POLLUTANT/HLTH HAZ	607	637	649	658	670	689	702
S13 SCI BS/MED RSH INF DIS	8927	9330	10780	11087	11316	11781	12037
S14 SCI BS/CBT CAS CARE RS	3917	4100	4446	4507	4591	4769	4874
S15 SCI BS/ARMY OP MED RSH	5346	5582	6262	6346	6478	6758	6910
S17 MOLECULAR BIOLOGY-HIV	422	443	0	0	0	0	0
S19 T-MED/SOLDIER STATUS	464	630	611	673	700	722	737

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

S20	SCIENCE BASE EMERGING INFECTIOUS DISEASES	3821	0	0	0	0	0	0
T22	SOIL & ROCK MECH	1815	1906	1939	1965	2002	2062	2103
T23	BASIC RES MIL CONST	1534	1613	1641	1663	1691	1742	1779
T24	SNOW/ICE & FROZEN SOIL	2346	2189	1244	1246	1257	1328	1354
T25	ENVIRONMENTAL RES-COE	4128	4551	4627	4691	4774	4918	5018
T51	COUNTER - TERRORISM RESEARCH	2884	0	0	0	0	0	0
T55	DISPLAY PERFORMANCE & ENVIRONMENTAL EVALUATION	1442	1985	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element sustains U.S. Army scientific and technological superiority in land warfighting capability, provides new concepts and technologies for the Army's Objective Force, and provides the means to exploit scientific breakthroughs and avoid technology surprise. This program responds to the scientific and technological requirements of the Department of Defense Basic Research Plan, the Army Science and Technology Master Plan, and the Army Modernization Plan by enabling the technologies that can significantly improve joint warfighting capabilities. The in-house portion of the program capitalizes on the Army's scientific talent and specialized facilities to expeditiously transition knowledge and technology into the appropriate developmental activities. The extramural program leverages the research efforts of other government agencies, academia, and industry. This translates to a coherent, well-integrated program which is executed by the five primary contributors: 1) the Army Research Laboratory (ARL), which includes the Army Research Office; 2) the Army Materiel Command Research, Development and Engineering Centers (RDECs); 3) the Army Corps of Engineers Research and Development Center (ERDC); 4) the Army Medical Research and Materiel Command laboratories; and 5) the Army Research Institute. The Army's research program promotes quality through activities such as in-depth reviews of the entire basic research program at all levels and the establishment of Strategic Research Objectives. The Army broadened its research base by expanding its basic research investments at Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs) to 5% of its individual investigator program. The basic research program is coordinated with the other Services via the Joint Directors of Laboratories panels, Project Reliance, and other interservice working groups. The projects in this Program Element involve basic research efforts directed toward providing fundamental knowledge for the solution of military problems related to long-term national security needs and is appropriately in Budget Activity 1. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	136650	138281	133309
Appropriated Value	137914	145450	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-1210	0
b. SBIR / STTR	-2993	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-578	0	0
e. Rescissions	-1262	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	6324
Current Budget Submit (FY 2003 PB)	133081	144240	139633

Change Summary Explanation:

FY02 - Congressional adds were made for Advanced Target Recognition Using Nanotechnologies, Project H57 (\$1000); Perpetually Assailable and Secure Information Systems, Research, Training, and Education, Project HA4 (\$3800); Display Performance and Environmental Evaluation Lab Project, Project T55 (\$2000); Cold Weather Sensor Performance, Project T24 (\$1000); and Optical Technologies, Project H57 (\$1000).

Projects with no R-2A:

Project F22:

- FY02 Funding = \$490 Research in Vehicle Mobility (F22): Conduct research in support of advanced military vehicle technology with emphasis on advanced propulsion, sophisticated vehicle dynamics and simulation, and advanced track and suspension concepts.

Project H68:

- FY02 Funding = \$378 Processes in Pollution Abatement Technology (H68): Provide fundamental understanding of the physical, chemical and biological properties of hazardous wastes and mechanisms that control their degradation and treatment on military installations.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002****BUDGET ACTIVITY
1 - Basic research****PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES****Project HA4:**

- FY02 Funding = \$3800 Perpetually Assailable and Secure Information Systems, Research, Training, and Education : The objective of this one year add is to conduct basic research into developing technologies to enable Perpetually Assailable and Secure Information Systems with military applications. No additional funding is required to complete this effort.

Project S04:

- FY02 Funding = \$637 Military Pollutants and Health Hazards (S04): Develop 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.

Project S17:

- FY02 Funding = \$443 Molecular Biology/Military HIV Research (S17): Develop methods for the prevention, early diagnosis, and treatment of human immunodeficiency virus (HIV).

Project S19:

- FY02 Funding = \$630 Telemedicine Soldier Status Research (S19): Provide realistic, simulated representations of medical procedures based upon R&D of enabling technologies in tissue modeling, haptics integration, graphics, and physiological representations and overall systems architecture.

Project T55:

- FY02 Funding = \$2000 Display Performance and Environmental Evaluation Lab Project : The objective of this one year add is to expand the capability to adequately measure and evaluate operator display performance in all military environments. No additional funding is required to complete this effort.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
305

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
305 ATR RESEARCH	1174	1226	1305	1317	1345	1414	1446

A. Mission Description and Budget Item Justification: This project supports basic research on the fundamental underpinnings of aided and unaided target detection and identification techniques for land warfare. Future Army systems must be able to act independently of the human operator to detect and track targets. Such capabilities are needed for smart munitions, unattended ground sensors and replacements for existing systems such as land mines. Critical technology issues include low depression angle, relatively short range, and highly competing clutter backgrounds. Electro-optic/infrared imaging systems that use advanced algorithms for compressing data, detecting and identifying targets over extended battlefield conditions are essential for the warfighter in the Objective Force. The research resulting from this project will provide fundamental capability to predict, explain, and characterize target and background signature content, and reduce the workload on the soldier. This research is aimed at understanding the complexity and variability of target and clutter signatures and ultimately will utilize that knowledge to conceptualize and design advanced Automatic Target Recognition (ATR) paradigms to enhance robustness and effectiveness of land warfare systems. ATR research strategies include emerging sensor modalities such as spectral imaging and multisensor imaging. These research findings support several technology efforts including multidomain smart sensors, third generation forward looking infrared (FLIR), advanced multi-function laser radar (LADAR) technology. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance, and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command.

FY 2001 Accomplishments:

- 1174 - Determined the fidelity of analytical thermal predictions for signature data and refined prediction models to economically generate real world imagery data on which to assess ATR algorithms.
- Correlated performance of one or more ARL ATR algorithms with image complexity measures. Complexity measures allow a quantitative measurement of how difficult it may be to find a target in a given image and can assess how closely a synthetic image reproduces a real image.
- Conducted phenomenological studies of hyperspectral data to assess minimum number of spectral bands needed to achieve high discrimination performance with low cost trade off. Initial studies showed that perhaps as few as 6 to 9 bands may provide all the information needed for superior automatic/aided target recognition results.

Total 1174

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCESPROJECT
305**FY 2002 Planned Program**

- 1226 - Provide framework for use of synthetic target image chips in the training and testing new ATR algorithms.
- Design new ATR approaches using hyperspectral data cubes and compare hyperspectral ATR algorithms to broadband and dualband ATR algorithm performance.

Total 1226

FY 2003 Planned Program

- 1305 - Correlate complexity measures of imagery with robustness and effectiveness measures of ARL ATR algorithms.
- Determine the minimum number of hyperspectral bands needed for effective target recognition algorithms.
- Assess significance of hyperspectral ATR for battlefield applications and report results.

Total 1305

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
31B

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
31B INFRARED OPTICS RSCH	2247	2482	2659	2671	2725	2866	2934

A. Mission Description and Budget Item Justification: This project supports the Army's theoretical and experimental research in materials and devices for active and passive infrared(IR) imaging systems. It generates new technologies to obtain unprecedented awareness of the battlefield and to continue to "own the night" notwithstanding foreign competition. To achieve these objectives for the Objective Force, IR Focal Plane Arrays (IRFPAs) with significantly improved performance, lower cost, and increased operating temperatures and compact low cost laser radar (LADAR) architectures are needed. Research is therefore focused on material growth, detector design and processing for large area multicolor IRFPAs. The main efforts are directed towards mercury cadmium telluride(HgCdTe) detector arrays grown on silicon (Si) substrates, antimonide (Sb) base superlattices, and quantum well and quantum dot infrared photon detectors. For the compact frequency modulated/continuous wave (FM/CW) LADAR, research has to be performed for some critical components, especially for a high frequency detector/modulator array. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command.

FY 2001 Accomplishments:

- 2247 - Determined fundamental aspects of material growth and device design required for long wave infrared (LWIR) FPA operating above 100°K.
- Grew and processed 0.8micron detector/modulator and incorporated into breadboard LADAR. Initialized growth for 1.5-micron detector/modulator..
- Designed IRFPAs to be utilized for active and passive imaging.

Total 2247

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCESPROJECT
31B**FY 2002 Planned Program**

- 2482 - Evaluate chemical and structural properties of HgCdTe for application to IR FPAs operating near room temperature.
- Investigate the controlled low-defect growth of Sb-based superlattices and quantum dots for application to IR FPAs operating near room temperature..

- Finish fabrication of a high temperature 2D detector/modulator array for 1.5-micron LADAR.

Total 2482

FY 2003 Planned Program

- 2659 - Determine best material system and detector structure for a large area, staring, multicolor IRFPA operating near room temperature.
- Optimize fabrication processes necessary to produce high temperature IR/LIDAR FPA devices.

Total 2659

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601102A - DEFENSE RESEARCH SCIENCES	PROJECT 52C
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
52C MAPPING & REMOTE SENS	2258	2348	2554	2586	2646	2727	2785

A. Mission Description and Budget Item Justification: This project supports research in topographic sciences to improve the tactical commander's knowledge of the battlefield; to extract and attribute natural and man-made features from reconnaissance imagery in near-real time; to exploit terrain analysis and reasoning techniques; and to explore the potential of space technology to provide real-time terrain intelligence, command and control, and targeting support. This research investigates new methods of exploiting terrain and environmental data to improve situational awareness and enhance information dominance leading to increased survivability, lethality, and mobility capabilities for the Future Combat Systems and Army Vision/Joint Vision 2020 concepts. The research provides the theoretical underpinnings for program element 0602784A, project 855. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2258 - Investigated an enhancement of neural net and subpixel methods of feature extraction to gain processing speed and increase information detail.
- Investigated hyperspectral imagery analysis/segmentation to improve feature differentiation and identification.
- Created a prototype model to predict precipitation frequency data in the absence of weather data in denied areas to permit greater operational use of terrain.
- Investigated the potential to integrate empirical and inductive analysis systems to increase speed and accuracy of analysis and to enhance descriptive quality of results.

Total 2258

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
52C

FY 2002 Planned Program

- 2348 - Investigate fluorescence feature extraction for enhanced accuracy and detail.
- Investigate multispectral and hyperspectral image compression for reducing process time and data storage requirements.
- Generate classification algorithms for thermal imagery.
- Investigate threat/terrain software and models for specific geographic areas.

Total 2348

FY 2003 Planned Program

- 2554 - Investigate Light Detection and Ranging (LIDAR) feature extraction to provide high resolution terrain data to enhance situational awareness on the battlefield.
- Investigate high resolution data fusion to enhance seamless integration of data and a common operating picture of the battlefield.
- Investigate and refine initial threat/terrain data analysis software to provide higher fidelity situational awareness resulting in improved Tactical Decision Aids.

Total 2554

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
53A

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
53A BATTLEFIELD ENV & SIG	3780	3912	4284	4317	4439	4705	4821

A. Mission Description and Budget Item Justification: This project provides an in-depth understanding of the complex atmospheric boundary layer associated with high-resolution meteorology, the transport, dispersion, optical characteristics and detection of chemical and biological aerosols, and the propagation of full-spectrum electro-magnetic and acoustic energy. The Army of the future will be required to operate in very complex environments and disparate terrain requiring new approaches to understanding, characterizing, and depicting microscale atmospheric phenomena. The lack of a complete understanding of the meteorological aspects of the complex microscale boundary layer in which the Army operates continues to have impacts on abilities to provide accurate and timely tactical weather intelligence to battlefield commanders. This project impacts Army chemical and biological defense operations, electro-optic and acoustic sensors, smoke/obscurant deployments and target acquisition. This project supports Army Strategic Research Objective, Intelligent Systems, provides technology for the Integrated Meteorological System (IMETS) and supports Project Reliance under the Defense Technology Area by providing Tri-Service transport and dispersion research and development. This project is the research leader in boundary layer meteorology over land and urban terrain. This project supports the Army's transformation to the Objective Force through the development of future capabilities and applications in such areas as the detection and identification of biowarfare agents, enhanced acoustic and electro-optic propagation modeling techniques for improved target detection and acquisition, and the development of objective analysis tools that can assimilate on-scene weather observations and fuse this information with forecasts to provide immediate nowcast products. These capabilities will have a direct impact on ensuring soldier survivability, weapon system lethality, and the mobility required for future combat operations. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Corps of Engineers.

FY 2001 Accomplishments:

- 3780 - Utilized the Cooperative Atmospheric Surface Exchange Study (CASES-99) data to model acoustic propagation in diurnal conditions.
- Investigated the feasibility of extracting environmental data from hyperspectral data. Results indicate that development of an enhanced capability for target detection and acquisition using hyperspectral data is possible.
- Investigated and employed the use of multiple excitation wavelengths and elastic scattering in characterizing aerosol particles, especially biological warfare agents.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
53A

FY 2001 Accomplishments: (Continued)

- Initiated experiments on low frequency acoustic propagation in forest canopies and regions to enable assessment of the environment impact on acoustic sensors.
- Evaluated new algorithms for depicting physical processes to better analyze turbulence, wind shear, and visibility at the temporal and spatial scales required for accurate, quantitative depiction of target area atmospheric conditions.
- Integrated a new Cumulus Parameterization Scheme for estimating convective precipitation into hydrostatic mesoscale models that has shown the potential to significantly improve fine-scale predictions of clouds and precipitation in the battlespace area. and enhance lethality and survivability.

- Conducted verification and validation of a coupled 3-D surface layer/boundary layer meteorological model with experimental data over complex terrain and urban morphology domains.
- Incorporated a detailed surface energy balance in the surface layer model for improved thermodynamic and stability effects.
- Improved the boundary layer atmospheric model by incorporating algorithms for depicting 3-D wind and temperature fields for both stable and unstable atmospheric conditions.

Total 3780

FY 2002 Planned Program

- 3912 - Improve tactical target acquisition using the additional dimension of polarization to more completely characterize the state of reflected and thermal radiation.
 - Model and perform experiments on acoustic propagation in forest canopies.
 - Research new high resolution, short-range forecasting models that can be initialized with meteorological data from critical areas of the battlefield. Improved models will directly impact nowcast accuracy for Objective Force operating areas and target areas.
 - Participate in a multi-agency field experiment investigating dispersion in urban domains to gain an understanding of the impact of urban terrain on dispersion.
 - Investigate and correct problems with the transient turbulence model to decrease computational requirements for counter-gradient dispersion.

 - Investigate the scientific foundation for a hazard avoidance decision aid using the coupled 3-D surface layer/boundary layer transport and dispersion model.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
53A

FY 2002 Planned Program (Continued)

- Investigate methods for performing 3-D data assimilation techniques with combined boundary layer and transport and dispersion models.

- Investigate a computationally efficient model for determining weather effects on nighttime illumination that includes cloud cover effects on light pollution from cities and military operations.
- Research a computationally efficient forecast model for surface layer optical turbulence effects and their impacts on target acquisition.

- Conduct field measurements of natural background aerosols in different geographic locations and at different seasons to establish expected backgrounds for bio-aerosols.

Total 3912

FY 2003 Planned Program

- 4284 - Establish an experimental capability for polarimetric discriminators in hyperspectral ground-based remote sensing imaging to enable improved target identification and acquisition.
 - Research high-fidelity acoustic signature simulation system for generating synthetic acoustic signatures.
 - Analyze data obtained in a multi-agency field experiment for the purposes of validating and/or improving dispersion modeling in urban domains.

 - Use simulated and actual fluorescent particle counter measurements to pinpoint sources and predict dispersion of biological agents in urban environments.

 - Explore, examine and integrate an explicit cloud microphysics scheme in the Battlescale Forecast Model for enhanced cloud depictions.

Total 4284

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
74A

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
74A HUMAN ENGINEERING	2633	2741	2974	2996	3057	3227	3303

A. Mission Description and Budget Item Justification: This project provides research on soldier performance, including the areas of visual, auditory, cognitive, and stress-related performance. The goal is to identify, describe and manage underlying human-system interface factors critical to the design of Army weapon systems. The barriers include an incomplete understanding of soldier physical, cognitive and perceptual processes and how to apply this understanding to new missions and systems. All of the work in this program is included in the Army Strategic Research Objective (SRO) titled "Enhancing Soldier Performance". The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP).. This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command.

FY 2001 Accomplishments:

- 2633 - Completed development of a robust and sensitive speech recognition test specifically applicable to noisy military environment. Validation efforts were completed in December 2001.
 - The hearing hazard model was refined and transitioned to other Army, government, and standards organizations (American Inst. Biological Sciences, SAE, NIOSH) as an improved method for auditory injury and occupational health risk assessment due to impulse noise.
 - Created a blast waveform database that includes hazard assessments used by NATO countries to compare auditory health risk criteria.
 - Expanded studies of selective visual attention on target acquisition to electro-optically (IR and I2) imaged scenes and provided results to AMSAA's soldier-in-the-loop target acquisition modeling effort.
 - Completed field experiment to quantify the effects of the availability of tactical information presented on helmet mounted displays on global and local situation awareness and mission performance of dismounted military teams. Data are being analyzed and findings will be transitioned to SBCCOM-NSC in 2Q FY02.
 - Transitioned results from stress research findings to assist in the development of information processing models and methods for improved vigilance and readiness within the digitized battlefield.
 - Identified resiliency characteristics and biochemical correlates, such as baseline amylase, of successful performance of junior enlisted personnel in support of the "Enhancing Soldier Performance" SRO.

Total 2633

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
74A

FY 2002 Planned Program

- 2741 - Determine the impact of infantry helmet on the auditory localization to provide guidelines for future helmet designs.
 - Conduct research to determine the best approach for improving spatial perception of combat important sounds in adverse listening conditions.
 - Apply streamlined, multi-dimensional, stress assessment battery in high workload and high stress environments in order to quantify the stress-performance relationships directly associated with the retention and effectiveness of experienced soldiers.
 - Complete studies of electrophysiological measures of cognitive performance and design follow-on studies with Objective Force Warrior perspective.
 - Generate multivariate and hierarchical models of soldier performance under a variety of stressful conditions.
 - Determine software architecture requirements for optimal representation of human behaviors in battlefield scenarios and for communication with other wargame models and validate specific models through experimental and field research paradigms.

Total 2741

FY 2003 Planned Program

- 2974 - Identify and begin to quantify the effects of spectral signal composition on auditory detection and recognition of acoustic signatures and warning signals.
 - Validate the multivariate and hierarchical models of soldier performance under conditions of high stress and high workload. Validate metric for measuring real-time alertness monitoring for detection and recognition of visual targets or related cues.
 - Conduct follow-on study to further define the effect of specific combat stressors in areas of situation awareness and decision making under uncertainty to improve management and control of battlefield stressor effects.
 - Transition data from localized brain activity and behavior research to cognitive models of soldier performance, field-validate predictive models, and integrate models and results with large-scale representations of system and unit performance.

Total 2974

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601102A - DEFENSE RESEARCH SCIENCES	PROJECT 74F
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
74F PERS PERF & TRAINING	2600	2830	2923	2957	3036	3139	3200

A. Mission Description and Budget Item Justification: This project covers behavioral science research in areas with high payoff opportunities for improved training, leadership, and personnel performance, including: methods for faster learning and improved skill retention; leader effectiveness for improved team and unit performance; understanding the impact of societal trends on Army readiness; and improving the match between soldier skills and their jobs to optimize performance. Research is focused on issues of small-team performance, leadership, and training to ensure that personnel performance and training research keep pace with future mission, structural, technological, equipment, and personnel changes. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Institute.

FY 2001 Accomplishments:

- 2600 - Determined the effects of computer mediated communication on the effectiveness of leader - subordinate relationships.
- Evaluated the use of latent semantic analysis to assess an individual's knowledge structure and to aid in the automatic analysis of free-range text.
- Determined the effects of different types of missions and gender issues on cohesion, morale, and performance effectiveness.
- Modeled the results of a long-term analysis on the durability of tank gunnery skills in the absence of practice.
- Advanced the development of a cognitive model of the commander by incorporating data on the effects of training on the ability of commanders to handle large amounts of information.

Total 2600

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
74F

FY 2002 Planned Program

- 2830 - Evaluate predictions from transformational leadership theory on the effectiveness of training transformational leadership skills.
 - Extend Procedural Reinstatement Theory to predict the unique characteristics of digital skills in terms of their effects on learning, durability, and transferability of trained skills.
 - Construct and validate techniques for developing the particular attributes needed for effective leadership of small units.
 - Incorporate the effects of distance communication discovered in emergency medical operations on models of effective leadership.
 - Develop preliminary results on the effectiveness of cohesion training on team performance.

Total 2830

FY 2003 Planned Program

- 2923 - Validate the ability to develop tacit leadership knowledge by direct training.
 - Determine the role of working memory and other cognitive abilities on higher level comprehension and long-term memory tasks.
 - Develop a model of how individuals value time in making long-term decisions.
 - Determine the value of latent semantic analysis and scenario-strategy to contribute to the training of leadership skills.

Total 2923

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601102A - DEFENSE RESEARCH SCIENCES	PROJECT F20					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
F20 ADV PROPULSION RSCH	2472	2589	2834	2885	2942	3115	3192

A. Mission Description and Budget Item Justification: The goal of this effort is increased performance of small air-breathing engines and power trains that will support Army Transformation in the areas of system mobility, reliability and survivability, and ultimately serve to reduce the logistics cost burden for the Objective Force. The problems are a need to have much greater fuel efficiency in propulsion systems, and to achieve reduced weight in these systems. Technical barriers for advanced propulsion systems are a limit on the maximum temperature that today's materials can safely withstand, and a lack of capability to accurately simulate the flow physics and mechanical behavior of propulsion systems, including the engine and drive train. This project is a joint Army/NASA effort and it is the only DoD basic research project focused on turboshaft engine-specific technology and mechanical power transmission technology. The Army is the lead service in these technology areas (under Project Reliance) and performs basic research in propulsion, as applicable to rotorcraft and tracked and wheeled vehicles. Technical solutions are being pursued through analysis, code generation, experiments and evaluations to improve engine and drive train components and investigate advanced materials. Component level investigations include compressors, combustors, turbines, injectors, pistons, cylinder liners, piston rings, gears, seals, bearings, shafts, and controls. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command.

FY 2001 Accomplishments:

- 2472 - Incorporated environmental effects in service life prediction model for advanced structural ceramics, including effects due to combustion products, which will enable transition of high temperature materials into advanced fuel-efficient propulsion systems.
- Conducted detailed measurements of heat transfer and secondary leakage losses of four port through-flow wave rotor to validate loss mitigation approaches and to improve the performance and efficiency of future air and ground propulsion designs.
- Confirmed through investigation the validity of newly developed engine weight and safety prediction algorithms. These algorithms will forecast the impact of advanced technologies on the weight and safety of new engines.
- Validated gear fault detection methodology incorporating sensor fusion for improved rotorcraft transmission safety and reliability.
- Validated 2D and 3D gear crack propagation codes for improved life and reliability predictions.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
F20

FY 2001 Accomplishments: (Continued)

- Applied signal processing techniques to improve signal/noise ratio and physical sensing bandwidth for ultrasonic data telemetry data system. Proved feasibility evaluation of microelectromechanical systems (MEMS) SiC pressure transducer concept at 600C, enabling internal measurements of flow phenomena in the 10kHz range.
- Proved the feasibility of MEMS based concept to implement microblowing and synthetic jets for non-intrusive active stabilization of centrifugal compressors, which offers enhanced engine performance and operability.

Total 2472

FY 2002 Planned Program

- 2589 - Conduct device-level evaluation of MEMS based synthetic injectors to establish the feasibility for flow range extension experiments on centrifugal compressor stage to enhance engine performance and efficiency.
 - Assess environmental barrier and impact resistant coatings stable to 1480C; incorporate erosion, impact, and environmental effects in life prediction model for advanced structural ceramics for more reliable engine designs.
 - Validate loss mitigation approaches to improve wave rotor performance.
 - Establish gear design parameters/charts/standards based on crack propagation prediction code to enable lighter weight and more durable drive systems for future rotorcraft.
 - Include elasto-hydrodynamic effects in the journal bearing performance code to improve performance analysis and predictions which will lead to engines with extended life, greater reliability and durability, and reduced maintenance.

Total 2589

FY 2003 Planned Program

- 2834 - Complete conceptual integration and hardware design of MEMS injectors for compressor component testing.
 - Complete evaluation of higher temperature range MEMS sensor for operation substantially above 600C, enabling internal measurements in advanced engine hot sections.
 - Conduct component experimentation of a self cooled 6-port wave rotor concept to achieve increased engine power without having to resort to costly advanced high temperature materials or augmented cooling systems. This arrangement will substantially reduce cooling requirements to the wave rotor and associated engine components.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
F20

FY 2003 Planned Program (Continued)

- Complete validation and delivery of new engine weight and safety prediction algorithms, which will forecast the impact of advanced technologies on the weight and safety of new engines.
- Evaluate use of ultrasonic data telemetry concept in a high temperature experimental environment that simulates engine conditions.
- Characterize effects of reduced atmospheric pressure (altitude) on foil bearing performance. Foil bearings are an essential enabling technology for oil-free turbomachinery and the elimination of lubrication support system hardware.

Total 2834

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H42

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H42 MATERIALS & MECHANICS	1955	2026	2162	2229	2274	2400	2458

A. Mission Description and Budget Item Justification: This project funds the Army's basic research program in materials science. The goal is to establish the science base allowing the creation and production of advanced materials which will provide higher performance, lower cost, improved reliability, and environmental compatibility for Army unique applications. Emphasis is on understanding the fundamental aspects of chemistry and microstructure that influence the performance and failure mechanisms of ceramics, advanced polymer composites, advanced metals, and multifunctional materials. These advanced materials will enable lethality and survivability technologies for the Objective Force. This research is conducted by the Army Research Laboratory, at the Aberdeen Proving Ground, MD, and at the NASA Langley Research Center in Hampton, VA, in support of materials technology applied research in project 0602105A/AH84. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command.

FY 2001 Accomplishments:

- 1955 - Explored novel technologies for energy dissipation in lightweight integrally -designed armor composite materials.
- Quantified the effects of interfacial chemistry on the morphology development in polymer/polymer and polymer/inorganic nanocomposites. Identified the most promising candidates for further investigation.
- Determined shock response and material damage/failure mechanisms of ballistically impacted ceramics likely to be used in lightweight armor configurations.
- Identified critical dynamic material properties required for improving the performance of future anti-armor concepts against complex threat armors.
- Evaluated the application of a new computational, elastomeric material modeling technology to intelligent material systems, including electrorheological fluids which may lead to less costly and more reliable damper systems for ground vehicles.

Total 1955

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H42

FY 2002 Planned Program

- 2026 - Conduct basic research to determine the complex microstructural relationships between the interphase and bulk composite properties of lightweight integral armor materials.
 - Correlate morphology and interfacial properties with mechanical performance in multilayered laminates and layered silicate nanocomposites.
 - Characterize dynamic and static material properties of advanced ceramics that can be tailored to control the onset of ballistic failure for improved lightweight armors.
 - Devise analytic models and experimental techniques for describing material response of dynamically loaded anti-armor concepts.
 - Evaluate large strain combined loads viscous models against measured data in cooperative program with Penn State, Brunel University, and Lord Corporation, and investigate the use of these new constitutive theories in the modeling of intelligent material systems, including electrorheological fluids.

Total 2026

FY 2003 Planned Program

- 2162 - Extend design models and experimental techniques to enable exploitation of composite material interphase design methodologies for high-performance lightweight integral armors.
 - Refine structure/property relationships and processing techniques for tailoring performance of advanced polymer systems to be used in integrated Objective Force Warrior systems.
 - Incorporate fundamental understanding of ceramics property behavior into a first-principles ceramic design tool for development of improved lightweight armors.
 - Incorporate analytic model of dynamic penetrator fracture into design codes for improved anti-armor concepts.
 - Investigate computational difficulties of simulating the manufacture of composite structures made with elastomers, and apply new constitutive models to viscoelastic damper problems in the Army fleet that will improve the Army's ability to predict thermodynamic effects.

Total 2162

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H43

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H43 RESEARCH IN BALLISTICS	4023	4200	5945	4489	4585	4818	4927

A. Mission Description and Budget Item Justification: This project funds the Army's basic research program in ballistics. The goal is to improve the understanding of the chemistry and physics controlling the propulsion and flight of gun launched projectiles and the flight of missiles, and to understand the interaction of these weapons with armored targets. This research results in the science base which allows the formulation of more energetic propellants, more accurate and lethal projectiles and missiles, and advanced armors for increased survivability of Army combat systems for the Objective Force. This research is conducted at the Army Research Laboratory, Aberdeen Proving Ground, MD in support of ballistic technology applied research in project 0602618A/AH80. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project Reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command.

FY 2001 Accomplishments:

- 4023 - Refined fundamental chemistry and physics models and expanded experimental techniques to elucidate the factors controlling gun and missile propellant initiation, combustion, sensitivity, and vulnerability.
 - Devised advanced computational models, smart munitions aerodynamic prediction capabilities, and flight vehicle control element design tools for low cost precision munitions.
 - Devised micromechanical model and defined theory critical experiments that describe the onset and propagation of damage to ballistically impacted ceramics.
 - Identified the physical processes associated with adiabatic shear band initiation and growth to improve performance of future anti-armor concepts.

Total 4023

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCESPROJECT
H43**FY 2002 Planned Program**

- 4200 - Employ fundamental and 3-D interior ballistics models and experimental techniques to understand the interaction of electrically generated plasmas with propellants and explicitly model shock and detonation propagation in propellant beds.
 - Couple high performance computational design tools to calculate control aerodynamics of smart munitions, missiles, and rocket systems.
 - Expand ceramic micromechanical model to describe intergranular flow, grain size, orientation, and boundary chemistry and conduct fundamental experiments to determine damage evolution under ballistic load.
 - Devise analytic model and conduct fundamental experiments to determine adiabatic shear onset criterion in emerging anti-armor alloys.

Total 4200

FY 2003 Planned Program

- 5945 - Expand first principles design tools to tailor propellant chemical formulation that will enable design of insensitive high-energy propellants for the Objective Force.
 - Incorporate structural flight vehicle response, aerodynamics, propulsion, guidance, navigation and control to enable a comprehensive design and evaluation capability for smart munitions, missiles, and rocket systems.
 - Validate ceramic micromechanical model using theory critical experiments and integrate model into numerical code to guide ceramic armor material developers.
 - Refine adiabatic shear model based on micromechanical experiments of candidate alloy materials and integrate into computational continuum mechanics code to enable improved design of anti-armor concepts.

Total 5945

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H44

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H44 ADV SENSORS RESEARCH	4023	4206	4371	4453	4550	4761	4867

A. Mission Description and Budget Item Justification: This project exploits new opportunities in the basic sciences to enable new sensing capabilities for advanced sensors for the Army's Objective Force. This work will produce future generations of sensors with capabilities beyond those currently being employed. Technical barriers include the fundamental speed and bandwidth limitations of current materials and devices, and the efficiency of current algorithms and computing architectures. The focus is on exploitation of digital and image processing modules and algorithms, nonlinear optical materials and devices, remote sensing, emissive materials and intelligent system distributive interactive simulations and battlefield acoustic signal processing algorithms. Research involves fundamental science and engineering principles that support survivable sensor systems, displays, and environmental monitoring, both point and remote. Monolithic and hybrid optoelectronic structures in gallium arsenide and lithium niobate are investigated as integrated processors for novel signal and radar processing and control. Diffractive and microoptic elements are investigated to enhance the performance of image and optical processors. For laser protection, nonlinear optical effects are being explored which will allow broad band protection. These nonlinear effects can also be used for optical image processing or holographic displays and storage. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command.

FY 2001 Accomplishments:

- 1364 - Integrated nonlinear beam propagation codes with the materials properties required for sensor/eye protection.
- Recorded and fixed multiplexed gratings in a 3D hologram required for true 3 dimensional display.
- 1051 - Created simulation that showed the capability of Scan MUSIC algorithm to resolve complex targets with a single antenna radar beam there by allowing improvements in real beam target detection.
- Completed improved processing techniques to enable modeling of tactical vehicles on a dielectric halfspace of UHF frequencies.
- Investigated and performed research on advanced acoustic classification techniques such as auditory signal modeling and fuzzy logic. Performed research in wide-band adaptive beam-forming and distributed sensor array processing so that multiple targets can be tracked and identified for attack.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H44

FY 2001 Accomplishments: (Continued)

- 1608 - Devised algorithms for on-the-fly visual information fusion and processing in the presence of atmospheric turbulence-induced phase distortion effects.

- Created the Atmospheric Laser Optics Testbed (ALOT), a first of its kind facility located in the National Capital Area. ALOT provides a research laboratory environment for studying the effects of and intensity fluctuations on ground-to-ground laser communications to reduce the effects on tactical communications in support of joint ARL/CECOM 6.2 research.

- Conducted imaging experiments with artificially generated turbulence located between the object and imaging system. Achieved a recently developed synthetic imaging technique that creates a single image by combining the best focused segments of multiple images. Resultant image quality superior to the undistorted image obtained in the absence of the turbulence.

Total 4023

FY 2002 Planned Program

- 1468 - Provide more realistic beam propagation codes for eye protection from lasers.
- Understand new display modalities.
- Investigate and enhance organic light emission device lifetimes.
- Explore limitations of engineered materials to provide eye protection to laser sources.
- 1077 - Validate applicability of the ScanMUSIC algorithm using measured data and determine the effects of noise clutter on its ability to resolve targets in cross-range.
- Develop and validate EM modeling tools to rapidly predict the signatures of a variety of targets at VHF and UHF frequencies.
- Implement and evaluate efficient encoding and processing schemes between sensor nodes and a centralized gateway.
- Investigate new advanced target classification techniques that exploit multiple sensor modalities through sensor networks.
- 1661 - Implement and evaluate image processing techniques based on nonlinear spatiotemporal dynamics occurring in large arrays of optoelectronic feedback circuits.
- Design a prototype of optoelectronic system for moving target tracking from nonstationary platforms, supporting AMCOM/ARL joint research goals.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H44

FY 2002 Planned Program (Continued)

- Adapt 4-D multigrid microscale Nuclear, Bio logical, Chemical (NBC)model to exploit the Army High Performance Computing Center capabilities and improve the near-real time responses with which the effects of NBC type information is processed.

Total 4206

FY 2003 Planned Program

- 1436 - Use realistic nonlinear optical beam propagation models to design optical limiters.
 - Determine optimal engineered materials for optical limiter applications.
 - Design and fabricate emissive elements on flexible substrates with high efficiency and good color characteristics.
- 1244 - Investigate real-time implementations of S-MUSIC model in multi-function RF systems.
 - Create plan for extending electromagnetic signature prediction capability to L-band.
 - Investigate and research time-frequency signal processing for detection and classification of transients. Continue research in efficient encoding and processing schemes for distributed sensor networks.
- 1691 - Combine nonlinear image processing algorithms with Very Large Scale Integration/Micro Electro-Mechanical Systems(VLSI/MEMS) technology for small target tracking and image processing from non stationary platforms, supporting AMCOM/ARL joint research goals.
 - Design multiwavelength laser communications system to provide the high bandwidth, secure transfer of information on the battlefield.

 - Explore techniques to remotely calculate ready to render information for computationally intensive models such as NBC models, and distribute over tactical communications networks thereby improving the ability of the Commander to react to NBC events.

Total 4371

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H45

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H45 AIR MOBILITY	1965	9018	2193	2236	2276	2354	2405

A. Mission Description and Budget Item Justification: This project provides funding for basic research in aerodynamics as applied to rotary wing aircraft. Analysis, code development, and test and evaluation are conducted on rotor-unique aerodynamics, performance, and acoustics. This project supports the Objective Force and Joint Vision 2020 by providing research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command.

FY 2001 Accomplishments:

- 1965 - Prepared rotor aerodynamic and acoustic software codes using scalable software.
- Conducted hover test using model blades equipped with oscillating blowing to control flow separation.
- Analyzed aeroelastic coupling characteristics for improved rotor stability.
- Validated analytical methods for on-blade control vibration characteristics.
- Designed and fabricated a two dimensional (2D) variable droop leading edge airfoil to delay dynamic stall.
- Developed and validated a new computational fluid dynamics (CFD) tool to design low Reynolds number airfoil using boundary vortex flux technique.

Total 1965

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCESPROJECT
H45**FY 2002 Planned Program**

- 2096 - Perform test to take necessary data for far wake measurement for helicopter and tiltrotor.
- Investigate experimental data to quantify Tiltrotor Vortex ring state measurement.
- Conduct test of 2D variable droop leading edge airfoil.
- 6922 - Conduct fundamental research for autonomous control of rotorcraft unmanned aerial vehicles.
- Investigate active flow control impact on rotorcraft, and evaluate active twist rotor concepts using neural net closed loop controllers.

- Using simulation, generate a synthetic vision database for sensor fusion requirements.

Total 9018

FY 2003 Planned Program

- 2193 - Design and fabricate a high lift 2D airfoil for low Reynolds number flow.
Investigate advanced active flow control concepts to reduce fuselage drag and improve rotorcraft performance
Develop computational fluid dynamics capability to investigate tiltrotor vortex ring state.
Investigate turbulence model on helicopter drag predictions.

Total 2193

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H47

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H47 APPLIED PHYSICS RSCH	3125	3246	3557	3579	3653	3860	3951

A. Mission Description and Budget Item Justification: The objective of this project is to investigate the physics of a variety of phenomena occurring in semiconductor materials and structures, including thin heterostructure systems where quantum confinement effects are important. Specifically, this project addresses research to determine carrier transport properties and lifetimes of a variety of important optoelectronic materials and structures, such as those used in high power infrared lasers, detector/modulators for laser radar (LADAR), IR detector structures, and eye safe laser sources. Technical barriers affecting performance, weight, cost, and power consumption will be addressed. These investigations will support the development of optoelectronic devices for the Army's Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1253 - Used microlaser models to predicted the threshold and energy output of lasers using various parameters for Er/Yb:glass with given pumping intensities.
 - Determined optical properties of electrically pumped laser and modulator structures.
 - Successfully modeled antimonide based superlattice and quantum dot IR detectors for high operating temperature.
 - Determined optical and electrical properties of semiconductor superlattice materials to optimize quantum cascade laser and detector arrays.
- 836 - Proved feasibility of new manganese cathode material for 2X energy density of Land Warrior battery at low temperatures.
 - Synthesized flame retardant electrolyte additive for non-flammable Li Ion batteries for FCS hybrid power sources.
- 1036 - Proved that new high-pressure pulsed-laser deposition (PLD) growth conditions provide conformal AlN coating for passivation of SiC diode structures.
 - Used a Low temperature PLD AlN as buffer layer to provide near-bulk lattice parameters in overlying AlN and to reduce stress in the underlying SiC-AlN buffer layer interface.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCESPROJECT
H47**FY 2001 Accomplishments: (Continued)**

- Showed that post deposition recrystallization of PLD AlN decreased interface traps by at least a factor of 10 for gate dielectric applications.

Total 3125

FY 2002 Planned Program

- 1412 - Complete 3-D laser cavity model with passive Q-switch for diode pumped Er/Yb:glass laser, and in collaboration with the Night Vision and Electronic Sensors Directorate of the Communication Electronics Command, compare model with experimental results; prepare report for publication.
- Refine model of carrier transport in semiconductor superlattice materials based on optical, electrical and magnetic measurements.
- 982 - Initiate research to improve catalysts for compact hydrocarbon fuel reformers for fuel cell systems.
- Explore materials for ultra-high energy density Li/air battery for Land Warrior and FCS.
- 852 - Investigate alternative dielectrics for SiC device layers that are more robust than silicon dioxide.
- Develop a basic model of the SiC-insulator interface that will delineate between the different surface mobility components and that will agree with experimental data.

Total 3246

FY 2003 Planned Program

- 1147 - Investigate intersubband-based devices for integrated optoelectronic systems in the IR spectral region.
- Investigate remaining defects in IR detector structures and their effects on device performance, especially for high temperature operation.
- 1126 - Synthesize new polymeric electrolyte for all solid-state Li-ion battery for Land Warrior and hybrid power sources for the Objective Force.
- Formulate improved chemistry for high performance direct-methanol fuel cell for Land Warrior.
- 1284 - Investigate the long term effects of dielectric degradation on SiC power device performance and reliability for high-temperature high-power applications and devise models that will predict the device performance effects on motor-drive/power conversion application circuits.

Total 3557

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H48

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H48 BATTLESPACE INFO & COMM RSC	6690	7057	7429	7597	7805	8206	8378

A. Mission Description and Budget Item Justification: This project addresses fundamental research in technologies that will enable intelligent and survivable command, control, communication, and intelligence systems for the Objective Force. As the combat force structure becomes smaller and operates in more dispersed formations, information systems must be more robust, intelligent, interoperable, and survivable if the Army is to retain both information and maneuver dominance. The goal of this research is to address the areas of information assurance and the related signal processing for wireless battlefield communications along with intelligent systems for C4I. Major barriers to achieving the goals are overcoming the inherent vulnerabilities associated with using standardized protocols and commercial technologies while addressing survivability in a unique hostile military environment that includes highly mobile nodes and infrastructure, bandwidth-constrained communications at lower echelons, diverse networks with dynamic topologies, high level multipath interference and fading, jamming and multiaccess interference, and information warfare threats. The intelligent systems for C4I research will focus on providing the agent technology capabilities that will reduce the cognitive load on the commander, improve the timeliness, quality and effectiveness of actions and in the long run speed the decision-making process and reduce the size of tactical operation center (TOC) staffs. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3860 - Completed development of efficient algorithms for Internet protocols for highly mobile tactical networks for experimental applications and transitioned technology for CECOM's MOSAIC ATD.
 - Evaluated final hierarchical digital modulation algorithms by testing, identifying and classifying complex signals for transitioning to CECOM classified program.
 - Finalized a mobile ad-hoc network to interconnect tactical units and higher echelons for improved information flow and transitioned technology for CECOM's MOSAIC ATD.
 - Validated the performance of source and channel coding for tactical communications in high bit error battlefield environments for transitioning to CECOM classified projects.
- 2830 - Validated hierarchical digital modulation algorithms for classification and identification of signals on battlefield.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCESPROJECT
H48**FY 2001 Accomplishments: (Continued)**

- Validated performance of spatial diversity combining algorithms for tactical communications for transitioning to CECOM classified programs.
- Validated intelligent agents for mission planning, rehearsal and status monitoring of a physical agent in support of the Advanced Battlefield Processing STO.
- Determined and displayed the state of physical or software agents through a 2D/3D battlespace situation display in support of the Advanced Battlefield Processing STO.
- Determined the robustness of the theoretical foundation for cooperating agents by using its architecture and control language to integrate agents assessing the network vulnerability and agents that monitor the execution of the mission in support of the Advanced Battlefield Processing STO.
- Validated the performance of natural language and context tracking agents that understand a speaker's intent while visualizing graphical information in support of the Advanced Battlefield Processing STO.

Total 6690

FY 2002 Planned Program

- 7057 - Document the improvement in information flow in a mobile ad-hoc network provided by the research suite of networking and control protocols.
 - Extend agent-based wireless network vulnerability assessment research to incorporate secure key management techniques.
 - Determine the fundamental limits on the detection/estimation of modulated signals and the estimation and synchronization of emerging ultra-wideband sources.
 - Investigate techniques to enhance the performance of ad-hoc networks that link unattended microsensors, focusing on routing and control protocols and medium access control algorithms.
 - Provide computational multilingual tools to support tactical, intelligence, and coalition operations that provide language-independent representations of meanings (ontologies) and translingual information search and retrieval.
 - Investigate format representation concepts for federations of ad hoc data management and wireless information distribution schemes to provide a formal representation of military concepts and facilitate coalition operations.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCESPROJECT
H48**FY 2002 Planned Program (Continued)**

- Examine the theoretical foundation for cooperating agents architecture and control language by integrating agents that monitor the status of multiple aspects of blue force operations.

Total 7057

FY 2003 Planned Program

- 7429 - Investigate algorithms for the efficient detection, estimation, and synchronization of ultra -wide signal sources.
- Assess wireless network vulnerabilities and secure key management.
- Validate the robustness of intelligent agent-based techniques to assess wireless network vulnerabilities and secure key management.
- Design validated primary key management techniques based on composite surrogate key structures for federations of ad hoc data management schemes and wireless information distribution schemes.
- Pursue promising techniques to enhance the performance of ad-hoc networks that link unattended microsensors .
- Publish a report defining the theoretical foundation for an architecture and control language for cooperating agents.

Total 7429

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601102A - DEFENSE RESEARCH SCIENCES	PROJECT H52					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H52 EQUIP FOR THE SOLDIER	973	1005	1177	1179	1196	1262	1292

A. Mission Description and Budget Item Justification: This project supports basic research required to achieve the Objective Soldier and the Army Transformation. The research is focused on five core technology areas critical to soldier systems: mathematical modeling, physical performance measurement, polymer science/textile technology, biotechnology and food technology. Research is targeted on 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 rations shortfalls. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the US Army Natick Soldier Center, Natick, MA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 973 - Prepared nonspherical and nonlinear nanoparticle precursors to evaluate their potential in improving the strength of composites for use in lightweight equipment to be carried or worn by soldiers.
- Determined that molecular modeling programs correctly predict the one-dimensional strain in polymeric and polymer nanocomposite materials for use in body armor and other protective equipment.
- Correlated military uniform (clothing) comfort with soldier performance by using a variety of clothing performance indicators.
- Evaluated cognitive performance assessment methodologies using cold exposure as a stressor.

Total 973

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H52

FY 2002 Planned Program

- 1005 - Validate the utility of a model created to assist in the design of better methods to carry loads, improving soldier performance.
- Measure effects of electric fields on the alignment of carbon nanotubes. These materials exhibit properties which suggest they can be used in transparent polymers for eye protection and ballistic shields for body armor.
- Synthesize peptides conducting polymer complexes for clothing and food sensor applications.
- Transition models on high rate phenomena occurring during ballistic impact events to 6.2 nanocomposites program.
- Validate cognitive testing paradigm for detection of food based performance enhancement under stressful conditions.
- Validate biomechanical and motor control methodologies that will provide guidelines to improve load carriage and reduce soldier fatigue.

- Determine dispersion in the binding of water molecules to various components of amorphous food systems as they relate to ration stability and safety.

- Create a new mechanics based theory for fiber-to-fiber interfacial behavior that can provide guidelines for the development of improved fibrous materials for the soldier.

Total 1005

FY 2003 Planned Program

- 1177 - Mathematically model the small energy perturbation of foot takeoff as it relates to walking stability and the ability to enhance soldier performance by understanding locomotion.
- Quantify the orientation of carbon nanotubes using electron microscopy and x-ray diffraction to assess their potential for use in body armor applications.

- Tailor genetically engineered polypeptide conducting polymer complexes to form biosensors to detect different target organisms for ration preservation and safety.
- Integrate cognitive performance paradigm into ongoing, related warrior performance efforts.
- Develop new experiments to quantify and assess the mechanical behavior of hybrid (blended) yarns in conjunction with the new fiber-to-fiber theory to create prototypes of improved materials for the soldier.
- Formulate and implement a novel computer based biomechanics model to assess gait and muscle control to further improve soldier performance.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H52

FY 2003 Planned Program (Continued)

- Validate model and use magnetic resonance imaging measurements to determine formulations that improve food quality and ensure safety.

Total 1177

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H57

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H57 SCI PROB W/ MIL APPLIC	49784	52612	54699	55463	56747	58386	59578

A. Mission Description and Budget Item Justification: This extramural research project seeks to discover and exploit new scientific opportunities and technology breakthroughs, primarily at universities, to improve the Army's Objective Force Capabilities. Current technologies are unable to meet the operational requirements of the Future Combat Systems. The Army Research Office maintains a strong peer-reviewed scientific research program through which leap-ahead technological solutions may be discovered, matured and transitioned to overcome the technological barriers of the Future Combat Systems. Included are research efforts for increasing knowledge and understanding in fields related to long-term Objective Force needs in the physical sciences (physics, chemistry, biology, and materials science), the engineering sciences (mechanical sciences, electronics, and mathematical, computer and information sciences), and environmental sciences (atmospheric and terrestrial sciences). Targeted research programs in nanotechnology, smart structures, multifunctional and microminiature sensors, intelligent systems, compact power and other mission-driven areas will lead to an Objective Force that is more strategically deployable, more agile, more lethal and more survivable. The breadth of this basic research program covers approximately 800 research grants and contracts with leading academic researchers and approximately 1,600 graduate students yearly, and supports research at 227 institutions in 46 states. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. . Work is performed by the Army Research Office. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 23809 - Produced high impedance ground planes for enhanced performance of GPS, radar, and wireless systems.
 - Optimized beryllium-free amorphous alloy composites which will outperform depleted uranium penetrators.
 - Conducted theoretical chemistry studies of oxygen reduction catalysts to increase efficiency of small fuel cells for individual soldier power systems.

- 25975 - Devised an enzyme -based biosensor to detect anticholinesterase chemical nerve agents and their chemical precursors.
 - Utilized magnetorheological fluid based dampers for improved stability of bearingless helicopter rotorblades.
 - Designed a square planar antenna with 1/10 the size of dipole antennas, capable of wider bandwidth and which are conformal thereby reducing the antenna signature on ground vehicles.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H57

FY 2001 Accomplishments: (Continued)

- Devised new classes of smooth bivariate and trivariate macroelements for data compressed visualization of open and urban terrain and to calculate chem/bio agent dispersion.
- Established a sediment transport model to predict short-term beach conditions for amphibious operations and logistics-over-the-shore.

Total 49784

FY 2002 Planned Program

- 23612
 - Devise ultrasensitive gravity gradiometers to detect underground bunkers and tunnels.
 - Use dendrimer-based polymer composites to provide a solid state solution to sensor and eye protection from laser threats.
 - Adapt enzymes which will detect nerve agents in water.
 - Identify how specific odor molecules, out of many thousands, interact with odorant receptors to detect trace amounts of chemical compounds such as explosives.
- 27000
 - Devise a high-fidelity model for fuel combustion and heat release for advanced, low emission/high efficiency gas turbine engines.
 - Devise small footprint parallel Hoffman encoding and decoding at previously unattainable rates for ultra-fast, secure communications.
 - Create high assurance embedded system methodologies leading to improved combat casualty care medical devices.
 - Create robust self-assembled monolayer coatings to ameliorate the adhesion of ice to solid surfaces.
- 1000
 - This one year congressional add is for basic research to develop advanced target recognition techniques using nanotechnologies.
- 1000
 - This one year congressional add develops a center for basic optical research for military applications.

Total 52612

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H57

FY 2003 Planned Program

- 24888
 - Create atom gyroscopes for passive, jam-proof navigation with an accuracy that exceeds GPS.
 - Devise an alternative to silicon-based electronic chips through the synthesis and assembly of molecules to form electronic circuits.
 - Conduct theoretical chemistry studies of hydrogen adsorption on carbon structures for safe, lightweight hydrogen storage devices for individual soldier power systems.
 - Use unique biomolecular combinatorial approaches to find peptides to nucleate electronic materials allowing enhancements in electronic transport and optical efficiency.
- 29811
 - Devise computational design methods based on new Chimera-related flow analysis techniques leading to enhanced helicopter and missile performance.
 - Assess whether using higher degree of Reed Solomon coding will lead to unequal data loss protection in compressed images yielding the highest image quality even when information packets are lost.
 - Conduct research in statistical decision and network theory for automatic data fusion for extremely low power, high bandwidth microsensor networks.

 - Create a physics-based model for prediction of the soil parameters that affect land mine sensor performance in different environments.

Total 54699

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601102A - DEFENSE RESEARCH SCIENCES	PROJECT H66					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H66 ADV STRUCTURES RSCH	1445	1495	1678	1684	1715	1817	1862

A. Mission Description and Budget Item Justification: The goal of this effort is to provide improved tools and methods to enable the design and use of composite structures that can better address the cost, weight, performance, and dynamic interaction requirements of future platforms, and ultimately result in safer, more affordable vehicles for the Objective Force supporting Army Transformation. This project is a joint Army/NASA effort that includes structures technology research into: structural integrity analyses; failure criteria; inspection methods which address fundamental technology deficiencies in both metallic and composite Army rotorcraft structures; use of composite materials in the design and control of structures through structural tailoring techniques; rotorcraft aeroelastic and aeromechanical stability; helicopter vibration (rotating and fixed systems); and the design and analyses of composite structures with crashworthiness as a goal. The problems in structures are inaccurate structural analysis and validation methods to predict durability and damage tolerance of composite and metallic rotorcraft structures and inadequate structural dynamics modeling methods for both the rotating and fixed system components to address reliability issues for future aircraft. The technical barriers include a lack of understanding of failure mechanisms, damage progression, residual strength, high-cycle fatigue, the transfer of aerodynamic loads on the rotor to the fixed system, and impact of these unknown loads on aircraft components. Technical solutions are focused in: advanced fatigue methodologies for metallic structures, improved composites technology throughout the vehicle, long-term maturation of an integrated stress-strength-inspection, advanced methods for rotor system vehicle vibratory loads prediction, and improved methods to predict vehicle stability. These advancements will extend service life, reduce maintenance costs, and enhance the durability of existing and future Army vehicles. As agreed under Project Reliance, this is the only project for rotorcraft and ground structures basic research within the DoD. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. . Work is performed by the Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1445 - Completed analyses of Active Twist Rotor wind tunnel test data to understand the forward flight characteristics of a twist actuated active rotor system in 'open loop' configuration and to define requirements for the design of 'closed loop' configured experiments. This work will enhance vibration control in advanced rotorcraft.
- Three main closed loop control laws were identified for implementation in the Active Twist Rotor (ATR). Identified major actuator concepts necessary for the next generation ATR design. This will lead to improved vibration control and aerodynamic performance of future advanced rotorcraft.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H66

FY 2001 Accomplishments: (Continued)

- Incorporated active control and smart material analytical models into a comprehensive analysis that has resulted in improved vibration and stability predictions for advanced rotors.
- Performed aeroelastic response studies of active stability controlled tiltrotor systems, and modified analytical tools to allow for a complete modeling of the Quad Tiltrotor concept.
- Derived improved damage growth prediction methods to better understand skin/stringer failure modes and to enhance structural reliability of future rotorcraft platforms.
- Completed crippling assessments to validate strength and durability predictions for damaged carbon-rod reinforced structures, which will enhance life usage and maintenance of current and future Army platforms.
- Generated draft test standards for mode 2&3 and mixed-mode 1&2 delamination onset criteria which will promote improved composites fatigue durability of future Army rotorcraft.

Total 1445

FY 2002 Planned Program

- 1495 - Investigate advanced macrofiber composite actuator concepts (greater strain capability, but at a reduced cost) to support the Low Cost Active Rotor (LCAR) program. These concepts may eliminate the need for the heavy, bulky, maintenance-intensive, swashplate rotor from future Army rotorcraft platforms.
 - Evaluate forward flight characteristics of twist actuated active rotor system in 'closed loop' configuration to help reduce rotor vibration.
 - Correlate tiltrotor analysis with wind tunnel test data to validate improved vibratory loads prediction capability.
 - Couple human occupant models and transient dynamic Finite Element simulation of vehicle crash tests to improve prediction of occupant exposure loads and survivability in Army aviation platforms.
 - Validate design criteria for skin/stringer failure models to promote structural reliability and durability of future Army rotorcraft designs.
- Investigate delamination characterization test standards for hybrid and angle-ply composite laminates for improved structural integrity of future advanced rotors.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
H66

FY 2002 Planned Program (Continued)

- Conduct experiments to understand interaction of delamination and curvature for low-velocity impact damage, in order to provide improved future design guidance for air and ground vehicle industry.
- Expand fatigue life predictive methods to incorporate probability distributions for bounding metallurgical flaw sizes, which will improve the accuracy of future platform designs.

Total 1495

FY 2003 Planned Program

- 1678 - Evaluate the performance characteristics of advanced actuators concepts identified for LCAR rotor configuration to enable the design of new rotors of lighter weight and increased reliability.
 - Validate the capability of an actively-controlled stability augmentation rotor system model to improve the tiltrotor stability boundary.
 - Validate predicted human occupant exposure loads with experimental data acquired in an "all composite" fuselage crash test to verify newly-coupled models and simulations.
 - Establish ballot delamination test standards within ISO and ASTM to promote an improved understanding and usage of hybrid composite laminates by industry.
 - Correlate residual strength predictions for low velocity impact damage to validate design criteria for composite sandwich panels and to promote greater use of these lightweight materials.
 - Conduct reliability-based experiments to assess small crack fatigue life methodology for aging Army air and ground vehicles.

Total 1678

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601102A - DEFENSE RESEARCH SCIENCES	PROJECT H67					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H67 ENVIRONMENTAL RESEARCH	3451	3613	3777	3833	3899	4033	4115

A. Mission Description and Budget Item Justification: The objective of this project is to focus basic research on innovative technologies for both industrial pollution prevention (P2) that directly supports the Army industrial base and for non-stockpile chemical warfare (CW) site remediation. The pollution prevention work invests in next generation manufacturing, maintenance, and disposal methods that will result in significantly reducing the usage of hazardous and toxic substances and their associated costs. The goal is to decrease the overall life-cycle costs of Army systems by 15-30% through the application of advanced pollution prevention technologies. The CW remediation efforts concentrate on the application of biotechnology in the characterization and physical clean up of agent contaminated soils and groundwater. The goal is to reduce the cost of remediating a site by at least 50% versus the use of conventional methods. Pollution prevention thrusts include: environmentally acceptable, advanced, non-radioactive, non-toxic and lightweight alternative structural materials to enhance weapon system performance; substitutes for ozone-depleting chemicals as solvents, refrigerants, and firefighting agents for military unique applications; energetic synthesis and process improvements to eliminate the use of hazardous materials and to minimize the generation of wastes from manufacturing operations; and surface protection alternatives to hazardous paints, cadmium, chromium, and chromate conversion metal and composite surfaces. CW thrusts include establishing the ecotoxicity of CW compounds, environmental fate and effect of CW compounds in soils and biodegradation of CW compounds. This project is linked to the Tri-Service Environmental Quality R&D Strategic Plan and addresses environmental technology requirements addressed in that plan. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Armament, Research, Development and Engineering Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3451 - Produced CL-20 and military grade 2,4-dinitrotoluene at bench scale using new environmentally benign processes.
- Applied selected coatings to medium and large caliber gun tubes that will be test fired.
- Characterized microstructural and performance properties of ceramic materials produced by biomimetic processes.
- Optimized soil ecotoxicological screening bioassays and predictive capabilities for labile CW agent compounds in soils.
- Compared the chemical resistance and physical/thermal properties of monolayer topcoats to with heavy-metal based primer-topcoat systems.

Total 3451

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCESPROJECT
H67**FY 2002 Planned Program**

- 3613 - Scale up ceramic production using conditions determined to produce desirable materials and investigate processing variables.
- Develop initial predictive capabilities for labile CW agent materials in soil.
- Characterize factors important for extending the lifetime of present gun barrels and accelerating the introduction of environmentally friendly coatings.

- Characterize PCL/clay nanocomposites processed as blown films.

Total 3613

FY 2003 Planned Program

- 3777 - Optimize processing parameters of biodegradable and recyclable nanocomposite systems.
- Formulate treatment/delivery matrix for anti-CW agent.
- Characterize performance of formaldehyde-free high performance adhesives derived from modified proteins.
- Characterize variables affecting spin solution fiber properties.

Total 3777

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
S13

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
S13 SCI BS/MED RSH INF DIS	8927	9330	10780	11087	11316	11781	12037

A. Mission Description and Budget Item Justification: This project supports focused research for healthy, medically protected soldiers in support of the "Medical" technology area of the Objective Force. Research efforts focus on investigation of medical countermeasures for naturally occurring diseases that are militarily significant due to their historically severe impact on military operations. Establishment of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations. Intramural research under this project is conducted at the U.S. Army Medical Research and Materiel Command's Medical Research Institute of Infectious Diseases, the Walter Reed Army Institute of Research and its overseas laboratories, and the Naval Medical Research Center and its overseas laboratories. Major contractors are The Institute for Genomics Research, Rockville, MD; McKesson Bioservices, Rockville MD, the Israeli Defense Force Medical Corps, Israel; and Kenya Medical Research Institute, Kenya. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Medical Research and Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4720 -Produced Plasmodium. falciparum, a malaria parasite, for all Department of Defense (DoD)-sponsored genome-sequencing efforts. Developed and implemented methods to complete the falciparum DNA sequence by manually filling in the data gaps left by the contractor's automated sequencing effort. Assisted the DoD malaria consortium to construct and verify maps of the malaria genome, the first step in turning raw sequence into data that can be applied to vaccine and drug discovery efforts.
- Characterized the proteins produced by malaria parasites at different stages in their life cycle and determined where in the parasite these proteins are found to identify new targets for vaccine and drug development.
- Identified methods that the malaria parasite uses to develop drug resistance in order to avoid or combat this resistance in future drugs
- Defined the epidemiology of severe anemia caused by malaria in northern Ghana to assess that location as a vaccine field trial site.
- Investigated new/improved approaches to prevention of diarrheal diseases, which are needed to protect and restore the health of soldiers.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
S13

FY 2001 Accomplishments: (Continued)

- 1556 -Evaluated the immune response to enterotoxigenic E. coli (ETEC) infection, a common cause of diarrhea, in United States military personnel on deployment in Egypt to identify proteins that will predict the effectiveness of candidate ETEC vaccines. Identified novel proteins that allow ETEC to adhere to the gut and cause disease for use as possible future vaccine components.
-Compared different strains of Campylobacter, another common cause of diarrhea, for differences in their proteins and genetic sequences to determine the range of strain variation and identified factors by which these organisms cause disease to determine the best Campylobacter proteins to use in future candidate vaccines.
- 2651 -Determined if the immune response to a previous dengue fever virus infection may be the cause of severe, life -threatening dengue disease in a subsequent infection, an important factor in designing a safe dengue vaccine. Validated a rapid, large volume test to measure effectiveness of dengue candidate vaccines. Identified proteins measurable in blood that reflect immune responses to infection with dengue fever virus, which can be used to develop tests to evaluate efficacy of vaccine candidates.
-Conducted epidemiologic studies in Indonesia and Egypt of arboviruses, a common group of disease-causing viruses, determining the potential risk to service members in those regions.
-Assessed the epidemiology of tick-borne diseases in Egypt and malaria in Thailand and Western Kenya to determine risk and recommend control measures in areas where our troops may deploy. Identified mosquito species that carry malaria in diverse regions of Africa (high altitude, urban, dry season) to develop vaccine study sites. Developed a standardized system for assessing dengue fever virus risk based on surveillance of mosquitoes that transmit dengue virus in Southeast Asia.

Total 8927

FY 2002 Planned Program

- 6318 -Investigate new or improved prevention and treatment methods for malaria necessary for protecting and restoring the health of soldiers.

-Complete DNA sequencing of vivax malaria, the second most militarily important cause of malaria in soldiers. These findings will identify malarial proteins that could be important targets in vaccine and drug development.
-Refine methods to find and measure unique proteins in the blood made in response to malaria and that can be used to measure immunity against malaria.

-Conduct epidemiological studies to define the causes of diarrhea in Cairo, Egypt, Southeast Asia and Incirlik, Turkey to allow the selection of bacterial strains in vaccine candidates that provide the broadest protection, and to identify potential future site for vaccine field testing.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
S13

FY 2002 Planned Program (Continued)

- Investigate new/improved prevention methods against diarrheal diseases needed to protect and restore the health of soldiers.
- Discover novel compounds that inhibit life-essential pathways in the malaria parasite to determine potential antimalarial drug candidates.
- Identify methods the parasite uses to survive antimalarial drugs to develop drugs avoiding or delaying parasite resistance to future drugs.

- 962 -Conduct basic research to support prevention of disease from bacterial infections to ensure there is no adverse operational impact from these diseases on our forces.
 -Define the range in natural strain variations of the organism that causes scrub typhus and that could affect the immune responses to these organisms in order to determine the necessary components of a broadly protective vaccine against this disease.
- 2050 -Conduct epidemiological studies to evaluate the different dengue strains, studying disease presentation and pathogenesis in Indonesia, Thailand, Peru and Venezuela, which will help to identify potential vaccine components, define the operational impact of dengue on the soldier and identify future potential field sites for testing vaccines and other countermeasures.
 -Develop a computerized mosquito identification system and assess the epidemiology of malaria to determine risk of carrying disease and to recommend control measures in areas to which our troops may deploy, including Peru, Korea and Indonesia and to evaluate the risk of tick-borne diseases to troops in South America.

Total 9330

FY 2003 Planned Program

- 6176 -Investigate new or improved prevention and treatment methods for malaria necessary for protecting and restoring the health of soldiers.
 -Provide annotated DNA sequence of the P. vivax malaria to research community to leverage the development of drugs and vaccines to combat malaria.
 - Incorporate DoD supported malaria DNA sequencing data into the malaria vaccine and drug development programs to expedite the identification of future vaccines and drugs.
 -Incorporate bioinformatics technology to effectively search genomic information to discover new approaches to solve military infectious disease problems.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
S13

FY 2003 Planned Program (Continued)

-Develop DNA microarray technology to rapidly screen potential target genes involved in malaria parasite survival and targets for drug and vaccine development.

-Perform epidemiological and laboratory studies to identify tests that will predict whether a candidate malaria vaccine is protective.

-Continue discovery efforts for novel compounds that inhibit metabolic pathways in the malaria parasite (potential antimalarial drug candidates). Continue to develop new in vitro assays to more rapidly and reliably test drug toxicity and pharmacology, and assays to screen new drug targets. Identify additional malaria drug targets and mechanisms of the parasite's drug resistance in order to replace older drugs that have lost effectiveness due to resistance.

-Produce an assessment of the presence of malaria drug resistance in different regions of the world for the Commanders-in-Chief (CINCs) so that they can determine the best measures to protect their soldiers when deployed to a specific area of the world.

- 2036 -Investigate new or improved methods needed to protect and restore the health of soldiers from diarrheal diseases, including epidemiological studies and genomic technology.

-Identify new vaccine components to improve protection against diarrhea caused by Campylobacter, a common cause of diarrhea in soldiers.

- 2568 -Perform epidemiological studies to identify tests that will predict whether a candidate ETEC or Campylobacter vaccine is protective.

-Conduct necessary basic research to define, acquire, and evaluate DNA sequences for the sensitive and specific diagnosis of infectious diseases of military interest and that are adaptable to the 1st generation common diagnostics platform.

-Examine mechanisms to prevent viral diseases such as dengue fever necessary for protecting the health of soldiers.

-Conduct necessary basic research leading to the development of medical countermeasures against hemorrhagic fevers caused by Rift Valley fever virus and Lassa virus, which can threaten our soldiers when deployed to areas where these diseases are found.

-Assess insect-borne disease threats to operational forces and provide guidance for suppression of disease-causing insects in areas of military operations.

Total 10780

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
S14

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
S14 SCI BS/CBT CAS CARE RS	3917	4100	4446	4507	4591	4769	4874

A. Mission Description and Budget Item Justification: This project supports focused research for healthy, medically protected soldiers to understand the basic mechanisms of combat-related trauma in support of the "Medical" and "Future Warrior" technology areas of the Objective Force. This research identifies trauma-related topic areas for basic techniques and the experimental models necessary to support in-depth trauma research studies. Research conducted under this project forms the basis for the advancement of trauma treatment and surgical procedures to delay cell death and reduce bleeding following traumatic injury, minimize lost duty time from minor battle and nonbattle injuries, and provide military medical capabilities for far-forward medical/surgical care of battle and nonbattle injuries. Intramural research under this project is conducted at the U.S. Army Medical Research and Materiel Command's Walter Reed Army Institute of Research and U.S. Army the Institute of Surgical Research. Another government contributor to this program in the area of ballistic head injuries is the Aberdeen Test Center. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1817 -Confirmed that inflammatory proteins are activated in hemorrhagic shock.
 -Developed a flexible computer program that can duplicate the blood loss or blood pressure profile of an uncontrolled hemorrhage.
 -Verified that two blockers of inflammatory proteins block lung injury seen in starting/stopping the flow of blood to the gut.
 -Investigated methods to measure retinal vessel blood oxygen saturation to diagnose hemorrhage severity and better triage wounded soldiers.

- 1216 -Conducted basic research on novel methods to repair and prevent hard and soft tissue injuries by testing germ-killing biologics to improve wound healing.
 -Discovered antimicrobial/antiplaque compounds that have kill rates equal to advanced antibiotics.

- 884 -Discovered that an anti-inflammatory drug significantly reduced brain injury and improved recovery after trauma. Discovered that a sodium ion channel blocking drug showed great promise as a neuroprotection treatment.

Total 3917

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
S14

FY 2002 Planned Program

- 1099 -Conduct basic research to enhance the resuscitation capabilities for combat medics by evaluating the extent of inflammation and the changes in extracellular electrolytes. Conduct further research to identify adjuncts that can be added to resuscitation fluids to protect against injury due to hemorrhage and other trauma.
- 1204 -Conduct basic research on novel methods to repair and prevent hard and soft tissue injuries by identifying and developing compounds capable of arresting primary and/or secondary colonization of the mouth by germs that cause gum disease. Determine the best methods to treat and/or stabilize penetrating extremity trauma at far-forward locations to improve battlefield mortality/morbidity rates.
- 897 -Study novel methods to reduce the damaging effects of brain injuries by testing drugs with anti-inflammatory actions that act by blocking pathways to reduce inflammation after hemorrhage.
- 900 -Conduct basic research to produce physiological sensors and devices aimed at diagnosing and treating injuries. Investigate methods to assess at a distance how severely a soldier is wounded and whether a casualty is alive or dead to reduce exposure of medics to enemy fire. Study methods for noninvasively assessing the presence of air or fluid in chest/abdominal cavities to deliver lifesaving treatment far forward.

Total 4100

FY 2003 Planned Program

- 2046 -Conduct basic research to enhance the resuscitation capabilities for combat medics by conducting tests of additional drugs to reduce inflammation after hemorrhage.
-Complete evaluation of relationship between clotting and stimulation of life-threatening inflammation during hemorrhage to prevent adverse consequences. Identify additional cell protective agents that can be added to resuscitation fluids to protect against injury due to hemorrhage and other trauma.
- 1247 -Conduct basic research on novel methods to repair and prevent hard and soft tissue injuries by determining improved methods to treat penetrating extremity trauma at far-forward locations. Complete testing of the most promising antiplaque products on human oral tissue and bone cell cultures to assess toxicity and select candidate for further development.
- 1153 -Conduct basic research to produce physiological sensors and devices aimed at diagnosing and treating injuries. Complete evaluation of noninvasive physiological sensors suitable for incorporation into the Land Warrior ensemble and determine suitability for incorporation into the medic's diagnostic equipment to improve diagnosis, triage, and treatment.

Total 4446

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601102A - DEFENSE RESEARCH SCIENCES	PROJECT S15					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
S15 SCI BS/ARMY OP MED RSH	5346	5582	6262	6346	6478	6758	6910

A. Mission Description and Budget Item Justification: This project supports focused research for healthy, medically protected soldiers, and funds research consistent with the "Medical," "Survivability," and "Future Warrior" technology areas of the Objective Force. This research will develop medical countermeasures to sustain performance when the opportunity for adequate rest is impaired or impossible due to combat conditions. The scientific and technical objectives for this project focus on physiological and psychological factors limiting soldier effectiveness, and on the characterization of health hazards generated by military systems and resulting from military operations. Research is conducted on militarily relevant aspects of environmental physiology and the neurobehavioral aspects of stress. The hazards of exposure to several classes of non ionizing radiation, directed energy, blast, jolt, vibration, noise, and toxic industrial chemicals as environmental contaminants are also investigated under this project. Specific tasks include delineating injury and sustainment, and enhancement of the physiological and psychological capabilities of military personnel under combat operations in all environments. The six main thrust areas include nervous system modulation of stress and cognition, metabolic regulation, control of regional blood flow, oxidative stress interventions, tissue remodeling/plasticity, and biomechanical/biodynamic mechanisms of injury. A portion of this research supports the Strategic Research Objective (SRO) on "Enhancing Soldier Performance." Intramural research under this project is conducted at the following U.S. Army Medical Research and Materiel Command laboratories: the U.S. Army Aeromedical Research Laboratory, the U.S. Army Research Institute of Environmental Medicine, and the Walter Reed Army Institute of Research and its overseas laboratories. Major contractor is McKesson Incorporated, Texas. Additionally, numerous Cooperative Research and Development Agreements (CRDAs) are held with universities and independent laboratories. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1126 -Improved methods for studying changes in behavior and in physiology resulting from non-thermal energy absorption of radio frequency radiation. This research will help materiel developers for future combat systems, (e.g., body worn antenna) avoid biologically harmful frequencies and power mixes.

- 960 -Explored combined amino acid/carbohydrate supplements to enhancement muscle strength and muscle metabolism in men and women to develop principals of ration component performance enhancements.

- 982 -Examined the role of antioxidants to reduce delayed onset of muscle soreness, musculoskeletal tissue damage, and performance decrements associated with strenuous and prolonged training. This will lead to preventive strategies to maximize performance and minimize injury.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
S15

FY 2001 Accomplishments: (Continued)

- 949 -Determined that the immune system was altered by cold stress combined with exercise to improve predictors of cold stress effects
- 1329 -Explored functional magnetic resonance imaging techniques to evaluate brain activity while performing cognitive tasks under sleep deprivation to demonstrate effectiveness of proposed future countermeasures.

Total 5346

FY 2002 Planned Program

- 5582 -Complete the assessment of the cardiovascular effects of ultra wide-band radiation and begin exploration of the interactions of neurotoxins and radio frequency radiation (RFR) on central nervous system physiology and function to identify potential health consequences of RFR and neurotoxin exposure.
 - Document the efficacy of consuming supplemental carbohydrate beverages for enhancing vigilance during simulated combat missions.
 - Utilize genomic or proteomic techniques to assess reproductive effects of environmental hazards during deployment.
 - Evaluate antifreeze proteins to protect skin cells and determine whether chronic heavy work impairs thermoregulation during sustained cold exposure.
 - Evaluate calcium channel blocker in reducing hypothermia mediated organ damage.

Total 5582

FY 2003 Planned Program

- 6262 -Explore and characterize mechanisms of brain cell physiology and morphology with RFR and neurotoxin exposure that may cause long-term health degradation inherent in neurodegenerative diseases.
 - Conduct field studies to validate models of water needs and to explore strategies to reduce water intake requirements while maintaining soldier and unit readiness. This research will provide direct support to the Objective Force by enhancing survivability of soldiers in adverse environments through the use of metabolic regulators.
 - Determine the effect of hypothermia and rewarming on heart rate variability to use as a possible predictor of cold injury. This research will serve to prevent non-freezing cold injuries during deployments to adverse environments.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
S15

FY 2003 Planned Program (Continued)

- Conduct studies to measure transmissible toxic effects in the offspring of animals exposed to environmental toxins and military relevant chemical compounds and mixtures. This research will enable identification of environmental hazards during deployment of the Objective Force.
- Explore brain imaging to determine whether increased cognitive load exacerbates the regional cerebral deactivations that characterize sleep deprivation. This research will enhance the cognitive performance of the Objective Force during sustained operations.
- Determine how the immune system functions during sustained cold-wet exposure and determine if altered by exhaustive exercise.

Total 6262

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T22

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T22 SOIL & ROCK MECH	1815	1906	1939	1965	2002	2062	2103

A. Mission Description and Budget Item Justification: The objective of this project is to create the fundamental knowledge of new materials that provide greater ballistic and penetration protection, control of the visual, infrared, and radar signatures, and rapid soil stabilization. This research will improve the physics-based understanding of geologic and structural materials due to dynamic loading. These technologies provide the basis for applied research that supports the civil engineering technologies for deployment, sustainment, mobility, and survivability of the Objective Force in program element 0602784A, project T40. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1815 - Completed analytic approach for response of target joints and fractures to projectile penetration to support the Army Transformation.
 - Modeled soil response to transient loading patterns of wheeled and tracked vehicles.
 - Evaluated pavement interface, load, dynamic response, and traffic distribution models to realistically represent future aircraft effects on pavement performance.
 - Determined appropriate combinations of responsive/passive composite materials for camouflage, cover, and deception as a function of environment and facility.
 - Matured methods to assess performance of advanced binders for increasing durability of paving materials.

Total 1815

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T22

FY 2002 Planned Program

- 1906 - Perform confined split Hopkinson pressure bar experiments on Indiana limestone to investigate pressure effects during high loading rates.
 - Produce experimental quantity of responsive/passive camouflage, cover, and deception material.
 - Investigate fundamental soil reinforcement mechanisms for nontraditional stabilization additives.

Total 1906

FY 2003 Planned Program

- 1939 - Improve trajectory algorithms for new, advanced penetrators to support the Army Transformation.
 - Evaluate multispectral characteristics of experimental quantities of responsive/passive camouflage, cover, and deception material.
 - Produce physics-based generalized soil theory for large deformations in soil from maneuver operations.
 - Complete vehicular surface interactive models for Future Combat System (FCS) surface interaction models.
 - Mature first-generation reinforcement models describing the interaction between soil particles and nontraditional stabilizers.
 - Define appropriate use of high-loading rate data in simulating response of Salem limestone to high-velocity projectile penetration.

Total 1939

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T23

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T23 BASIC RES MIL CONST	1534	1613	1641	1663	1691	1742	1779

A. Mission Description and Budget Item Justification: This project supports facilities research in forming a fundamental understanding of the long-term durability of composite materials, the behavior of structural elements, and collaborative design theories to support Army Installation Transformation. The project will lead to leap-ahead technologies to solve military-unique problems in the planning, programming, design, construction, and sustaining of deployed facilities (buildings, etc.) and energy and utility infrastructure. This project supports exploratory development efforts in program element 0602784A, projects T41 and T45. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1534 - Completed axiomatic collaboration design theory to improve design quality.
- Formulated micro-mechanical failure models for Fiber Reinforced Polymer (FRP) composite materials for cost effective non-disruptive facility seismic rehabilitation.

Total 1534

FY 2002 Planned Program

- 1613 - Investigate ability of collaborative design theory to simulate the design process and product engineering conflict.
- Enhance fundamental micromechanical stiffness and strength models of infrastructure FRP Composites for improved ductility of seismic connection.

Total 1613

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T23

FY 2003 Planned Program

- 1641 - Investigate algorithms to optimize facility planning/design processes to improve transformation requirements-match and increase throughput.
- Formulate moisture/temperature material property transport models for long-term performance modeling of structural composite materials.

Total 1641

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T24

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T24 SNOW/ICE & FROZEN SOIL	2346	2189	1244	1246	1257	1328	1354

A. Mission Description and Budget Item Justification: This project is the only focused Department of Defense basic research effort investigating the physical, chemical, and electrical properties of snow, ice, and frozen soil and characterization of dominant winter and cold regions processes impacting military materiel, operations, and facilities. These investigations lead to improved understanding of the terrestrial environments and near surface in all seasons. Objective Force lethality and survivability will be enhanced by exploiting advanced sensor capabilities facilitating standoff engagements in all types of terrain and in all seasons. Characterization of the battlespace environment and forecasting the state of the terrain will enable the Objective Force to fully exploit emerging sensing capabilities and achieve superior mobility and survivability. Research focuses on material characterization, physical and chemical processes, and energy propagation applicable to predicting state of the terrain, the effects of the environment on target and target background signatures, and future mobility enhancements in support of the materiel development community. It thus provides the knowledge base for understanding and assessing environmental impacts critical to battlespace visualization. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1137 - Parameterized complex behavior of boundary layer turbulent energy exchange over snow for validating sensor design parameters and performance expectation.
- Investigated acoustic wave propagation in snow, frozen ground, and urban terrains for application to wide area munition sensor technology.

- Determined the effectiveness of current decontamination solution "decon green" to destroy surrogate biological agents (anthrax type spores) in a winter environment for battlefield and Homeland Security areas.
- 1209 - This one year Congressional add (Project T24) completes efforts that identified degradation (fracturing) processes associated with freezing of composite materials and investigated the impact of cloud water content variability on aircraft icing. No additional funding is required to complete this effort.

Total 2346

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T24

FY 2002 Planned Program

- 1189 - Investigate terrain geometry and material properties controlling millimeter-wave signatures. This work will impact vehicle mounted obstacle detection systems.
- Determine military unique seismic/acoustic signatures to improve sensor target detection and classification performance in urban areas and snow covered terrain.
- Investigate sensor fusion strategies to measure aerosolized endospores in complex natural environments. This supports remote detection and identification.
- 1000 - This one year Congressional add (Project T24) completes efforts to investigate physical properties of snow effecting microwave extinction for deep snow conditions and frozen ground chemistry effecting the complex dielectric constant of soil. No additional funding is required to complete this project.

Total 2189

FY 2003 Planned Program

- 1244 - Investigate a new deformation modeling approach for snow and other deformable materials to formulate a physic-based theory. This effort supports conceptual vehicle mobility design and performance evaluation of wheeled and tracked vehicles.
- Identify environmental enablers to ground-wave communication technologies as low-detectability (and wireless) alternatives to traditional airwave and wire communications.
- Determine the physical property dynamics related to seasonal environmental transitions of electromagnetic signatures. This work supports model formulation to improve predictions of sensor performance in highly complex terrain.

Total 1244

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T25

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T25 ENVIRONMENTAL RES-COE	4128	4551	4627	4691	4774	4918	5018

A. Mission Description and Budget Item Justification: The objective of this project is to provide the basic research needed to develop the technologies to address Army issues in the restoration, compliance, conservation, and non-industrial pollution prevention areas. The focus in restoration provides the basic knowledge needed to develop physical, chemical and biological technologies to clean up the Army's contaminated sites. Compliance and pollution prevention efforts address knowledge gaps for troops installations and compliance at industrial installations. The focus in conservation is on landform and ecological modeling, the feasibility of development and propagation of resilient plant species for rehabilitation of damaged lands. This project will also examine the underlying requirements for comprehensive environmental modeling and simulation products to address environmental issues. The project supports applied research under program element 0602720A, projects F25, 048, and 896. Funds in this project are used to support basic research via university contracts for in-house laboratory efforts. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4128 - Completed investigation of bacterial enzymes for biodegradation of nitroaromatics identifying RDX-digesting bacteria from a munitions wastewater treatment plant for use in next-generation biodegradation technologies.
- Evaluated RDX and HMX biodegradation under identical conditions and excess hydrogen to determine the resistance to biodegradation that might hinder the degradation process.
- Identified physiological indicators of stress in surrogate endangered bird species to develop cost-effective techniques to evaluate effects of military training on federally-listed endangered species.
- Completed determination of fundamental mechanisms of how soils erode under soil freeze/thaw conditions.
- Completed determination of genetic characteristics of native plants in cold regions for use in developing improved training range erosion control methods.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T25

FY 2001 Accomplishments: (Continued)

- Completed description of the fundamental mechanisms by which micro-organisms biologically stabilize (restrict the movement and chemical transform to more hazardous chemicals) of Polycyclic Aromatic Hydrocarbons (PAHs) for soils and sediments where the nitrogen content has been reduced/eliminated.
- Completed the determination of ratios $^{15}\text{N}/^{14}\text{N}$ ratio of TNT versus the concentration of TNT in environmental systems to develop improved and less costly means of chemical analysis of TNT.
- Investigated other concepts by which to identify/characterize the types of micro-organisms in the ground by way of how/what they breathe to aid in the development and use of biological in-situ treatment processes.
- Explored the fundamental behavior of micro-organisms when introduced as part of zero-valent iron in-situ contaminant treatment systems.
- Determined the dielectric and conductive properties of contaminated fine-grained sediments to provide the bases for the development of improved tools to characterize contaminated sites and to support the development of improved explosives treatment processes.
- Investigated basic principles required to determine if simple, on-site soil invertebrates assays can be used to tell if explosives are present in soils.
- Developed micro-scale methods for the identification of TNT and TNT biologically rendered byproducts in soil for the development of improved characterization methods and to support the development of improved explosives treatment processes.

Total 4128

FY 2002 Planned Program

- 3310 - Complete non-linear theories for acoustic behavior in the near-field from blast wave for use in predicting noise absorption using corresponding analytical models for noise mitigation in the near field from blast waves caused by weapons noise mitigation.
- Initiate field evaluation of physiological response and habituation of endangered bird species to military stressors to assess relative effects of military training disturbance, environmental variability and geographic variability in physiological stress response of federally-listed endangered species.
- Determine genetic differences in native species diploid populations to enhance resilience for land rehabilitation.
- Complete the determination of mechanisms of adsorption and transformation of explosives in low carbon aquifer soils for the later (applied) development of physical and biological treatment methods under these less conditions that are currently difficult to address.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T25

FY 2002 Planned Program (Continued)

- Complete determination of the basic principles of the physical and biological immobilization of 2,4- and 2,6-Dinitrotoluenes (particularly toxic explosives byproducts) in soils based upon concentration levels and soil physical and chemical characteristics.
 - Complete determination of the dielectric and conductive properties of contaminated fine-grained sediments to provide the bases for the development of improved tools to characterize contaminated sites and to support the development of improved explosives treatment processes.
 - Investigate other concepts by which to identify/characterize the types of micro-organisms in the ground by way of how/what they breath to aid in the development and use of biological insitu treatment processes.
 - Explore the fundamental behavior of micro-organisms when introduced as part of zero-valent iron in-situ contaminant treatment systems.

 - Determine whether explosives vapors diffuse up through frozen soil as functions of soil temperature and moisture content to support the development of improved site characterization under frozen soil conditions.
 - Investigate how TNT and TNT transformation products (nitroaromatics) bind to the organic and mineral fractions of soil and determine how the nitroaromatics can be extracted from the soil fractions to support the development of improved in-situ treatment processes.
- 1241 - Establish basic understanding of physical, chemical, and biological phenomena specific to contaminant toxicity assessment and mineralization and to ecosystem maintenance, mitigation, and rehabilitation.

Total 4551

FY 2003 Planned Program

- 1895 - Characterize large molecular weight degradation products on biodegradation of RDX for remediating contaminated environments.
- Establish adaptations to physiological stress response in endangered bird species to military versus non-military stressors to determine role of behavioral habituation in the physiological stress response of endangered avian species.
- Map genome traits of grasses shown to have improved establishment and resilience characteristics.
- Complete the determination of concepts by which to identify/characterize the types of micro-organisms in the ground by way of how/what they breath to aid in the development and use of biological insitu treatment processes.
- Determine optimum experimental/numerical approaches to describe how various mixtures and concentrations of contaminant become more or less toxic to support the development of quantitative hazard/risk assessment methods.
- Define the fundamental behavior of micro-organisms when introduced as part of zero-valent iron in-situ contaminant treatment systems .

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

February 2002

BUDGET ACTIVITY
1 - Basic research

PE NUMBER AND TITLE
0601102A - DEFENSE RESEARCH SCIENCES

PROJECT
T25

FY 2003 Planned Program (Continued)

- Complete investigation of how explosives vapors travel up through snow and frozen soil to describe optimum explosives vapors detection under a variety of environmental conditions.
- Use natural soils to further determine how specific soil physical and chemical properties affect how much explosives contamination is accumulated and are toxic to soil invertebrates such as earthworms. This will serve as a basis for the development of risk-based site assessments of explosives contaminated sites.
- Identify at the particle and sub-particle scale where and how TNT and TNT transformation products (nitroaromatics) are bound to soils and how this affect availability, binding, and toxicity to resident plants and animals.
- 2732 - Establish basic understanding of physical, chemical, and biological phenomena specific to contaminant toxicity assessment and mineralization and to ecosystem maintenance, mitigation, and rehabilitation.

Total 4627

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	58120	73054	74855	70487	71211	69657	73505
H50 COMMS & NETWORKS COLLAB TECH ALLIANCE (CTA)	9384	7875	8107	8280	8465	9314	10107
H53 ADV DIS INTR SIM RSCH	2638	2569	2594	2587	2579	2778	2826
H54 ADVANCED SENSORS COLLAB TECH ALLIANCE (CTA)	9574	6084	6306	6488	6680	7548	8361
H56 ADV DECISION ARCH COLLAB TECH ALLIANCE (CTA)	5724	6020	6168	6274	6382	6901	7382
H59 UNIV CENTERS OF EXCEL	2166	19229	11977	11954	11937	7042	7077
H62 ELECTROMECH/HYPER PHYS	9434	7911	7948	7923	7942	8347	8680
H64 MATERIALS CENTER	2462	2155	2267	2379	2491	2615	2774
H65 MICROELECTRONICS CTR	949	983	986	981	978	1004	1095
H73 NAT AUTO CENTER	6646	2944	3042	3080	3133	3231	3295
H7A SCIENCE-BASED REGULATORY COMPLIANCE STUDY	961	0	0	0	0	0	0
HA1 GLOBAL INFORMATION PORTAL	0	1000	0	0	0	0	0
HA2 THERMAL FLUID DESIGN TOOL	0	1000	0	0	0	0	0
HA3 VIRTUAL PARTS ENGINEERING RESEARCH CENTER	0	1000	0	0	0	0	0
HA5 CENTER FOR OPTICS MANUFACTURING	0	1500	0	0	0	0	0
J08 INSTITUTE FOR CREATIVE TECHNOLOGY	8182	6806	9463	4589	4707	4982	5225
J09 POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	0	5978	6021	6007	5996	5991	5978
J12 NANOTECHNOLOGY	0	0	9976	9945	9921	9904	10705

A. Mission Description and Budget Item Justification: This program element leverages research in the private sector through Federated

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

Laboratories, Collaborative Technology Alliances (CTA), Centers of Excellence, and the University Affiliated Research Centers. A significant portion of the work performed within this program directly supports Objective Force requirements by providing the enabling technologies which will make development of Objective Force equipment possible. Collaborative Technology Alliance (CTA) are innovative alliances built on the highly successful Federated Laboratory program of the Army Research Laboratory (ARL) which were completed in late FY01. The CTAs will establish alliances among government, industry and academic organizations to exploit scientific and technological breakthroughs and to transition these breakthroughs to exploratory development and applied research. CTAs will be competitively established in the areas of Advanced Sensors, Advanced Decision Architecture, Communications and Networks, Power and Energy, and one applied research CTA in Robotics. This program element includes the Army's Centers of Excellence, which couple state-of-the-art research programs at academic institutions with broad-based graduate education programs to increase the supply of scientists and engineers in materials science, electronics and rotary wing technology. The Army's Institute of Creative Technologies (ICT) is also included in this program element. The ICT is a partnership with academia and the entertainment industry to leverage innovative research and concepts for training and design. Examples of specific research of mutual interest to the entertainment industry and the Army are technologies for realistic immersion in synthetic environments, networked simulation, standards for interoperability, and tools for creating simulated environments. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	59316	69147	49993
Appropriated Value	59865	73647	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-593	0
b. SBIR / STTR	-1760	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	564	0	0
e. Rescissions	-549	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	24862
Current Budget Submit (FY 2003 PB)	58120	73054	74855

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
0601104A - University and Industry Research Centers

Change Summary Explanation:

FY03 funding increase of (+24862) enhances the Army basic research program in Project H59 University and Independent Research Centers by creating a Biotechnology Center of Excellence for basic research into the use of biotechnology to support the Objective Force Warrior; Project J09 A Power and Energy Collaborative Technical Alliance to leverage world class research efforts for lightweight and compact energy conversion and control technologies; and to expand Project J08 the research efforts at the Institute of Creative Technology in support of the Objective Force.

FY02 Congressional Adds were made for Project HA1 (+1000) to support the Global Information Portal project; Project HA2 (+1000) to support Thermal Fluid Design Tool development; Project HA3 (+1000) to support Virtual Parts Engineering Research; and HA5 (+1500) to support a Center For Optics Manufacturing

Project with no R-2A:

Project H65

- FY02 Funding = \$983 Microelectronics Center of Excellence (H65): This program allows the Army to leverage extensive scientific manpower and knowledge of the universities to conduct innovative research and exploit new concepts in solid state physics, electrical engineering, photonics, microelectromechanical systems (MEMS) and the use of chemical/electrochemical engineering to produce microelectronic devices to support specific Army needs.

Project HA1

- FY02 Funding = \$1000 Global Information Portal : The objective of this one year Congressional add is to study the technologies necessary to create a Global Information Portal for distribution of Military information in a secure and real time manner. No additional funding is required to complete this project.

Project HA2

- FY02 Funding = \$1000 Thermal Fluid Design Tool : The objective of this one year Congressional add is to develop a CAD Thermal Fluid Design Tool for Army applications. No additional funding is required to complete this project.

Project HA3

- FY02 Funding = \$1000 Virtual Parts Engineering Research Center : The objective of this one year Congressional add is to support development of a Virtual Parts Engineering Research Center. No additional funding is required to complete this project.

Project HA5

- FY02 Funding = \$1500 Center For Optics Manufacturing : The objective of this one year Congressional add is to support a Center For Optics Manufacturing. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H50

	COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H50	COMMS & NETWORKS COLLAB TECH ALLIANCE (CTA)	9384	7875	8107	8280	8465	9314	10107

A. Mission Description and Budget Item Justification: This project supports a competitively selected university/industry consortium, the Collaborative Technology Alliance (CTA) that was formed to provide solutions for the Army's requirements for robust, survivable, and highly mobile wireless communications networks. The Objective Force has a requirement for state-of-the-art wireless mobile communications networks for command-on-the-move. The barriers include designing communications systems for Survivable Wireless Mobile Networks, providing Signal Processing for Communications-on-the-Move, Secure Jam-Resistant Communications, Automated Information Protection and Detection, Survivable Information Infrastructures, and Information Assurance Situational Awareness for Mobile Tactical Information Systems. The results of this work will significantly affect Objective Force communications/networking development efforts. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 9384 - Validated energy-efficient techniques for secure, jam-resistant, multi-user communications effective in noisy and hostile environment including wideband low-probability of intercept signal design, adaptive spectrum reuse, interference rejection, and jammer detection and mitigation. This research/technology was transitioned to CECOM's Networked Sensors for the Objective Force ATD.
- Completed energy-efficient tactical information protection technologies including computationally-efficient intrusion detection, automated intrusion detection and vulnerability assessment, and highly efficient security infrastructures. This research/technology was transitioned to CECOM's Networked Sensors for the Objective Force ATD.
- Established/awarded a cooperative agreement for the Collaborative Technology Alliance in Communications and Networks focusing on basic research into technologies to enable highly dynamic mobile tactical and sensor networks in noisy/hostile wireless environments and under severe bandwidth and energy constraints.
- Defined space-time compression of FLIR (Forward Looking Infrared) video images with compression ratios of 256-to-1 while preserving motion features.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H50

FY 2001 Accomplishments: (Continued)

- Completed and demonstrated self-configuring wireless networking technologies that provide auto-configuration, auto-addressing, and mobile ad hoc routing functionality. This research/technology was transitioned to CECOM's MOSAIC ATD.
- Completed refinement and validation of the Dynamic Registration and Configuration Protocol (DRCP) and Dynamic Registration and Configuration Protocol (DCDP) which provides functionality for wireless, multi-hop networks and that permits configuration in milliseconds and enables the auto-configuration of mobile routers. This research/technology was transitioned to CECOM's MOSAIC ATD.

Total 9384

FY 2002 Planned Program

- 7875 - Investigate and simulate dynamically self-configuring wireless network technologies including ad hoc wireless routing, medium-access-control algorithms, auto-addressing, and adaptive network configuration.
 - Investigate and simulate signal processing techniques to enable communications among highly mobile users in adverse channel conditions including channel propagation modeling, spread-spectrum and space-time coding, compression, and collision resolution algorithms.
 - Investigate and simulate secure, jam-resistant, multi-user communications effective in noisy and hostile environment including wideband low-probability of intercept signal design, adaptive spectrum reuse, interference rejection, and jammer detection and mitigation.
 - Investigate and simulate tactical information protection technologies including computationally-efficient intrusion detection, automated intrusion detection and vulnerability assessment, and highly efficient security infrastructures.

Total 7875

FY 2003 Planned Program

- 8107 - Investigate and show energy-efficient techniques for dynamically self-configuring wireless network technologies including ad hoc wireless routing, medium-access-control algorithms, auto-addressing, and adaptive network configuration.
 - Investigate and show energy-efficient signal processing techniques to enable communications among highly mobile users in adverse channel conditions including channel propagation modeling, spread-spectrum and space-time coding, compression, and collision resolution algorithms.

Total 8107

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601104A - University and Industry Research Centers	PROJECT H53					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H53 ADV DIS INTR SIM RSCH	2638	2569	2594	2587	2579	2778	2826

A. Mission Description and Budget Item Justification: This project supports a long-term collaboration between the Army Research Laboratory and a competitively selected Army Center of Excellence in Information Sciences (ACEIS). The problem is that to date no large scale heterogeneous collaborative architectures have been modeled. Implementation and integration of future command and control system Commander/User requirements with architectures which utilize enterprise javabean methodologies are the most significant technical barriers. Areas of emphasis include interactive and intelligent systems, database and information systems, and distributed and parallel processing systems. A major portion of the work of the ACEIS is performed at the Clark Atlanta University, a HBCU institution. Research efforts to overcome the technical barriers are listed in the FY01-03 planned program bullets below. This project also supports Army critical research at the Army High Performance Computer Research Center focused on the Objective Force, including: neutralizing the effects of airborne and groundborne contaminant transport, structural response of armored vehicles to perforating and nonperforating projectiles, investigating more efficient gun projectile and missile propulsion systems, and evaluating materials suitable for armor/anti-armor applications. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 500 - Created a Distributed Collaborative Battlefield Visualization System (DCBVS) to record and store video, images, text and voice of command planning sessions for later playback and review by the staff. DCBVS was incorporated into the Advance Battlefield Processing STO.
- 2138 - Validated models for heated regions in the design of seekerheads for future contaminated soils interceptor systems for AMCOM.
- Improved computational models for the remediation of explosives of the bioavailability and biodegradability of nitroaromatic explosives within soil granulates.
- Applied data mining algorithms to analyze scientific data sets for clustering and pattern discovery in fluid mechanics and structural mechanics for enhanced simulation and design of Future Combat Systems (FCS).
- Established the framework for computational multi-disciplinary signature modeling that will enable the FCS developers to design systems with minimal signatures to increase survivability.

Total 2638

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H53

FY 2002 Planned Program

- 771 - Devise mobile agent technology for a distributed combat information systems to enhance collaboration between the Commander and his staff.
- Design a prototype battlefield data exchange and retrieval system to automate the transfer and exchange of information between a Commander and his staff.
- 1798 - Apply intelligent processing techniques in composite manufacturing to the Objective Force.
- Improve portability of partitioning algorithms for use in the design of Army combat platforms.
- Analyze and apply principles of simulation based design to reduce cost and time to fielding the Objective Force.
- Extend scalable algorithms to next generation High Performance Computing platforms.

Total 2569

FY 2003 Planned Program

- 785 - Design and perform laboratory experiments on the battlefield data exchange and retrieval systems to define hypotheses on collaboration and information transfer.
- Perform usability studies on the data manager and distributed combat information system, including heuristic walk-throughs with experts and users; as well as usability experiments with users to validate and verify the hypotheses.
- 1809 - Apply data mining tools and techniques to test data and extract patterns useful for design of Objective Force components.
- Apply predictive groundwater contaminant transport techniques for demilitarization of Army hazardous explosive and biocontaminated sites.

- Apply scalable, dynamic partitioning methods in the design of lightweight structures for the Objective Force.

Total 2594

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H54

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H54 ADVANCED SENSORS COLLAB TECH ALLIANCE (CTA)	9574	6084	6306	6488	6680	7548	8361

A. Mission Description and Budget Item Justification: This project supports long term collaboration between the Army Research Laboratory (ARL) and the competitively selected industry/university consortium for the purpose of leveraging world class research relevant to the needs of the Objective Force and Army Transformation needs. The technical areas addressed under this project include overcoming technical barriers associated with: multidomain smart sensors (includes multispectral infrared focal plane arrays); sensor modeling and algorithms for automatic target recognition (ATR) involving multiple sensors; radar sensors and sensing phenomenology; and signal processing. Emphasis is being placed on capitalizing on commercially available hardware, microsensors which integrate microelectromechanical systems (MEMS), acoustic, seismic, and RF technologies for application to the Objective Force materiel requirements. This Collaborative Technology Alliance (CTA) links a broad range of government technology agencies and industry/academia partners with ARL. The CTA will conduct innovative research focusing on three main technical areas: microsensors, electro-optic smart sensors, and advanced frequency concepts to support the Objective Force's requirement for advanced sensing technologies. In FY2001, this project establishes a new Power and Energy CTA. Starting in FY2002, the Power and Energy CTA will be funded in 61104/J09. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 6574 - Integrated single-band target detection and chipping algorithm into microsensor computing architecture for improved battlefield situational awareness.

- Completed moving target indicator algorithm and transitioned to Program Manager-Night Vision/Reconnaissance, Surveillance and Target Acquisition for application to the Long Range Advanced Scout Surveillance System.
- Incorporated cooperative signal processing into a network of distributed microsensors; yield improved battlefield situational awareness.

- Established capability to create dual-band Focal Plane Arrays in HgCdTe using Molecular Beam Epitaxy.
- Completed millimeter wave clutter database.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
**0601104A - University and Industry Research
Centers**PROJECT
H54**FY 2001 Accomplishments: (Continued)**

- 2000 - Established new Sensors CTA with three main technical areas: Microsensors, Electro-Optic Smart Sensors, and Advanced Radar Frequency Concepts.
- 1000 - Established a new Power and Energy CTA with three main technical areas: Portable Compact Power Sources (non-electrochemical), Fuel Cells and Fuel Reforming, and Hybrid Electric Propulsion and Power. (Starting in FY02, the Power and Energy CTA Planned Program is funded in 61104/J09.)

Total 9574

FY 2002 Planned Program

- 6084 - Execute first full year of new CTA with three main technical areas: microsensors, electro-optic smart sensors and advanced radar frequency concepts.
 - Investigate target and background phenomenology and modeling.
 - Investigate advanced materials and devices.
 - Investigate novel architectures and sensor fusion.
 - Investigate signal and image processing techniques and architectures.
 - Investigate automatic target recognition.

Total 6084

FY 2003 Planned Program

- 6306 - Execute CTA with three main technical areas: microsensors, electro-optic smart sensors and advanced radar frequency concepts.
 - Devise and adapt specific milestones/deliverables for the Cooperative Agreement after the competitive award is made.

Total 6306

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601104A - University and Industry Research Centers	PROJECT H56					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H56 ADV DECISION ARCH COLLAB TECH ALLIANCE (CTA)	5724	6020	6168	6274	6382	6901	7382

A. Mission Description and Budget Item Justification: This project supports a new consortium, a competitively awarded Collaborative Technology Alliance (CTA) which begins in FY2002. This CTA, which links a broad range of government technology agencies and industry/academia partners with ARL, conducts innovative research to support the Objective Force's requirement for state-of-the-art information technology applications for responsive situational awareness, distributed commander-staff-subordinate collaboration, and planning and execution monitoring in a high tempo, high stress environment. This CTA continues the information control and data visualization efforts begun under the prior Federated Laboratory university/industry consortium formed to provide solutions for the many requirements for information assimilation on the battlefield. The Federated Laboratory contract ended in FY2001. The technical barriers associated with this project are: human-computer interface in an information rich environment; display configuration; real time visualization; architecture; information presentation; and control coupling. The approach to overcoming the technical barriers is outlined in a planned program beginning in FY2002. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 5724 - Finalized the Integrated Support Laboratory (ISL) architecture and transitioned package to CECOM and Battle Labs at Ft. Leavenworth and Ft. Huachuca.
- Provided algorithms using wavelets and fractals for embedded coding of image/video to the Agile Commander ATD LAN.
- Incorporated talking and gesturing avatars into collaborative planning and execution scenarios to the Agile Commander ATD LAN.
- Extended the FOX-RAVEN-OWL-CORAVEN-ACAD-CADET paradigm to include collaborative planning within the intelligence arena.
- Provided a commander/staff model capable of conducting cognitive engineering of Army command and control interfaces; created a model of opposing force commanders to direct other State operator and results (SOAR)-controlled unit entities.
- Began investigating technologies to enable commanders to tailor C2 systems to support their individual cognitive processes. Work will be completed in 1Q FY2002.
- Researched intelligent systems that provide an enabled understanding of information needs for situation and tasks and integrated into CORAVEN.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H56

FY 2001 Accomplishments: (Continued)

- Established a new cooperative agreement with Collaborative Technology Alliance in Advanced Decision Architectures. Contract was awarded in May 2001.

Total 5724

FY 2002 Planned Program

- 6020 - Identify key decision parameters that predominate in field settings, develop cognitive architectures to extend the methods and techniques of computational models, prepare decision centered design principles based on cognitive systems engineering and naturalistic decision making.
 - Create models of expert decision making from cognitive task analysis of distributed tactical operations.
 - Create tools to facilitate multi-modal communication and user adaptable interfaces.
 - Prepare prototype architectures to accommodate adaptive interface agents, mediating representations for context-sensitive information presentation, data fusion and information integration to combine uncertainty for intermediate abstractions.

Total 6020

FY 2003 Planned Program

- 6168 - Complete prototype integration of cognitive computational models as decision aids to support command decision-making.
 - Identify level and scope of user-state model fidelity to predict different aspects of user state.
 - Complete concept evaluation on measuring situation awareness to determine readiness for operations and analytical tools for collaborative evaluation and planning.
 - Identify auto-adaptive architectures that provide high situation awareness, low workload, mode awareness and user trust for inclusion in the decision integration testbed.

Total 6168

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601104A - University and Industry Research Centers	PROJECT H59					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H59 UNIV CENTERS OF EXCEL	2166	19229	11977	11954	11937	7042	7077

A. Mission Description and Budget Item Justification: Army Centers of Excellence couple state-of-the-art research programs with broad-based graduate education programs at academic institutions with the goal of increasing the supply of scientists and engineers in Army high priority areas. The Army Centers have significant collaborative participation by Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) and all future Army Centers will be formed in partnerships with an HBCU/MI. Army Centers supported within this project are currently active in the field of rotary wing technology.. Beginning in FY2002, this project will focus on Army Rotorcraft Centers of Excellence, nanoscience, image science, and science, mathematics and engineering (SME) education. This project supports the Objective Force and Joint Vision 2020 by providing research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles and the Objective Force Warrior. Industry is encouraged to actively support Army Centers of Excellence and the University Affiliated Research Center in nanoscience to leverage and synergize the investment in these collaborative efforts. In FY02, this project establishes the Institute for Soldier Nanotechnologies. A single university will host this institute, which will emphasize revolutionary materials research toward advanced soldier protection and survivability capabilities. This program will transition to 61104/J12 starting in FY03. The project also supports the Objective Force through the sponsorship of a nation-wide education competition that encourages the nation's youth to pursue advanced education and careers in SME thereby providing a pool of technologically trained soldiers and civilians for the Army workforce of tomorrow. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2166 - Investigated rotor aerodynamics and acoustics during maneuvering flights.
- Investigated passive and active noise reduction concepts for blade-vortex interactions.
- Investigated adaptive driveshafts/struts for noise and vibration reduction, and damage mitigation.
- Established alleviation concepts of aeromechanical stability and whirl flutter through blade-embedded elastomeric tuned dampers for lag damping and Shape Memory Alloy (SMA)-based passive wing damping.
- Investigated high flexibility rotorcraft driveshafts using flexible matrix composites and active bearing controls.
- Established simulation and controls of helicopter shipboard launch and recovery operations.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H59

FY 2001 Accomplishments: (Continued)

- Investigated theory and analysis of the behavior of deformable airfoils in rotor control applications.
- Conducted damage tolerance analysis of stiffened composites and rotor hubs.
- Established neural network based adaptive flight control concepts.

Total 2166

FY 2002 Planned Program

- 1968 - Investigate vibration mechanisms and establish reduction concepts in level and maneuvering flight.
 - Investigate transmission design for robust diagnostics and prognostics.
 - Establish carefree maneuvering control laws for rotorcraft.
 - Investigate deformable wake dynamics for maneuvering flight simulation.
 - Investigate warping actuation of rotor blades by using active materials.
 - Investigate data fusion and biomimetic materials for rotorcraft health monitoring systems.
 - Establish advanced analysis, design and experimental testing capabilities of hybrid active-passive rotor systems for vibration reduction and performance enhancement.
- 9825 - Establish University Affiliated Research Center focusing on application of nanoscience to enhance Objective Force Warrior survivability through nanotechnology-based materials and devices.
- 2479 - Accelerate image science research to develop algorithms for cluttered, highly dynamic scenes to improve real-time robotic perception.
 - Investigate artificial intelligence based algorithms to enable adaptive tactical behaviors in diverse, complex environments.
- 4957 - Complete concept for Army Competition in Education and develop education testing package.
 - Conduct regional beta test of the web-based game challenge and launch Army Competition in Education Program.

Total 19229

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H59

FY 2003 Planned Program

- 3389 - Establish semi-active damping control concepts of rotor systems.
- Investigate adaptive control concepts of helicopter vibrations with self-contained active-passive hybrid actuators optimally distributed in the airframe.

- Investigate passive and semi-active reduction technologies of gearbox vibration and noise.
- Conduct studies of advanced flight control systems.
- Investigate elastically tailored smart composite rotor blade concepts.
- 8588 - Establish an Army center for research in biotechnology to harness the enormous new opportunities that exist between the biological and non-biological sciences. Scientific investigations have been identified initially in the following areas: - Novel biocomputation approaches to information processing, using information content of macromolecules and their interactions. - Self-assembly processes for molecular manufacture of ultra-high density EMO materials. - Photodynamic protein-based molecular memory for rapid and accurate information processing and storage. - Biologically derived and biologically inspired synthesis and processing for enhanced performance materials properties.

Total 11977

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601104A - University and Industry Research Centers	PROJECT H62					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H62 ELECTROMECH/HYPER PHYS	9434	7911	7948	7923	7942	8347	8680

A. Mission Description and Budget Item Justification: This project funds electromechanics and hypervelocity physics Army basic research relating to electromechanical components (electromagnetic launchers and power supplies) for applications to electromagnetic (EM) guns. Additionally, this project provides for research, testing and computer modeling of advanced hypervelocity projectiles. This project funds a University Affiliated Research Center, the Institute for Advanced Technology (IAT), at the University of Texas. In keeping with the Army EM Armaments Program strategy, highest emphasis has been placed on advancing the state-of-the-art in pulsed power, materials to achieve extended rail life, and on establishing the utility of hypervelocity projectiles. The sum of these focused efforts serves as a catalyst for technological innovation and provides crucial support to the Army technology base for advanced weapon systems development with applications for anti-armor, artillery, air defense, and the Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 7434 - Evaluated thermal management technology for EM pulsed power, switching, and railgun needs. Identified most promising candidates.
 - Designed and implemented laboratory launcher for technology evaluation and investigations of transition in the armature. Upgraded the pulsed forming network to be capable of 2 MJ muzzle energy compared to previous 1 MJ level.
 - Evaluated alternate EM pulsed power options. Developed a model of the EM pulsed power system and used to describe performance of pulsed alternators.
 - Evaluated material and structural components of launchers and launch packages for future field applications. Developed models of the sequence of events leading to armature transition and applied to compute launch package dynamic behavior.
 - Exploited robust EM gun penetrators.
 - Conducted research on advanced switch technology, specifically examining the magnetohydrodynamic processes in advanced vacuum gap switch concepts.
- 2000 - Advanced state-of-the-art research in pulsed power, to achieve extended rail life and to establish the utility of hypervelocity projectiles for electromagnetic guns.

Total 9434

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H62

FY 2002 Planned Program

- 7911 - Devise solutions for armature transition using the C-armature.
- Evaluate laboratory launcher and launch packages for technology evaluation.
- Conduct component trials for alternate EM pulsed power options.
- Prove advanced material and structural components of launchers and launch packages for future field applications.
- Prove robust EM gun penetrator lethality against advanced targets.
- Investigate the utility for optical triggering for advanced EM switch technology.

Total 7911

FY 2003 Planned Program

- 7948 - Investigate next generation armature transition solutions including magnetic armatures.
- Prove advanced integrated launch packages.
- Prove alternate EM pulsed power options.
- Prove muzzle shunt operation over the full range of velocities and projectiles.
- Prove robust EM gun penetrator lethality against advanced targets using the lowest energy solution.
- Validate advanced switch technology, including Silicon Carbide (SiC) and optical triggering, for EM.

Total 7948

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H64

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H64 MATERIALS CENTER	2462	2155	2267	2379	2491	2615	2774

A. Mission Description and Budget Item Justification: This project concentrates scientific resources on research to advance innovative materials technologies and exploit breakthroughs in materials science and engineering through Materials Cooperative Research Agreements (MCRAs). MCRAs promote long-term synergistic collaboration between Army Research Laboratory (ARL), Aberdeen Proving Ground, MD, scientists and university researchers. The MCRAs provide for mutual exchange of personnel and sharing of research facilities with U. Delaware, Johns Hopkins U., U. Maryland-College Park, U. Minnesota, U. Pennsylvania, Tuskegee U. and Howard U. The MCRAs focus research on armor, anti-armor, personnel protection, ground vehicle, rotorcraft and tactical missile applications. Lightweight, multi-functional composites, advanced armor ceramics, bulk amorphous metals, nanomaterials technology, and new polymer hybrid materials for flexible extremities (combat warrior) protection are emphasized. Closely coordinated with ARL in-house materials research projects (PE 0601102A, Project H42), this effort enables the effective and efficient transfer of fundamental scientific research to address requirements for the Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1962 - Devised analytical and computational models of structural response of composite armor during ballistic impact.
- Devised models relating microstructural deformation and damage in polymer composites during dynamic loading.
- Characterized high-strain-rate mechanical properties and damage accumulation mechanisms of metal/intermetallic microlaminates.
- Optimized joining processes of high performance ceramics in metal encapsulations.
- Devised electromagnetic manipulation strategies for controlling orientation in electrospinning of nanofibers, and assessed the effects of orientation on microstructure.
- 500 - Enhanced Materials Center of Excellence research ongoing at the University of Delaware (FY2001 Congressional add).

Total 2462

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
**0601104A - University and Industry Research
Centers**PROJECT
H64**FY 2002 Planned Program**

- 2155 - Devise techniques and models for controlling functionally-graded properties in thick-section composites.
- Devise models of energy dissipation mechanisms in the composite backing plate of lightweight armors during ballistic impact.
- Produce and characterize controlled macrostructure ceramic armor materials.
- Devise computer techniques to model and optimize the use of graded metal matrix composites in dynamic failure environments.
- Synthesize novel organic/inorganic hybrid materials for ultra-light weight personnel extremities protection systems.

Total 2155

FY 2003 Planned Program

- 2267 - Devise models of deformation behavior and energy dissipation in porous materials during ballistic impact.
- Improve lightweight structural armor models relating ballistic impact and penetration to dynamic structural responses.
- Devise computer simulations to predict the performance of ceramics under high-strain-rate impact loading.
- Devise integrated two and three dimensional computer codes to simulate dynamic failure in bulk amorphous metals and nanostructured metals.

- Evaluate high strain rate response of novel organic/inorganic hybrid materials and provide parameters to be used in the modeling of their performance in a ballistic environment.

Total 2267

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601104A - University and Industry Research Centers	PROJECT H73					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H73 NAT AUTO CENTER	6646	2944	3042	3080	3133	3231	3295

A. Mission Description and Budget Item Justification: The Center of Excellence for Automotive Research, established in 1994, is a key element of the basic research module of the National Automotive Center (NAC), located at the U.S. Army Tank-Automotive Research, Development, and Engineering Center (TARDEC). The Center of Excellence for Automotive Research is an innovative university/industry/government consortium leveraging commercial dual-use technology for the Army through on-going and new programs in automotive research, resulting in significant cost savings while maximizing technological achievement. The goal of this PE is to significantly enhance the Objective Force's application of advanced vehicle technologies. This transformation will be accomplished through leap ahead technologies resulting in phased improvements over the next decade. To achieve the Army vision, the Army must also be more strategically deployable and agile, with a smaller logistical footprint. In addition, lighter ground vehicle systems must be pursued that are more lethal, survivable, and tactically mobile. The selected university partners include: University of Michigan, University of Wisconsin, Wayne State University, University of Alaska, University of Tennessee, and Clemson University, while key industry partners include the major U.S. automotive manufacturers and suppliers. The 21st Century Truck Initiative will research alternate fuels, advanced propulsion, advanced materials, reduced parasitic losses, vehicle intelligence, and safety. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. In FY 2001, Congress added \$2 million for NAC university research. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2797 - Explored concepts for simulating and advancing technology in vehicle intelligence and wireless systems for future Department of Defense (DOD) and Army applications.
 - Evaluated methods for validating unique simulation environments.
- 1849 - Performed simulation based modeling and analysis in support of all areas of technology under investigation.
 - Optimized powertrains for the Army's next generation of vehicles.
 - Performed state-of-the-art trade-off analyses on concept vehicles and components.
 - Researched the current state-of-the-art in advanced sensing systems for vehicle intelligence systems.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
H73

FY 2001 Accomplishments: (Continued)

- 2000 - Congressional add was used for the modeling of ground vehicles with simulation based acquisition in support of enhancement of simulation based acquisition tools.

Total 6646

FY 2002 Planned Program

- 2944 - Formulate and mature advanced modeling and simulation strategies for the Army's Future Combat Systems (FCS) efforts.
 - Optimize the dual-need overall simulation network.
 - Model and experimentally validate advance propulsion/mobility simulation models for the Army's future fleet of vehicles.
 - Explore concepts for advancing technology of wireless vehicle intelligence systems for future DOD and Army applications.
 - Experimentally validate fully functional system model using advanced prototypes.

Total 2944

FY 2003 Planned Program

- 3042 - Advance state-of-the-art simulation and modeling for future Army automotive technologies, including FCS.
 - Complete final validation and implementation of future FCS mobility and propulsion predictive algorithms.
 - Evaluate and analyze systems for intelligent remote monitoring, guidance and control to be used for autonomous and semi-autonomous vehicles.

 - Evaluate and analyze models suitable for design decisions for collision avoidance warning systems, rollover warning, active yaw control, lane departure, and intelligent airbag systems.

Total 3042

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601104A - University and Industry Research Centers	PROJECT J08					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
J08 INSTITUTE FOR CREATIVE TECHNOLOGY	8182	6806	9463	4589	4707	4982	5225

A. Mission Description and Budget Item Justification: This project supports simulation and training technology research at the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. The ICT was established in August 1999 by DDR&E as a University Affiliated Research Center (UARC) to support Army training and readiness through research into simulation and training technology for applications such as mission rehearsal, leadership development, and distance learning. The ICT will actively engage industry (multimedia, location-based simulation, interactive gaming) to exploit dual-use technology and will serve as a means for the military to learn about, benefit from, and facilitate the transfer of applicable entertainment technologies into military systems. The ICT will also work with creative talent from the entertainment industry in order to adapt their concepts of story and character to increasing the degree of participant immersion in synthetic environments and to improve the realism and usefulness of these experiences. In return, industry will leverage DoD-sponsored research being done by the Modeling and Simulation UARC. Creating a true synthesis of the creativity, technology and capabilities of the industry and the R&D community will revolutionize military training and mission rehearsal by making it more effective in terms of cost, time, the types of experiences that can be trained or rehearsed, and the quality of the result. It will also allow the United States to maintain dominance in simulation and training technologies. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 8182 - Examined entertainment industry methods and data for their applicability to networked, realistic simulation tools for combat training.
- Published IEEE Jan 01 Article informing the community on experiential learning.
- Conducted research to understand the levels of reality/fidelity required to suspend disbelief and generate verisimilitude in virtual environments in support of the new Army Vision/Transformation.
- Continued research with the Mission Rehearsal Exercise for Virtual Human representation, speech recognition, and interactive stories.
- Investigated the use of avatars to depict locals, friendly and hostile forces and mission team members for mission rehearsal environments.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
**0601104A - University and Industry Research
Centers**PROJECT
J08**FY 2001 Accomplishments: (Continued)**

- Showcased the Virtual Human aspect of the Mission Rehearsal Exercise at the American Association for Artificial Intelligence Fall conference.
- Created advanced immersive environment utilizing sound, visual cues, motion and other sensory elements.
- Studied concepts for creating projected spaces for immersion to include emotion.

Total 8182

FY 2002 Planned Program

- 4327 - Conduct basic research in the three essential elements of immersive environments - graphics visualization, immersive 3D audio environments and algorithms, and virtual humans including non-verbal communication (e.g. gesture, gaze, emotion, facial expression).
 - Conduct research to exploit advances in computer science to explore techniques, algorithms, methods, and multi-sensory stimuli to enhance training across operational military functions.
- 2479 - Accelerate research on intelligent avatars for virtual environments to enhance realism of interactions with trainee(s) and increase training effectiveness.

Total 6806

FY 2003 Planned Program

- 4475 - Conduct research to advance virtual environments through selected multisensory techniques.
 - Investigate the balance between selective fidelity and computing environments to determine scalability and affordability of promising advances in computational geometry, signed processing for audio, and artificial intelligence approaches to interactive reasoning.
- 4988 - Advance basic research for the promising development of the Experience Learning System (ELS), a widely scaleable systems of virtual reality systems that is cross platform, networked, and completely immersive.
 - Investigate advanced visual techniques for photo realism and environmental effects like shadows for synthetic representations.
 - Research the enabling technologies in modeling, simulation, and training for the development of new paradigms in training the Transformation Force.

Total 9463

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601104A - University and Industry Research Centers	PROJECT J09					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
J09 POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	0	5978	6021	6007	5996	5991	5978

A. Mission Description and Budget Item Justification: This project supports a Collaborative Technology Alliance (CTA) in Power and Energy Technologies. The CTA is a long-term collaboration between the Army Research Laboratory (ARL) and a competitively selected industry/university consortium for the purpose of leveraging world-class research relevant to Army needs. Power and energy research supporting lightweight, compact power for the individual soldier and energy conversion and control technologies for advanced electric mobility, survivability, and lethality applications such as hybrid electric drive, electromagnetic armor, and electro-thermal-chemical gun, for fuel efficient Future Combat Systems vehicles and robotic platforms. Technical barriers include overcoming energy density limitations of traditional electrochemical portable power sources, reforming of logistics fuels to generate reformat fuel for fuel cells, and reducing the size and weight of electric power components and systems. This project was competitively awarded in FY2001. In FY2001 this program is funded in 61104/H54. The CTA focuses on three main technical areas: Portable Compact Power Sources (non-electrochemical), Fuel Cells and Fuel Reforming, and Hybrid Electric Propulsion and Power. These technologies are fundamental elements required to realize the Army Transformation and support the Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- None. FY2001 program is funded in 61104/H54.

FY 2002 Planned Program

- 5978 - Operate the electrostatic microturbine generator at high speed.
- Operate the micro gas turbine hydrogen demo engine at high speed.
- Develop PROX catalysts for RT PEM fuel cells.
- Conduct initial system modeling of a 1W planar Direct Methanol Fuel Cell system.

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

February 2002

BUDGET ACTIVITY
1 - Basic research

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

PROJECT
J09

FY 2002 Planned Program (Continued)

- Perform modeling of Si IGBT AC module.
- Investigate etch processes for SiC diodes and thyristors.

Total 5978

FY 2003 Planned Program

- 6021
 - Design and model the magnetic micro air turbine generator.
 - Design and model a hydrocarbon fueled micro gas turbine.
 - Fabricate a 1W multi-layer ceramic Direct Methanol Fuel Cell substrate.
 - Design a carbon monoxide removal reactor.
 - Perform sulfidation screening tests of sorbents and H2S absorption kinetics for logistics fuel desulfurization.
 - Investigate high temperature turbomachinery candidate materials.
 - Investigate 3-in-1 AC power modules of 1200V, 25A-100A.

Total 6021

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

February 2002

BUDGET ACTIVITY 1 - Basic research	PE NUMBER AND TITLE 0601104A - University and Industry Research Centers	PROJECT J12					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
J12 NANOTECHNOLOGY	0	0	9976	9945	9921	9904	10705

A. Mission Description and Budget Item Justification: Funding for this program was begun in FY02 in Project H59. This is a new Project initiated by the Office of the Assistant Secretary of the Army (Acquisition, Logistics and Technology) to support nanotechnology research at an as yet to be determined Institute for Soldier Nanotechnologies. A single university will host this institute, which will emphasize revolutionary materials research toward advanced soldier protection and survivability capabilities. This institute will work in close collaboration with industry, the Army's Natick Soldier Center (NSC), the Army Research Laboratory (ARL) and other Army Research Development and Engineering Centers (RDECs) in pursuit of its goals. The institute will be designated as a University Affiliated Research Center (UARC) to support the Army Objective Force Warfighter through research to develop nanometer-scale science and technology solutions for the soldier. This research will emphasize revolutionary materials research toward an advanced uniform concept. The uniform will integrate a wide range of functionality, including ballistic protection, responsive passive cooling and insulating, screening of chemical and biological agents, chameleonic color changes, biomedical monitoring, and extremities protection. The objective is to lighten the soldier's load through system integration and multifunctional devices while increasing his survivability and lethality. Computational models will be developed that predict the soldier's performance with the new technologies. The new technologies will be compatible with the other requirements, including soldier performance, limited power generation, integrated sensors, communication and display technologies, weapons systems, and expected extremes of temperature, humidity, storage lifetimes, damage and soilage. These technologies are fundamental elements required to realize the Army Transformation and support the Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

NONE

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
1 - Basic researchPE NUMBER AND TITLE
**0601104A - University and Industry Research
Centers**PROJECT
J12**FY 2002 Planned Program**

This program starts in 2002 under Project H59 by establishing the Institute for Soldier Nanotechnologies.

FY 2003 Planned Program

- 9976 - Advance materials research with the objective of developing a revolutionary soldier uniform concept
- Advance research in new computational models that predict and monitor the soldier's performance

Total 9976

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602105A - MATERIALS TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	30625	20617	18659	14215	15602	15750	17591
H7B ADVANCED MATERIALS PROCESSING	6729	6946	0	0	0	0	0
H7C AMORPHOUS METAL KINETIC ENERGY PENETRATOR	2884	0	0	0	0	0	0
H84 MATERIALS	11400	13671	18659	14215	15602	15750	17591
HM1 HARDENED MATERIALS	9612	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) provides materials technology for armor and armaments to enable US dominance in future conflicts across a full spectrum of threats in a global context. It provides the technologies essential for Army Transformation. Project AH84 is directed toward devising materials technology that will make our heavy forces lighter and more deployable, and our light forces more lethal and survivable. It provides the technology base required for solving materials-related problems in individual soldier support equipment, armor, armaments, aircraft, ground and combat vehicles and combat support. Technology for advanced materials will enable the Future Combat Systems' (FCS) and Objective Force survivability and lethality. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602105A - MATERIALS TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
President's Previous Budget (FY 2002 PB)	27304	13794	12762
Appropriated Value	27557	20794	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-177	0
b. SBIR / STTR	-523	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	3844	0	0
e. Rescissions	-253	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	5897
Current Budget Submit (FY 2003 PB)	30625	20617	18659

Change Summary Explanation:

FY03 (+5897) - Project H84 increased to accelerate development of affordable technologies for multifunctional, polymer-inorganic. hybrid nanocomposite materials to revolutionize survivability and lethality of the Objective Force Warrior and other objective force platforms; and to accelerate the testing of a prototype laser ultrasound NDE system.

FY02: Congressional adds were made for Advanced Materials Processing Center, Project H7B (\$3000); Future Combat Systems Composites Research, Project H7B (\$2500); and AAN Multifunctional Materials, Project H7B (\$2500).

Projects with no R2-A:

Project H7B:

FY02 funding = \$2500 FCS Composites Research : This one year congressional add focuses on advanced resins and fibers, thick-section mechanics, damage tolerance, processing sciences, validated design models, and predictive models for the optimal application of composite materials for FCS requirements.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002****BUDGET ACTIVITY
2 - Applied Research****PE NUMBER AND TITLE
0602105A - MATERIALS TECHNOLOGY**

Project H7B:

FY02 funding = \$1500 Army after Next Multifunctional Materials : This one year congressional focuses on the development of rigid rod polyphenylene structural materials with potential military applications.

Project H7B:

FY02 funding = \$3000 Advanced Materials Processing Program. : This one year Congressional add focuses on applied research in advanced material discovery, characterization and processing technologies for composite and metallic materials.

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602105A - MATERIALS TECHNOLOGY	PROJECT H84					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H84 MATERIALS	11400	13671	18659	14215	15602	15750	17591

A. Mission Description and Budget Item Justification: The goal of this project is to provide the technical foundation for materials technology in metals, ceramics, polymers, and composites that are essential for lethal and survivable Future Combat Systems (FCS) and other Objective Force platforms. In order to meet the challenge of the Army Vision, new systems must be significantly lighter, more deployable, and more sustainable. The barrier to this challenge is the requirement for new materials and structures solutions that offer significant weight reduction with improved performance, durability and cost reduction for application to individual soldier support equipment, armor, armaments, aircraft, ground combat vehicles, and combat support equipment. This project will address these needs through: improved physics-based material, mechanics, and structural models; high strain rate material characterization techniques; non-destructive inspection/evaluation technologies; new high strength/temperature materials and coatings; and advanced fabrication/processing methodologies. Applied research efforts are focused in armor/armament materials, as well as lightweight structural materials and materials affording protection against chemical, biological, or directed energy threats. The work is conducted at the Army Research Laboratory, Aberdeen Proving Ground, MD and Hampton, VA and provides required technologies for advanced development programs at the Armaments Research, Development and Engineering Center, Picatinny Arsenal, NJ; the Tank and Automotive Research, Development and Engineering Center, Warren, MI; the Aviation and Missile Research, Development and Engineering Center, Huntsville, AL; the Natick Soldier Center, Natick, MA; the Edgewood Chemical and Biological Center, Edgewood, MD; and the Communications and Electronics Research Development and Engineering Center, Ft. Monmouth, NJ. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 7069 - Proved reduced-cost (30%), appropriate quality composite processing technology for lightweight combat vehicles that feature integrated armor structure technologies.
- Devised structure/property relationships (enhanced barrier properties of perm-selective clothing membranes), processing methodologies (nanocomposites for ballistic protection), and advanced characterization techniques for emerging nanomaterials and multi-functional protective coatings to enable a survivable and sustainable Objective Force.
- Modeled and engineered emerging lightweight armor materials including improved titanium and advanced silicon carbide ceramics and encapsulated ceramic armor structures to improve penetration resistance and minimize collateral damage in future lightweight combat vehicles.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602105A - MATERIALS TECHNOLOGY

PROJECT
H84

FY 2001 Accomplishments: (Continued)

- 3590 - Devised physics-based models to predict back face deformation and blunt trauma and performed ballistic evaluation experiments to characterize the failure mechanisms of personnel protective armor materials to ballistic impact of emerging threats.

- Optimized physics-based models of propellant interactions with gun bore surface and transitioned thermo-chemical erosion modeling package to the Armaments Research, Development and Engineering Center for design of improved wear-resistant gun tubes for Advanced Technology Demonstration Program.

- Provided thin film phase shifter materials with high tunability and temperature stability properties comparable to bulk materials that will significantly reduce the cost and weight of future antenna systems under development at the US Army Communications and Electronics Command.
- 741 - Validated mechanical/thermal models and characterized mechanical/thermal fatigue properties of continuous fiber metal matrix composites (MMC) for application to future lightweight munitions and gun tubes.

- Devised and proved out advanced laser ultrasonics, microwave, and thermal Non Destructive Evaluation technologies for thick multi-layered structures in support of FCS; investigated and applied sensor technologies to assess fatigue behavior in metallic and composite structures for life extension; and experimentally characterized high-speed, ground vehicle tire and TACOM 5-ton truck tire to provide modeling and simulation input parameters for improved tire designs (technology transferred to TACOM).

Total 11400

FY 2002 Planned Program

- 7415 - Provide improved process for affordably and reliably infusing composite and multi-functional materials to produce low cost, large-scale sections for FCS and Objective Force platforms.

- Design and synthesize novel nano-structured materials and multi-functional coatings to provide improved protection and sustainability for the Objective Force.

- Validate penetration and structural simulations and integrate emerging materials technology (lightweight metals, ceramics, ceramic laminates, composites, and energetic materials) with novel defeat mechanisms for FCS armors and survivability concepts.

- Investigate novel lightweight armor materials and processing techniques and refine physics-based models to improve the performance of ballistic protection for the future lightweight warrior.
- 3459 - Devise improved models, characterization techniques, and processing technologies to enable the design and synthesis of improved penetrator/warhead materials for future munitions.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602105A - MATERIALS TECHNOLOGY

PROJECT
H84

FY 2002 Planned Program (Continued)

- Evaluate electro-ceramic materials for discrete and integrated microwave applications including fire control radar, smart munitions, and point-to-point communications.
- Optimize mechanical characterization techniques, modeling and simulation design tools, and processing capability for continuous fiber MMCs for FCS armament/ammunition applications.
- 814 - Evaluate a prototype laser ultrasonic NDE concept that uses low energy, low cost pulsed laser diodes for improved detection; establish database of microwave measurements to improve damage assessment in Army composite structures; extend fatigue sensor to enhance measurement of fatigue life expended in ground vehicle dynamic components; and investigate alternative control algorithms for a Fuzzy Logic Controller for an active vehicle suspension to enhance performance and response.
- 1983 - Explore novel methodologies for the integration of nanomaterials technologies, and emerging concepts from the Institute for Soldier Nanotechnologies University Affiliated Research Center, to enable the design and development of future ultralightweight, multifunctional personnel protective system(s) for the Objective Force Warrior.

Total 13671

FY 2003 Planned Program

- 8525 - Optimize lightweight armor materials, structures, and modeling and simulation tools for transition to FCS vehicle designers.
- Employ advanced models and processing techniques to optimize performance of promising nano-structured materials and multi-functional coatings to provide improved protection and sustainability for the Objective Force.
- Provide novel lightweight materials and physics-based design tools to development community for integration into future lightweight warrior protective systems.
- 3826 - Synthesize candidate penetrator/warhead alloys, evaluate ballistic performance against threat armors, and transition promising concepts to ammunition designers and Army Manufacturing Technology (MANTECH) Program.
- Optimize and transition electro-ceramic materials and processing techniques to CECOM for integration into advanced antennas for FCS.
- Design, produce, and characterize prototype gun tube or projectile shell and transition design tools/prototype to armament/ammunition designers for application to FCS.
- 899 - Conduct field experiments on a prototype laser ultrasonic NDE system; prototype microwave measurement instrument for NDE assessment of large area composite structures; conduct validation experiments of fatigue sensors on selected rotorcraft and ground vehicle dynamic components; and test advanced algorithms for the fuzzy logic controller of an active vehicle suspension.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602105A - MATERIALS TECHNOLOGYPROJECT
H84**FY 2003 Planned Program (Continued)**

- 5409 - Optimize physical-mechanical properties, improve predictive models, and develop affordable synthesis/processing technologies to facilitate development of multifunctional, polymer-inorganic hybrid nanocomposite materials to revolutionize survivability and lethality of the Objective Force Warrior and other Objective Force platforms.
- Explore and discover nano intelligent materials, which incorporate emerging nano and bio technologies, to enable protection of Objective Force Warrior and Objective Force Platforms from non-traditional threats posed during asymmetric confrontations.

Total 18659

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	22662	31934	24305	24624	25834	26756	27386
140 HI-POWER MICROWAVE TEC	2655	2746	3111	3248	3866	4062	4154
142 PASSIVE MMW CAMERA	2404	2084	0	0	0	0	0
H15 GROUND COMBAT ID TECH	3346	7996	3648	3878	4056	4185	4268
H16 S3I TECHNOLOGY	14257	16608	17546	17498	17912	18509	18964
SA1 ADVANCED SENSORS AND OBSCURANTS	0	2500	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program is to enhance the capabilities of the Future Combat Systems (FCS) and the Objective Force by: (1) providing sensor, signal and information processing technology for advanced reconnaissance, surveillance, and target acquisition (RSTA), ground-to-ground and air-to-ground combat identification (ID), and fire control systems, as well as the fuzing and guidance-integrated fuzing functions in future munitions; and (2) significantly improving the survivability, lethality, deployability, and sustainability of FCS by devising high-power electronic components and technologies for compact, light-weight power and energy storage, conversion and conditioning, and radio frequency (RF)/microwave directed energy (RF-DE) weapons. Critical technologies to be addressed to increase the combat effectiveness of tactical Army forces include: (1) high power, solid-state/vacuum, power/RF component technology; (2) combat identification technology; (3) sensors, signatures, signal and information processing (S3I) technology. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Force Modernization Plan, and Project Reliance. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	23008	25797	22011
Appropriated Value	23222	32197	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-263	0
b. SBIR / STTR	-346	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-214	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	2294
Current Budget Submit (FY 2003 PB)	22662	31934	24305

Change Summary Explanation:

FY03 (+\$2294) was added to project H16 to address sensor cueing issues for a distributed sensor network, enhance the ability of an ultra-wideband radar to detect concealed objects, and to establish a baseline hyperspectral target detection algorithm.

FY02 - Congressional adds were received for Passive Millimeter Wave Camera, Project 142 (\$2100); S3I Technology Project, Project H16 (\$1800); and Advanced Sensors and Obscurants, Project SA1 (\$2500).

Projects with no R2-A:

Project 142

- FY02 funding = \$2100 Passive Millimeter Wave Camera : This one year Congressional add is for applied research to complete the fabrication and perform field testing of a new and improved version of the camera that will be lightweight, low-cost, and flightworthy. No additional funding is necessary to complete this project.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

Project SA1

- FY02 funding = \$2500 Advanced Sensors and Obscurants : This one year Congressional add is for applied research into the development of integrated multispectral and advanced designer obscurants and dissemination methods. No additional funding is necessary to complete this project.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

PROJECT
140

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
140 HI-POWER MICROWAVE TEC	2655	2746	3111	3248	3866	4062	4154

A. Mission Description and Budget Item Justification: The objective of this project is to significantly improve the survivability, lethality, deployability, and sustainability of Future Combat Systems (FCS) and the Army's Objective Force by devising high-power electronic components and technologies for compact, lightweight power and energy storage, conversion and conditioning. Current technical barriers result in excessive size and weight requirements for these components and systems. Matching potential FCS radio frequency (RF)/microwave directed energy (RF-DE) and high energy laser (HEL) weapons and other electric power loads such as electromagnetic gun, electromagnetic (EM) armor and electric drive to the FCS electric power sources will be improved with the advances in this project. This program is coordinated and, when appropriate, leveraged with directed energy (both RF and laser) and power programs in the Air Force, Navy, Defense Special Weapons Agency, National Labs, university Consortia and relevant industry and foreign partners. The emphasis of this project is being focused to more effectively support the Army Transformation, by concentrating on the critical path technology of power components common to all Directed Energy Weapons (DEW) and hybrid electric propulsion systems. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2655 - Successfully drove a 15-hp 3-phase induction motor load with the 10-kW class matrix converter. Power levels up to 5 kVA have been achieved, and 10 kVA is anticipated in the near future, demonstrating the feasibility for AC motor drive applications in future Army combat systems.
- Assembly of a 100kW class matrix converter prototype is nearing completion. Initial laboratory operation is expected before the end of CY01.
- Characterized power conditioning topologies (modulators) for FCS applications, such as EM armor and DEWs.
- Determined characteristics of advanced energy storage techniques, such as modeling the Marx-Generator configured, lithium-ion battery.
- Created initial design parameters for RF-Agile Target Effects System (RF-ATES) breadboard system and surveyed/assessed existing and planned transmitters/antenna technology to determine applicability. RF-ATES will enhance survivability/lethality of FCS and suppressing/defeating close-in threats.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602120A - Sensors and Electronic SurvivabilityPROJECT
140**FY 2001 Accomplishments: (Continued)**

- Modeled electro-mechanical behavior of the linear diesel alternator with SPICE to allow modeling confirmation with University of West Virginia DEPCOR program for evaluation hybrid power system design and optimization (includes model of diesel engine and alternator).

Total 2655

FY 2002 Planned Program

- 2746 - Operate the 100-kW matrix converter in a laboratory breadboard environment.
 - Evaluate alternatives for solid-state switch-based power conditioning topologies for EM armor.
 - Evaluate advanced energy storage techniques - construct Marx-battery breadboard.
 - Investigate effectiveness of DEW candidates on ATEs targets and finalize RF-ATES requirements.
 - Confirm linear diesel alternator model with experiments at University of West Virginia (DEPCOR program) and use simulation to optimize design and determine suitability for FCS-HEV platforms (first order platform approximation, simple load).

Total 2746

FY 2003 Planned Program

- 3111 - Operate a 100-kW matrix converter in a relevant environment driving an electric drive traction motor such as those needed for FCS applications
 - Finalize design of RF-ATES breadboard and research and acquire/develop sub-system.
 - Prototype a 100-kW class matrix converter using high temperature/high power silicon carbide switches for traction motor drive applications.
 - Evaluate advanced energy storage techniques - construct brass board of Marx-battery system.
 - Link linear diesel alternator model to model of matrix converter and mockup of HEV power conditioning system and load to determine suitability of linear diesel alternator for a realistic FCS-HEV platform (complex load approximation).

Total 3111

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602120A - Sensors and Electronic Survivability	PROJECT H15					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H15 GROUND COMBAT ID TECH	3346	7996	3648	3878	4056	4185	4268

A. Mission Description and Budget Item Justification: The objective is to develop and demonstrate emergent combat identification (CID) systems for air-to-ground and ground-to-ground (mounted, dismounted, forward observer and forward air controller) mission areas for the Objective Force in support of Joint, Allied and Coalition operations (i.e. US, UK, France, Germany, Canada, and Australia). This program provides the technologies necessary for the Coalition Combat Identification Advanced Concept Technology Demonstration. The program provides maturation of the enabling technologies necessary to set the baseline for the objective force to enable fratricide reductions through Combat Identification (CI) concepts for Joint, Allied and Coalition operations. The hardware and software improvements and modeling and simulation (M&S) advances provided by this program are essential for linkage to the Objective Force as we progress to the transformation of the Army. This program expands and builds upon the increased lethality for the Objective Force due to greater capability to identify friend from foe and minimize fratricide incidents across the battlefield. CI must be software functional, portable across a family of platforms, tied to the future tactical internet, over-the-horizon capable and highly resistant to countermeasures. The Objective Force CI capability will fuse situational awareness (SA) and Point-of-Engagement target Identification into a common through sight picture. The future CI architecture will necessitate the integration of a network composed of diverse reconnaissance, surveillance and target acquisition (RSTA) sensors that include non-cooperative capabilities in the sensor suites and a cooperative ID capability that will be realized as part of the future real-time SA. Coordination will be accomplished with other services, allies and coalition partners. MANPRINT will be addressed in all activities. Future CI will operate with the Objective Warrior System providing a seamless boundary with vehicle CI. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), The Army Modernization Plan, and Project Reliance. The program element contains no duplication with any efforts within the Military Departments. Work is performed by various contractors and the Communications Electronics Command (CECOM). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3346 - Characterized Ground Integration Target Identification System technical and operational performance.
- Completed investigation of Combat Identification (CI) solution for helicopters and execute the design.
- Completed CI Architecture Study.
- Completed evaluation of lightweight CI transponder system for helicopters.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

PROJECT
H15

FY 2001 Accomplishments: (Continued)

- Evaluated low cost, high efficiency antenna.
- Characterized technical performance of CI for Apache-Longbow.
- Studied CI solution for vehicle -to-soldier application.
- Established program to implement North Atlantic Treaty Organization (NATO) Battlefield Target ID (BTID) Waveform per Standardization Agreement (STANAG) 4579.
- Determined Radio Based Combat D feasibility for Allied radios.

Total 3346

FY 2002 Planned Program

- 7996 - Implement advanced CI concepts for airborne applications as part of the Coalition Combat Id (CCID) ACTD.
 - Evaluate several software gateways to establish a coalition SA Network.
 - Continue implementation of STANAG 4579 waveform.
 - Conduct Radio Frequency (RF) Tags study.
 - Support development of STANAG for individual soldier application.
 - Perform virtual model development for experiments of all systems participating in CCID ACTD.

Total 7996

FY 2003 Planned Program

- 3648 - Demonstrate advanced CI concepts for airborne applications as part of the CCID ACTD.
 - Continue implementation of SA gateway.
 - Transition implementation of STANAG 4579 to PM CI.
 - Perform platform integration of BTID, RBCI, and Enhanced Position Location Reporting System (EPLRS) systems and characterize system performance.
 - Support development of STANAG for RBCI waveform.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

PROJECT
H15

FY 2003 Planned Program (Continued)

- Continue development of STANAG for individual soldier application.

Total 3648

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602120A - Sensors and Electronic Survivability	PROJECT H16					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H16 S3I TECHNOLOGY	14257	16608	17546	17498	17912	18509	18964

A. Mission Description and Budget Item Justification: This project is focused on advanced sensor, signal processing and information technologies to provide the Future Combat Systems (FCS) and the Objective Force with decisive new capabilities to locate, identify, and engage battlefield targets. The ultimate utility of this work will be to protect our soldiers and to increase their lethality and range and speed of engagement. Emphasis is placed on solving critical Army -specific battlefield sensing and information management problems such as dealing with false target situations, complex terrain, movement of sensors on military vehicles, etc. Cost reduction is a key concern. Care is taken to insure that this work is coordinated with outside organizations, particularly the RDEC's and DARPA. Significant areas of research include the following: (1) Low cost sensors designed to be employed in large numbers as unattended ground sensors or sensors for smart munitions. Research into acoustic, seismic, magnetic, and radar sensors is being conducted. Technical barriers include low-power sensors and electronics, small-long-life batteries, autonomous reconfigurable networks, and sensor fusion to maximize the performance of a collection of relatively low performance sensors. (2) Low cost acoustic sensors that can passively detect and track battlefield targets such as tanks, helicopters, etc. and detect and locate gun fire. Technical barriers include algorithms to handle multi-path and reduce false alarm rates. Work to monitor the health of soldiers is also being explored. (3) Sensors and supporting technologies for smart munitions using GPS for guidance or tracking. Technical barriers include high-g electronics. (4) High performance multi-function radio frequency (RF) systems which allow target acquisition, combat identification, active protection, surveillance, and communications systems to consolidated into a single system, reducing system cost and size. Technical barriers include maintaining performance of each function in the combined system. (5) High performance passive and active RF sensors capable of high resolution imaging to detect targets hidden in foliage, smoke and fog. Ultra wideband radar work will enable buried mine detection and target imaging through dense foliage. Technical barriers include real-time signal processing and false alarm rate. (6) Aided/automatic target recognition (ATR) to allow sensors to autonomously or semi-autonomously locate and identify battlefield targets. This research will minimize the workload on the soldier while in combat to find and identify targets using laser radar (LADAR), multi-band infrared cameras, and hyperspectral imagers. Technical barriers include acquisition of large data sets to train and validate ATR algorithms. (7) Optoelectronic (OE) interconnects and processors are being built which will greatly speed the movement of information within and between electronic digital processing units to facilitate smart sensors, adaptive sensors, and sensor fusion for situation awareness, survivability, and lethality. Sensor processing, analysis, and displays will provide soldiers with clearer, higher resolution images from their targeting systems. (8) Advanced battlefield sensor and information processing to conduct a dynamic and real time situation assessment to present a common picture of the battlespace to commanders. Technical barriers include fusion of data from dissimilar sensors, coherent display of complex information, and human factors. (9) Advanced information processing methods to provide automatic information technologies to enable commanders to utilize widely dispersed sensor and legacy information sources. Technical barriers include development of autonomous reconfigurable networks. This work supports the following Army Programs: Future Combat Systems (FCS), Objective Force, Multi-Function Starting Sensors Suite (MFS3), Warrior Extended Battlespace Sensors (WEBS), Smart Sensor Webs, Anti-Personnel Landmine Alternatives (APL-A), Precision Guided Mortar Munition (PGMM), Third Generation forward-looking infrared (FLIR), Full Spectrum Active Protection, and Quicklook.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

PROJECT
H16

The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3005 - Delivered and evaluated first generation reconfigurable signal processor for unattended ground sensor applications.
 - Conducted field experiment with CECOM-NVESD on acoustic, seismic, magnetic, infrared imager nodes.
 - Evaluated sensor fusion options for unattended ground sensors so enemy threats can be identified before they see our troops.
- 1176 - Showed distributed networked acoustic sensors in support of STO.
 - Designed, built and evaluated optimized physiological monitoring sensors with remote wireless capability in select operating environments so the soldier's health can be monitored remotely.
- 735 - Developed first iteration of a distributed sensor network simulation capable of modeling the detection of moving targets.
 - Provided GPS targeting expertise and support to ARDEC Quicklook program.
- 2434 - Produced simulated synthetic aperture radar images using an imaging geometry consistent with a ground vehicle.
 - Used the ARL HPC to compute the signatures of 2 vehicles at UHF and VHF frequencies.
 - Collected fully polarimetric signatures of an M-60 tank, asphalt runway, grass and a treeline were collected to allow analysis of polarimetric characteristics for improved target detection in clutter.
 - Achieved real-time, high precision tracking of kinetic energy penetrator in range and velocity.
- 1308 - Built and tested a low cost vertically scanned 35 GHz antenna.
 - Completed control hardware and software for vertically scanned antenna.
 - Designed flexible architecture for data acquisition, timing and control, and signal processing for multi-function RF testbed based on field programmable gate array technology.
- 977 - Conducted phenomenological studies of hyperspectral data to assess the minimum number of bands to achieve high discrimination performance at an affordable cost for land warfare systems. In parallel, investigated algorithms that can perform simultaneous compression and detection on hyperspectral data, to reduce bandwidth requirements so the data can be processed on the vehicle or transmitted with minimal bandwidth.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

PROJECT
H16

FY 2001 Accomplishments: (Continued)

- Recommended preferred operating wavelengths for broadband imagers, based on experiments using measured phenomena. Delivered preliminary algorithms for processing such data to enhance target detection.
- Conducted studies with stabilization and moving-target indicator (MTI) algorithms using relevant data. Delivered preliminary codes to AMCOM.
- 2113 - Incorporated improved high-data-rate (1GHz) VCSEL/CMOS link into real time optoelectronic transfer of image frames with some CMOS image processing included.
- Conducted joint measurements with AMCOM of improved VCSEL/CMOS processor in missile processor architecture.
- Designed full color electroluminescent devices using single host.
- Characterized engineered limiter materials in best optical designs.
- 1996 - Transitioned an agent-based approach for mediation with legacy software subsystems to improve the commander's ability to synchronize manned and unmanned sensor assets in a lightweight FCS force. This research/technology is on the transition path for CECOM's Agile Commander STO.
- Transitioned enhanced gesture and natural language based control of software components that improve the commander's ability to recognize patterns and trends through the use of intuitive visualization techniques and operate "hands free". This research/technology is on the transition path for CECOM's Agile Commander STO.
- 513 - Next- Generation Autonomous Vehicle Navigation Control System (AUTOVAV) (Partner: Germany): Design of an advanced autonomous vehicle navigation control system. Completed sub-system tests of obstacle detection, classification, and avoidance technologies.

Total 14257

FY 2002 Planned Program

- 3537 - Complete and evaluate second generation reconfigurable processor for unattended ground sensors.
- Evaluate multi-sensor nodes systems against real targets along with CECOM-NVESD and transition all WEBS technologies to follow-on advanced technology demonstration (ATD).
- 1457 - Study performance of three-axis seismic sensors for direction finding and fuse data output with acoustic sensors.
- Implement efficient algorithms for target recognition for WEBS low power unattended ground sensor application.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602120A - Sensors and Electronic Survivability

PROJECT
H16

FY 2002 Planned Program (Continued)

- Prove out high-resolution beam forming algorithms for long-range infrasonic detection.
- Develop sensor error estimates for ammunition suite.
- Complete RF forward imaging experiments for robotic vehicle sensors and generate synthetic aperture radar (SAR) images from measured data.
- Generate improved tactical target detection algorithm for foliage-penetrating (FOPEN) radar.
 - Model polarimetric target and clutter signatures for passive and active MMW sensors for pilot situation awareness.
 - Integrate radar with IR angle tracker and demonstrate real-time engagement of KE penetrator.
 - Explore innovative concepts in long-wavelength and high-bandwidth VCSELs for VCSEL/CMOS interconnects and processing.
- Complete building of multi-function RF testbed.
 - Implement timing and control hardware and software to conduct both communications and radar functions in a programmable configuration.
- Investigate improvement in material classification/target identification algorithms through the use of adaptable hyperspectral algorithms that adjust to environmental variation in signatures.
 - Conduct feature studies of 3-5 micron and 8-12 micron imagery to determine advantages of dual band features.
 - Investigate registration techniques, image differencing, and change detection strategies for target acquisition.
- Apply VCSEL/CMOS links to unorthodox digital processing architectures for improved processing of images and other sensor data.
- Integrate software components from Advanced Battlefield Processing Technology STO to improve information access and operator focus of attention, enabling the warfighter to operate within the enemy's decision cycle.
 - Significantly improve tactical knowledge management through intelligent agent based applications and information portals; intelligent systems will acquire and reason on data related to terrain, weather, force distribution, etc. from local and reach back sensors and sources presenting the information from these disparate sources without distorting the spatial and temporal properties of the information.

Total 16608

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602120A - Sensors and Electronic SurvivabilityPROJECT
H16**FY 2003 Planned Program**

- 2167 - Complete and evaluate third generation reconfigurable processor for unattended ground sensors which includes communications and sensor functions.
 - Evaluate multi-sensor nodes against real targets along with CECOM-NVESD and Dismounted Battlespace Battle Lab as part of the WEBS STO completion.
- 1825 - Refine integrated acoustic and seismic sensor output and apply advanced algorithms for target recognition and localization in support of DTO.
 - Validate acoustic battlefield decision aid model using signature database and advanced detection and recognition algorithms.
- 498 - Develop capability to address sensor cueing issues in the distributed sensor network simulation.
- 3863 - Show ability of ultra-wideband radar sensor to detect obstacles concealed by foliage for robotic applications.
 - Assess foreign demonstrator radar and address user defined shortcomings.
 - Evaluate fully polarimetric passive MMW imagery to assess helicopter obstacle avoidance in fog and clouds.
 - Integrate Electronically Scanned Antenna with 35 GHz Active Protection Radar.
- 1557 - Perform communications and radar functions on multi-function RF testbed hardware.
 - Show cost vs. performance trade-offs on Multi-Function RF concept.
- 945 - Establish baseline hyperspectral target detection algorithm using joint spatial and spectral information.
 - Establish baseline technique(s) for MTI using relevant imagery data from unattended ground sensor imagers.
 - Create algorithm to simultaneously exploit 3-5 & 8-12 micron dual wavelength FLIR imagery and evaluate the resulting performance improvement.
- 3219 - Transition VCSEL/CMOS digital processor technology to AMCOM.
 - Apply VCSEL/CMOS optoelectronic digital processing approach to the ATR problem.
- 2611 - Significantly improve tactical knowledge management through intelligent agent based applications and information portals. Intelligent systems will acquire and reason on data related to terrain, weather, force distribution, etc. in background and through reach-back to more capable information sources in order to scale and present the information from these disparate sources without distorting the spatial and temporal properties.
- 861 - Funds reprogrammed for ARL lab management support.

Total 17546

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602211A - AVIATION TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	30216	43859	43692	34857	34792	36368	37167
47A AERON & ACFT WPNS TECH	26688	40211	39453	30517	30357	31674	32363
47B VEH PROP & STRUCT TECH	3528	3648	4239	4340	4435	4694	4804

A. Mission Description and Budget Item Justification: The Aviation Technology program element (PE) conducts applied research and expands scientific knowledge in the area of manned and unmanned rotary wing vehicle (RWV) technologies in support of the Objective Force and Joint Vision 2020. Based on the Army transformation, this PE has been refocused to investigate technologies applicable to unmanned systems and supports selected opportunities for manned systems. Unmanned rotary wing vehicles bring unprecedented agility, maneuverability, and lethality to the Objective Force while providing reduced signature and logistics. Emphasis will be placed on developing unmanned combat, reconnaissance, and communications relay capability. Technologies will be investigated that enable the autonomous flight, higher aerodynamic airframe loads, and increased maneuverability than possible with unmanned aerial vehicles. These technologies also will be assessed for their ability to support the long-term sustainability and reduced logistics required of Objective Force airframes. This PE also supports the National Rotorcraft Technology Center (NRTC), a partnership of government, industry and academia, and adds as a major focus to develop organic air vehicles designs and other unmanned rotorcraft technologies. Efforts under this PE transition to projects supported by PE 0603003A (Aviation - Advanced Technology). Upgrade activities of DoD systems such as the RAH-66 Comanche, AH-64 Apache, UH-60 Black Hawk, Navy SH-60 Seahawk and USMC AH-1 Cobra are included in this PE. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance for which the Army is the lead service for the maturation of rotorcraft science and technology. The program element contains no duplication with any effort within the Military Departments. Work in this PE is performed by the Aviation and Missile Research, Development and Engineering Center, Redstone Arsenal, AL and the Army Research Laboratory, Adelphi, MD. This PE supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602211A - AVIATION TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	30794	49265	31564
Appropriated Value	31080	44265	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-406	0
b. SBIR / STTR	-417	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-447	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	12128
Current Budget Submit (FY 2003 PB)	30216	43859	43692

Change Summary Explanation:

FY 02: Congressional decrement of \$5 million to fund National Aeronautics and Space Administration shortfall.

FY 03: Program growth to support investigation into the Unmanned Armed Combat Rotorcraft (UCAR).

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A - AVIATION TECHNOLOGY	PROJECT 47A					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
47A AERON & ACFT WPNS TECH	26688	40211	39453	30517	30357	31674	32363

A. Mission Description and Budget Item Justification: The Aeronautical and Aircraft Weapons Technology project investigates rotary wing vehicle (RWV) technologies for unmanned and manned Army / DoD rotorcraft for increased strategic and tactical mobility / deployability; improved combat effectiveness; increased aircraft survivability; and improved combat sustainability. This project supports the Objective Force and Joint Vision 2020 by providing technology to improve capabilities in Dominant Maneuver, Precision Engagement and Focused logistics. Areas of research are focused on technology application to UAV systems and supports selected opportunities for manned systems. These technologies will provide higher performance, improved survivability, improved sustainability, and reduced cost for propulsion of unmanned and manned aerial vehicles. This project will begin research for the Unmanned Combat Armed Rotorcraft (UCAR), a long endurance, armed, rotary wing platform. UCAR will be capable of performing suppression of enemy air defense (SEAD) and, like Comanche, putting weapons on a target using Loitering Attack Missile-Aviation (LAM-A). The propulsion component technology investigated in this project provides improved specific fuel consumption, horsepower to weight ratios, and operation & support (O&S) savings for future and current rotorcraft engines. Advanced active controls, aerodynamics, handling qualities, acoustic signature attenuation and smart materials (materials that respond to specific stressors) technologies will provide rotors and flight controls with increased payload / range, maneuverability / agility and survivability. Unmanned/manned system interface, flight simulation, weapons integration, and pilot-vehicle interface technologies are focused on research of advanced mission equipment packages that will provide increased lethality and mission operational effectiveness. This project also supports work done by NASA and work done under the auspices of the National Rotorcraft Technology Center (NRTC). Technologies researched within this project will transition to advanced development technology demonstration programs with application to future, as well as current, Army / DoD rotorcraft systems. Work in this project is performed by contractors including: Boeing Company, Mesa, AZ and Philadelphia, PA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Lockheed Martin, Atlanta, GA; General Electric Aircraft Engines, Lynn, MA; Honeywell, Phoenix, AZ; Sikorsky Aircraft Corporation, Stratford, CT; Rolls -Royce/Allison, Indianapolis, IN; Kaman Aerospace Corp., Bloomfield, CT; Pratt & Whitney, Hartford, CT; Raytheon Company, Arlington, VA; and United Technologies Research Center, Hartford, CT. Additionally, work in this project is performed by universities including Arizona State University, AZ; Georgia Institute of Technology, GA; Naval Postgraduate School, Monterey, CA; California Polytechnic University, San Luis Obispo, CA; Ohio State University, OH; Penn State University, PA; Purdue University, IN; Texas A&M, TX; University of Southern California, CA; University of Florida, FL; University of Illinois, IL; University of Maryland, MD; University of Michigan, MI; University of Utah, UT; Virginia Polytechnic Institute and State University, VA; Wichita State University, KS; Cornell University, NY; Iowa State University, IA; Prairie View A&M College, TX; University of Dayton, OH; University of Texas Automation and Robotics Institute, TX; University of Alabama, Huntsville. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

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2 - Applied Research

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PROJECT
47A

FY 2001 Accomplishments:

- 6980 - Conducted analytical / simulation validation of active / passive external cargo load stabilization allowing higher operational speeds and flight test evaluation of Control Designer's Unified Interface (CONDUIT) / Real-Time Interactive Prototype Technology Integration/Development Environment (RIPTIDE) optimized control laws to achieve a high bandwidth in-flight simulation capability.
 - Conducted initial study of analytical / simulation study of interactions of flight control and Individual Blade Control (IBC) rotorcraft control.
 - Matured hardware and performed flight test evaluation using Rotorcraft-Aircrew Systems Concepts Airborne Laboratory (RASCAL) for envelope limiting / cueing concepts.
 - Validated partial authority flight control concepts, providing attitude command/attitude hold capability with existing partial authority actuators in a joint flight test experiment in National Research Council (NRC) in-flight simulator (Ottawa, Canada).
 - Prepared and evaluated human model for Man-Machine Integrated Design and Analysis System (MIDAS) and transitioned tool to NASA and industry for further development and possible commercialization.
 - Created and analyzed conceptual designs of advanced rotorcraft in support of activities like the Army Science Board and the Integrated Concept Team (ICT) for Aviation Science and Technology.
 - Authenticated a Commercial Off-the-Shelf (COTS) based, open systems mission processor hosting Apache Longbow operational flight program (OFP) applications in an Apache-like laboratory environment. Used COTS operating system and open graphics language as the host software environment. Integrated the mission processor with the network components (data buses, network interfaces, switches) and authenticated performance with Comanche OFP applications in a Comanche-like laboratory setting.
- 6967 - Completed bench and wind tunnel testing of critical components for variable geometry rotor core concept technologies.
 - Formulated, selected, and recommended rotor system technology configuration for the 6.3 Variable Geometry Advanced Rotor Demonstration (VGARD) program.
 - Completed core concept applicability based on small scale validation testing.
 - Conducted active on-blade control loads modeling tools upgrade for transition to 6.3 VGARD concept mix and pre-design requirements.
- 6101 - Conducted component research / test / validation and transition of NRTC technology to government / industry partners in the areas of rotorcraft performance improvement and exterior noise reduction.
 - Improved prediction methods for complex rotorcraft applications.
 - Improved tiltrotor shipboard handling qualities.

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PROJECT
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FY 2001 Accomplishments: (Continued)

- Performed NRTC advanced technology research efforts in low noise, improved bevel gear design concepts, advanced transmission technology, variable speed vapor cycle system, health and usage monitoring (HUM) smart transducer data bus research, antenna technology, composite durability and damage tolerance, non-deterministic fatigue life methodology, and integrated helicopter design technology.
- 2710 - Authenticated full-scale, light weight, high-efficiency engine infrared (IR) suppressor; performed low-energy dynamic impact testing of load adaptive crashworthy landing gear strut; performed coupon impact testing of alternative crashworthy fuel system components / designs for system weight reduction; performed conceptual analyses of advanced ballistic protection techniques for Army rotorcraft to achieve 15% net reduction in installed armor weight; affirmed 50% assembly labor reduction for complex composite rotorcraft assemblies; applied smart materials to adaptive airframe structures to reduce vibration; matured more accurate structural load predictions to reduce airframe weight and development time; evaluated durable composite rotorcraft structural concepts to reduce weight and operational costs.
- Screened low glint canopy coating material specifications.
- 2450 - Designed and authenticated smart material actuator and global control schemes that can alter the structural response of an airframe in-flight in response to changing mission conditions.

- Utilized modeling and simulation to predict the performance and screened candidate adaptive landing gear concepts; conducted design support tests on most promising concept.

- Identified smart material/actuator technology that can be integrated into adaptive helicopter airframe structure for active control of loads/vibration; screened innovative technologies applicable to high reliability control signal and power requirements of evolving advanced rotor concepts.
- 1480 - Fabricated high strength, lightweight shaft providing a reduction in the number of bearings required; fabricated advanced fuel control providing improved engine/airframe performance and affordability; designed advanced inlet particle separator providing increased separation efficiency and durability and reduced engine losses.

Total 26688

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FY 2002 Planned Program

- 9087 - Perform preliminary simulation/flight test validation of autonomous guidance control laws using unmanned rotorcraft and piloted simulation quantifying benefit of "high situation awareness" rotorcraft cockpit displays emphasizing obstacle/traffic avoidance.
 - Install test monitoring equipment on aircraft and perform flight test planning for passive external load stabilization.
 - Affirm significant improvement in agility and all-weather operations using rotor state feedback in RASCAL.
 - Conduct wind tunnel test of integrated flight/rotor control using on-blade flaps.
 - Flight validate tactile cueing (real-time feedback of aircraft limits to pilot's sidestick controller)/active sidestick benefit for rotorcraft maneuver limiting.

 - Produce rotorcraft primary flight display symbology aeronautical design guide, incorporating findings from other services/government labs.

- 6610 - Conduct component maturation / test / validation and transition of NRTC technology to government / industry partners in the areas of: unmanned rotorcraft, rotorcraft interior noise reduction, rotorcraft interactional aerodynamics, rotorcraft performance improvement, carefree maneuvering technology, enhanced handling qualities for night operations, limited authority flight control technology, damage tolerance, crashworthiness and advanced structures, advanced low-cost composite manufacturing, structural joining technologies, rotorcraft transmission casting technologies, and enhance non-destructive engineering development.
 - Perform NRTC advanced technology maturation efforts in improved bevel gear design concepts, advanced transmission technology, HUM smart transducer data bus maturation, antenna technology, composite durability and damage tolerance, non-deterministic fatigue life methodology, and integrated helicopter design technology.

- 4118 - Conduct research on the application of autonomous controls on single and multiple teamed unmanned aerial vehicles.
 - Conduct research on the application of autonomous controls applied to terrain and obstacle avoidance.
 - Conduct research on the application of autonomous controls applied to mission flight.

- 3721 - Build and validate super lightweight thermal insulation components that reduce density by 50% over current state-of-the-art COTS insulation. - Conduct analytic screening of advanced aircraft camouflage designs that reduce visual signatures in both desert and vegetated environments by 50% compared to current coatings.

- 2568 - Design, modify, test full-scale adaptive landing gear shock strut to affirm a 50% improvement in crash energy attenuation.
 - Perform detailed design of control and actuation concepts for an adaptive structure concept capable of reducing airframe loads/vibration at a 50% reduction in weight penalty compared to current parasitic approaches.
 - Conduct detailed design of high reliability adaptive structure hardware for transferring flight critical control signals.

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2 - Applied Research

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PROJECT
47A

FY 2002 Planned Program (Continued)

- 12362 - Research and evaluate NASA and NRTC designs for UAV heavy-fuel internal combustion engines.
 - Research and validate NASA and NRTC simulation models for candidate Unmanned Combat Armed Rotorcraft (UCAR) airframe concepts.
 - Define NASA and NRTC candidate autonomous modes of operation for UCAR.
 - Research NASA and NRTC human systems interface alternatives for implementation in UCAR.
 - Research concepts for integrating air-to-ground sensors, designators, and Netfires (LAM-A and PAM-A) to demonstrate cooperative manned-unmanned systems capabilities.
 - Research real-time synthetic vision-based guidance and trajectory capability for precision maneuvering in combat.
- 1745 - Test Metal Matrix Composite (MMC) shaft and validate weight reductions; upgrade simulation software/hardware and perform final closed loop bench test of advanced fuel control; design and fabricate advanced inlet particle separator providing increased separation efficiency and durability and reduced engine losses; design advanced power turbine providing increased cycle efficiency and reduced engine weight.

Total 40211

FY 2003 Planned Program

- 10547 - Flight validate passive load stabilization.
 - Research control system/handling qualities criteria for Objective Force rotorcraft, to include tilt-rotor.
 - Research autonomous control laws and operator interface for small scale UAV Vertical Take-Off and Landing (VTOL) aircraft.
 - Flight validate elements of high situation awareness display technology, including cockpit display of traffic information (CDTI).
 - Refine display research / evaluation methodology for associated unmanned aerial vehicle aeronautical design guide.
 - Conduct research for candidate autonomous modes of operation for UAV.
 - Continue research of designs for UAV heavy-fuel internal combustion engines.
 - Improve and apply methodology for conceptual design of advanced rotorcraft to meet evolving needs.
- 6775 - Conduct component research / test / validation and transition of NRTC technology to government / industry partners in the areas of rotorcraft interactional aerodynamics, rotorcraft performance improvement, carefree maneuvering technology, enhanced handling qualities for night operations, limited authority flight control technology, damage tolerance, crashworthiness and advanced structures, advanced low-cost composite manufacturing, structural joining technologies, and rotorcraft transmission technologies.

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2 - Applied Research

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PROJECT
47A

FY 2003 Planned Program (Continued)

- Perform NRTC advanced technology research efforts in improved bevel gear design concepts, HUM smart transducer data bus research, composite durability and damage tolerance, non-deterministic fatigue life methodology, and integrated helicopter design technology.
- 4065 - Establish loads and affordability baselines for the swashplate-less rotor geometry; design rotor for the swashplate-less concept.
- 3932 - Fabricate and validate canopy glint suppression materials to reduce solar glint signatures of current transparency materials by 50% without adversely impacting optical clarity and night vision device performance.
- 2415 - Investigate the applicability of smart materials to the research of high reliability actuation devices/concepts for on-blade control surfaces associated with advanced rotor concepts. Create and validate models for each of the major process variability drivers. Trade-off enhanced process control versus relaxed design tolerances. Investigate application of smart actuation / adaptive structural concepts to "reconfigure" airframes subject to damage
- 1719 - Fabricate rig test of advanced inlet particle separator providing increased separation efficiency and reduced engine losses and O&S costs; fabricate advanced power turbine providing increased cycle efficiency and reduced engine weight.
- 10000 - Conduct research and evaluate design for UCAR heavy fuel engines.- Conduct research and evaluate technologies to reduce UCAR acoustic signature.
- Conduct reserach on candidate autonomous modes of operation and selected human system interface options for UCAR.
- Conduct research on selected concepts on UCAR for integrating air-to-ground sensors, designators, and NetFires.
- Conduct research on real-time synthetic vision-based guidance and trajectory capability for UCAR precision maneuver in combat operations.

Total 39453

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

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602211A - AVIATION TECHNOLOGY	PROJECT 47B					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
47B VEH PROP & STRUCT TECH	3528	3648	4239	4340	4435	4694	4804

A. Mission Description and Budget Item Justification: The Vehicle Propulsion and Structure Technology project investigates engine, drivetrain and airframe technologies for Army / DoD rotorcraft that significantly increase strategic and tactical mobility/deployability, increase reliability, reduce maintenance costs and increase combat sustainability. The problems being addressed in propulsion technology include increased fuel efficiency and reduced propulsion systems weight. Technical barriers include temperature limitations for materials, accurate modeling for flow physics, and accurate prediction of propulsion system mechanical behavior. The problem being addressed in structures is the inability to design for acceptable reliability and durability with current tools, which leads to heavier, more costly designs and poor life cycle management. Technical barriers include inadequate structural analysis design tools, inadequate structural dynamics modeling methods for the rotating and fixed system components, incomplete loads/usage data, and inaccurate inspection and tracking methodologies. Technical solutions are pursued through: 1) propulsion research focused on fluid mechanics, high temperature materials, and mechanical behavior for significantly improved small airflow turbine engines, transmissions, and gears, bearings, and shaft components for advanced drivetrains at significantly reduced weight and cost; and 2) structures research focused on aerodynamic loads, aeroelastic interactions, integrated composites, structural integrity, low cost manufacturing and crashworthiness that will provide improved rotor and airframe structures subsystems. This propulsion research supports the goals of the DoD integrated high performance turbine engine technology (IHPTET) / Joint Turbine Advanced Gas Generator (JTAGG) program. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2131 - Conducted air injection feedback control experiments on a turbine engine centrifugal compressor stage that indicated the potential for a 20-50% extension in stable operating range. This means improved operability over a broader range of adverse environmental conditions.
- Completed baseline performance database of engine components for a compact two-stage compressor that will reduce engine size, weight, and fuel consumption.
- Established feasibility of effective cooling geometrics for ceramic matrix composite turbine nozzle airfoil to support IHPTET very high temperature operating requirements.
- Established baseline thermal behavior of an advanced helical gear drive system and determined performance of SiC pressure sensor for engine component applications that will contribute to drive train and advanced engine reliability and durability and to improve engine diagnostics.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602211A - AVIATION TECHNOLOGYPROJECT
47B**FY 2001 Accomplishments: (Continued)**

- Completed engine combustor and compressor simulations using improved software that validated substantial reductions in engine design turnaround times.
- 1397 - Successfully assessed aeroelastic stability of variable diameter tiltrotor concept in support of the Vertical Take-off and Landing capability for the Objective Force.
- Completed wind tunnel tests of active twist rotor for the complete flight envelope. Major improvements in vibration. Technology transitioned to Industry.
- Completed preliminary lab assessments of "Regenerative Electronics" power and control system to improve response time performance and reliability.
- Determined bondline interfacial effects on adhesive bond strength of composite structures for improved vehicle structural reliability.
- Completed static experiments to correlate strength and stiffness predictions of tailored composite panels to improve the prediction accuracy for future tiltrotor thin wing designs.

Total 3528

FY 2002 Planned Program

- 1987 - Conduct experiments using innovative Micro Electro Mechanical Sensor (MEMS) air injection technology (zero net mass flow) in the diffuser of a centrifugal compressor to extend compressor stability operating range.
- Conduct performance experiments on compact high performance two-stage compressor to enable reduced engine weight and size.
- Optimize processing parameters for fabrication of ceramic matrix composite turbine nozzles in support of high temperature IHPTET requirements.
- Complete baseline experiments of unique, high speed/high temperature gas path seal rig to enable reduction of engine secondary air flow losses, thereby improving efficiency.
- Complete thermal experiments on high-speed helical gear design to enhance future drive system reliability.
- 1661 - Assess the 'closed-loop' control actuation capability of Active Twist Rotor (ATR) for vibration reduction and to determine potential for noise reduction.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602211A - AVIATION TECHNOLOGYPROJECT
47B**FY 2002 Planned Program (Continued)**

- Investigate concepts for a Low Cost Active Rotor (LCAR) which provides for "Full Authority" control, eliminating the need for a rotor swashplate.

- Perform comparison studies of soft-inplane blade and hub loads versus conventional stiff-inplane hub to improve understanding of the tiltrotor stability boundary and to extend its performance envelope and investigate 3D finite element model of hybrid rotor hub flexbeam concept for improved rotorcraft structural integrity.
- Perform component experiments using thermal non-destructive evaluation (NDE) measurements to correlate bondline geometry with bond strength for an improved understanding of vehicle structural reliability and durability.
- Investigate airframe concepts for application to large-scale, pressurized rotorcraft fuselages in support of the Objective Force rotorcraft.

Total 3648

FY 2003 Planned Program

- 2529 - Assess MEMS air injection technology capability to provide extended stability operating range in a centrifugal compressor.
 - Complete experimental evaluation of cooled monolithic ceramic and ceramic matrix composite turbine nozzles under simulated high temperature engine conditions in support of IPHTET requirements.
 - Complete experiments on foil bearing for oil-free, small turbine engine applications.
- 1710 - Establish high speed, high power face gear allowable stress levels for application to advanced rotorcraft transmissions.
 - Investigate design concepts (using advanced design comprehensive method) of "Full Authority" on-blade active control rotor system taking advantage of best smart actuators available to enhance control and performance.
 - Acquire smart actuator materials to enable construction of "Full Authority" "Low Cost Active Rotor" rotor blades.
 - Conduct static and fatigue experiments of scaled hybrid flexbeams to validate improved design criteria for fatigue durability and damage tolerance.

- Perform characterization experiments to evaluate strength and damage tolerance of pressurized airframe components to be used on Objective Force rotorcraft.

Total 4239

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

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602270A - EW TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	21624	17292	19584	20448	21257	21632	23389
442 TACTICAL EW TECHNOLOGY	9654	10028	10874	11618	12090	11921	12390
906 TAC EW TECHNIQUES	7259	7264	8710	8830	9167	9711	10999
91F MULTIPLE INTEL REMOTED SENSOR SYSTEM - 2ND GEN	4711	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) researches and investigates electronic warfare (EW) technologies to improve the Army's Objective Force battlespace situational awareness (SA). It also will provide deployed elements of the Objective Force with information dominance and increased force protection. The intent of the PE is to deny, disrupt, or degrade the enemy's use of the electromagnetic spectrum for offensive or defensive operations. Specifically, its technologies focus on the threat emitters associated with weapon guidance systems, targeting systems and command, control, communications, computers, and intelligence (C4I) systems and networks. Work in this PE covers the spectrum in the radio frequency (RF), infrared (IR), electro-optical (EO), and ultra-violet (UV) ranges. In addition, this PE offers improvements to our EW sensors, and electronic countermeasures (ECM) systems to further protect high-value ground targets, aircraft, and the soldier from threat surveillance/tracking systems, imaging systems and advanced RF/EO/IR missiles, artillery, and smart munitions. Improvements to the next generation EW protection sensors augment the classic intelligence, surveillance, and reconnaissance (ISR) sensors by providing multi-functional capabilities for on-board, and off-board SA, targeting, and combat identification. Finally, this PE will research automated intelligence fusion and automated battlefield assessment management tools. The cited work is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, the Future Combat Systems and Project Reliance. It adheres to the Tri-Service Reliance Agreements on Intelligence And Electronic Warfare (IEW). It is related to and fully coordinated with efforts in PE 0602782A (Command, Control and Communications (C3) Technology), PE 0602709A (Night Vision and Electronics-Optics Technology), PE 0603789F (C3 Intelligence Technology Development), PE 0603270A (Electronic Warfare Advanced Technology), PE 0604270A (Electronic Warfare Development), and PE 0603745A (Tactical Electronics Support Systems - Advanced Development). The PE contains no duplication with any effort within the Military Departments. Work is performed by the US Army Communications-Electronics Command, Fort Monmouth, NJ. This program supports the objective force transition path to the Transformation Campaign Plan (TCP).

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602270A - EW TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	22007	17449	18333
Appropriated Value	22210	17449	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-157	0
b. SBIR / STTR	-384	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-202	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	1251
Current Budget Submit (FY 2003 PB)	21624	17292	19584

Change Summary Explanation:

Significant Changes: An FY01 Congressional add of \$4900 was received for Multiple Intelligence Remoted Sensor System, Project 91F

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A - EW TECHNOLOGY	PROJECT 442					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
442 TACTICAL EW TECHNOLOGY	9654	10028	10874	11618	12090	11921	12390

A. Mission Description and Budget Item Justification: This project researches, investigates and applies technologies to provide self protect capabilities to the Objective Force and Future Combat Systems (FCS). The intent is to use RF, IR and EO technologies to detect, identify, locate, and employ countermeasures against threat systems. Specifically, this project will investigate the use of RF technologies against radar directed target acquisition, target-tracking sensors, Surface-to-Air Missiles (SAMs), Air-To-Air Missiles (AAMs), top attack and fuzed munitions. It also will investigate and apply IR technologies against heat seeking SAMs, AAMs and Anti-Tank Guided Missiles (ATGMs). Additionally, this project will focus on EO technologies against laser-aided and electro-optically directed gun or missile systems. Finally, this project will look at those Electronic Support (ES) technologies used against non-communications signals for targeting and tactical SA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3420 - Investigated conformal and low observable, multi-octave antenna technology for upgrades to RF and missile warning systems.
 - Tested System Integration Lab's (SIL) upgraded data links with battle labs and schools for interactive simulations using RF countermeasure systems.
 - Designed RF deception and countermeasure techniques testbed.
 - Conducted additional field-testing of radar countermeasures under technical panels 1 and 2 of the Technical Cooperation Program Electronic Warfare Simulator.
 - Evaluated enhancements in detection and location capabilities through the integration of communications intelligence (COMINT) and electronic intelligence (ELINT).
- 1914 - Evolved the missile warning applications of low cost sensor and corresponding warning algorithms common to air and ground platforms.
 - Conducted field measurements of IR and UV signatures of SAMs, ATGMs, background and manmade point false alarm sources.
- 2894 - Investigated warning algorithms for 2-colored ATGMs and evaluated IR countermeasures to advanced ATGMs and emerging SAMs and AAMs including focal plane array (FPA) imaging missiles.
 - Evaluated cooperative jamming and decoy/flare techniques to support a demonstration of integrated countermeasures against ATGMs and SAMs.

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0602270A - EW TECHNOLOGY

PROJECT
442

FY 2001 Accomplishments: (Continued)

- Designed, in coordination with DARPA and Tri-Service Technology Panel for EW (TPEW), a multispectral laser to counter missile seekers and trackers.
- 1426
 - Evolved antennas and RF collectors for airborne and ground tactical maneuver vehicles.
 - Integrated spread spectrum receiver technology for eventual transition to countermeasure systems.
 - Performed research to provide ES technology to intercept, geolocate, and counter emerging hostile non-communications emitters on the battlefield.
 - Participated in a Battle Labs distributed simulation demonstration that evolved radio software algorithms to refine their operational concepts and improve signal mapping visualization and analysis tools.
 - Evolved advanced antennas, and collection and mapping capabilities of micro electromechanical systems (MEMS) low voltage switch technology.
 - Evolved Single Channel Ground and Airborne Radio System (SINCGARS) for radio location sensor.
 - Evolved electronic mapping signal intelligence (SIGINT) object model using artificial intelligence algorithms and digital signal processing (DSP) based optimization techniques.

Total 9654

FY 2002 Planned Program

- 1500
 - Mature & test an advanced wavelet based algorithm for simulation of specific emitter identification (SEI).
 - Conduct multi-function electronic collection and mapping system simulation using a combination of field experiments and operational workstation demonstrations.
- 3710
 - Research and conduct simulation of innovative RF countermeasures capabilities with SIL and Battle Labs.
 - Utilize RF countermeasures testbed to test deception techniques against targeting and air defense radars.
 - Research techniques against frequency hopping air defense radars and top attack munitions.
 - Conduct SIL testing of countermeasures against artillery top attack fuzes.
- 2844
 - Transition warning algorithms for 2-colored ATGMs to FPA missile warning program. Demonstrate IR countermeasures to advanced ATGM's and emerging surface-to-air and air-to-air missiles including FPA imaging missiles.
 - Test and evaluate cooperative jamming and decoy/flare techniques to support integrated countermeasure technology demonstration.

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602270A - EW TECHNOLOGY

PROJECT
442

FY 2002 Planned Program (Continued)

- Research multispectral laser to defeat advanced IR surface-to-air and imaging missiles.
- Mature IR jammer to defeat advanced ATGMs.
- 1974 - Research, mature and test the missile warning applications of low cost sensor and corresponding warning algorithms common to air and ground platforms.
- Conduct field measurements of IR and UV signatures of surface-to-air missiles, ATGMs, background and manmade point false alarm sources.

Total 10028

FY 2003 Planned Program

- 2667 - Test, in the laboratory and the field, new techniques against frequency hopping air defense radars and top attack munitions.
- Establish techniques for an enhanced ground vehicle and aircraft protection suite to simultaneously counter multiple advanced RF threats.
- 3089 - Evaluate capability of an IR jammer to defeat ATGMs.
- Evaluate ability of a multispectral mid-IR laser to defeat advanced IR SAMs and IR imaging missiles.
- 2562 - Integrate and test a system of new low cost sensor and warning algorithms for protection of air and ground platforms against missiles.
- Continue field measurements of IR and UV signatures of SAMs, ATGMs, background and manmade point false alarm sources.
- 1123 - Begin categorization of Low Probability of Detection (LPD)/Low Probability of Intercept (LPI) radar waveforms.
- Investigate adaptive antenna nulling and commercial modulation schemes in support of a fully integrated ES capability.
- Research multi-functional digital receivers, processor and software tools that will reduce size, weight and operator requirements for future ES systems.
- Investigate detection, deinterleaving and tracking techniques that will provide full coverage against emerging next generation non-communication threat emitters.
- 938 - Investigate key sensor component technologies in support of a modular, multi-spectral (UV/IR) sensor required for multiple Objective Force systems. Sensor component maturation will concentrate on modular design techniques to provide adaptability to a variety of platforms.
- Research new techniques to increase detection, identification and classification of "background clutter" signals.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602270A - EW TECHNOLOGYPROJECT
442**FY 2003 Planned Program (Continued)**

- 495 - Test warfighter collection system co-resident on surrogate DSP based radio platform.
 - Show/evaluate linking, processing and dissemination of information as well as visualization of the collected data to all levels of intended users.

 - Design and test a direction-finding antenna and interface to receiver.

Total 10874

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A - EW TECHNOLOGY	PROJECT 906					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
906 TAC EW TECHNIQUES	7259	7264	8710	8830	9167	9711	10999

A. Mission Description and Budget Item Justification: The project researches and applies key EW technologies to intercept, and locate current and emerging threat communications emitters in accordance with concepts for Objective Force intelligence operations. The results are used for targeting, tactical situation awareness, and disruption/destruction of C4I systems. This project matures RF collection and mapping technologies into integrated multifunction devices, to offer real time emitter detection, location, and identification. Efforts include adding an autonomous RF collection capability and algorithms into tactical internet radios to detect, locate and display enemy RF emissions. It also evolves electronic attack (EA) components into smaller, lower power, lightweight, common modules that counter modern threat C4I systems. In addition, this project will enable a remote capability to disrupt, deny or destroy threat communication signals. Other research areas include fusion (automated assimilation and synthesis) of battlefield intelligence data, and brigade level joint intelligence, surveillance and reconnaissance (JISR) capability to address operational shortfalls. Fusion and dissemination efforts will integrate data from traditional intelligence sensors and non-traditional sources, such as target acquisition systems, to provide ground force commanders unprecedented battlefield awareness and dominance of the electro-magnetic spectrum. This system supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1114 - Demonstrated in a laboratory environment an advanced exploitation and attack methodology against identified vulnerabilities in adversaries emerging communications networks, tactical information systems, and computer based networks.
 - Matured commercial-off-the-shelf (COTS) technologies to exploit and attack tactical internet (TI) network security, to identify and fix significant shortcomings in the Army's TI.
- 1996 - Evolved software products that integrated existing joint and national intelligence sensors to provide a common format for integration of sensor information and provide a common SA of enemy forces for the brigade commander.
 - Identified technologies and techniques to provide next generation tools for intelligence preparation of the battlefield, asset management, and SA.
- 4149 - Generated non-cooperative signal detection and recognition algorithms using digital signal processing (DSP)-based optimization techniques that were sized in processing requirements to be compatible with Joint Tactical Radio System (JTRS) software radio architectures.
 - Designed a functional layout of a multi-function RF collector that would be compatible with radio functions.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602270A - EW TECHNOLOGYPROJECT
906**FY 2001 Accomplishments: (Continued)**

- Investigated signal collection, mapping, analysis and visualization tools for autonomous operation and target geolocation for Battle Lab test.
- Participated in a Mounted Maneuver Battle Lab distributed simulation demonstration using force-on-force events to refine RF collection concepts and improved signal mapping visualization and analysis tools for early threat warning and threat situation awareness.
- Integrated electronic mapping of SIGINT object models into workstations.

Total 7259

FY 2002 Planned Program

- 530 - Evaluate data requirements for exploitation and attack capabilities against emerging threat commercial based systems.
- Determine typical information protocols -wireless and wired (Internet -like) used in an urban area that can be exploited by an advanced electronic attack capability.
- 4134 - Design, fabricate and test breadboard RF collector/functional radio to evaluate/test algorithms using radio receiver parameters.
- Mature RF emission geolocation capability using feature vectors and minimum communications.
- Conduct a lab based multi-function electronic collection and mapping simulation using a combination of field experiments and operational workstation demonstration.
- 2100 - Complete software to integrate existing joint and national intelligence sensors into a common format for JISR ACTD.
- Assess improved JISR system performance and military utility in several tactical field exercises.
- 500 - Model JTRS architecture impacts on RF collection design. Initiate RF collector /radio control strategy.

Total 7264

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602270A - EW TECHNOLOGYPROJECT
906**FY 2003 Planned Program**

- 3982 - Identify and test techniques to cross cue/correlate RF emission geolocations and Internet Protocol (IP) virtual address locations.
- Investigate methods to use building security and communications and other urban sensors as threat locating aides.
- Integrate Radio Frequency and Internet Protocol or wire-based attacks on a simulated threat based tactical system.
 - 1090 - Modeling and simulation with Training & Doctrine Command (TRADOC) to define threat set. Identify/mature system architecture for advanced ESM capability, initiate design and development of digital receiver, antenna and software algorithms.
 - 495 - Complete interface and lab testing of SEI and communications emitter location algorithms with digital receiver testbed. Field test as part of C4ISR demo.
 - 1486 - Conduct experiment with high fidelity modeling and simulation of all-source sensor correlation that uses advanced data mining web applications to minimize volume of network data traffic. Conduct experiment with military operators to optimize user interfaces in support of JISR ACTD.

- Demonstrate Initial Operational Capability (IOC) and begin transition to the objective system.
 - 1657 - Interface/correlate multi-intelligence sensor data from the network sensors ATD to all levels of command
- Total 8710

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602303A - MISSILE TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	71056	61085	31884	36743	39208	39965	40819
214 MISSILE TECHNOLOGY	49990	54635	31884	36743	39208	39965	40819
223 AERO-PROPULSION TECHNOLOGY	18266	6450	0	0	0	0	0
340 SWORD	2800	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This applied research program element investigates advanced technologies for missiles, rockets, and unmanned vehicles for use on the Objective Force, including the Future Combat Systems (FCS). Major technology areas include missile guidance systems, air defense acquisition systems, multi-spectral seekers, high fidelity simulations, missile aerodynamics and structures, and missile propulsion. The overall objectives are to increase the survivability of launch systems; provide greater lethality and effectiveness under adverse battlefield conditions; increase kill probabilities against diverse targets; and provide powerful new simulation and virtual prototyping analysis tools. As Compact Kinetic Energy Missile (CKEM) technologies mature, demonstrations will be conducted under PE 0603313A (Missile and Rocket Advanced Technology). The CKEM program transitions in FY02-03 to the advanced technology demonstration phase. Another effort in this PE is the high-g, low cost, Micro Electro-Mechanical Systems (MEMS) Inertial Measurement Unit (IMU) program. This effort will provide MEMS IMU's for precision guidance of missile and munitions. This program is a collaboration with the Armament Research and Development and Engineering Center. The MEMS IMU effort is funded by a combination of applied research and mantech funding. Funding has been increased in FY02-05 and FY07 to complete the design, demonstration, and testing for this effort.

Work in this program element is related to, and fully coordinated with, efforts in PE 0602702E (Tactical Technology), PE 0602602F (Conventional Munitions), PE 0603601F (Conventional Weapons Technology), PE 0601104A (University and Industry Research Centers), PE 0603313A (Missile and Rocket Advanced Technology), PE 0603654A (LOSAT Advanced Concept Technology Demonstration), PE 0602782A (Command, Control and Communications (C3) Technology), PE 0605601A (Army Test Ranges and Facilities) and PE 0708045A (Industrial Preparedness). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan (AMP) and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Aviation & Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. This PE supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602303A - MISSILE TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	70035	40112	31872
Appropriated Value	70683	61612	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-527	0
b. SBIR / STTR	-1779	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	2800	0	0
e. Rescissions	-648	0	0
OSD Realignment	0	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	12
Current Budget Submit (FY 2003 PB)	71056	61085	31884

Change Summary Explanation:

Significant Changes:

FY02 - Congressional Adds totaling \$21.5M, as noted below, added to this PE

Congressional Adds:

FY02 - Congressional adds were made for Low Cost Guidance and Navigation Unit, Project 214 (\$5000); Accelerated Dev/Test Tactical Missile Components, Project 223 (\$3000); MEMS IMU-GPS, Project 214 (\$7000); CKEM IMU, Project 214 (\$1000); Loitering Attack Munition for Aviation, Project 214 (\$2000); and Jet Interaction FCD Testbed, Project 223 (\$3500)

Projects with no R2-A:

Project 223 - Aero Propulsion Technology

- (\$3000) Accelerated Dev/Test Tactical Missile Components, Project 223: The objective of this one-year Congressional Add is to design, develop and test advanced missile components for hypervelocity missile airframes. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602303A - MISSILE TECHNOLOGY

-\$3500) Jet Interaction FCD Testbed, Project 223: The objective of this one-year Congressional Add is to pursue hypersonic missile technology. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A - MISSILE TECHNOLOGY					PROJECT 214	
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
214 MISSILE TECHNOLOGY	49990	54635	31884	36743	39208	39965	40819

A. Mission Description and Budget Item Justification: This project focuses on missile and rocket technologies that support lightweight, highly lethal weapons concepts with greatly reduced logistics requirements for the FCS and Objective Force. Major technology areas investigated are missile guidance systems, air defense target acquisition systems; multi-spectral seekers; high fidelity simulations; missile aerodynamics and structures; and missile propulsion. Research objectives are to enhance the survivability of launch systems, provide greater effectiveness under adverse battlefield conditions, increase kill probabilities against diverse targets, and provide powerful new simulation and virtual prototyping analysis tools. The major effort in this project is the CKEM. This missile is a prime candidate to provide overwhelming lethality for the FCS Direct Fire System with increased stowed rounds. The funding for this program was increased in FY01 and FY02 to accelerate component testing to ensure that a prototype is ready in FY04. As efforts in this project mature, work is transitioned to PE 0603313A (Missile and Rocket Advanced Technology) to support demonstrations of capabilities for CKEM and Common Missile. Another effort in this project is the high-g, low cost, MEMS IMU program. This effort will provide MEMS IMU's for precision guidance of missile and munitions. This is a joint program with the Armament Research and Development and Engineering Center. The MEMS IMU effort is funded by a combination of applied research and mantech funding. Funding has been added in FY02-07 to complete the design, demonstration, and testing for the MEMS IMU effort. Major contractors are Lockheed Martin, Dallas, TX; MILTEC/Boeing, Huntsville, AL; Raytheon Company, Tucson, AZ; and BAE Systems, Austin, TX. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 18819 - CKEM - Awarded three contracts to mature the system design concepts and validate component technology.
 - CKEM - Performed detailed design using the emerging results from the technology and component development effort. Defined technical risk and develop a risk reduction plan; developed cost breakouts for elements; and developed objective/thresholds for key performance parameters in a Cost as an Independent Variable (CAIV) strategy.
 - CKEM - Performed system trades and assessments utilizing both 6-Degrees-of-Freedom and Force-on-Force models.

- 6897 - High-G MEMS IMU - Performed research to mature sensor and electronic design, foundry processes, and testing at competing contractor facilities for advancement of affordable, high-G MEMS IMUs. This technology is applicable to 90% of DOD requirements from both high-g; gun launched precision munitions and high performance guided missiles. This is a cooperative Industry/Government program jointly managed by the gun and missile communities. Three contracts have been awarded to industry.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602303A - MISSILE TECHNOLOGY

PROJECT
214

FY 2001 Accomplishments: (Continued)

- 7443 - Missile guidance systems - Developed a prototype MEMS-based roll rate sensor and laboratory tested it over limited military environments. Used collected data in flight simulations and performance assessments for applicability of ATR to relevant weapon systems. Tested infrared imaging counter-countermeasures.

- High fidelity system level simulations and aerodynamics - Investigated infrared (IR) target signature models applicable to active IR target acquisition and tracking sensors. Devise methods and wrote software for representing 3-dimensional target geometry models applicable to active IR sensors where signal polarization may be a processing discriminant. Investigated methods of projecting hardware -in-the-loop (HWIL) in-band IR target images and scenes with adequate scene detail and dynamic range to include the effects of active and passive IR countermeasures. Completed and demonstrated the target verification monitor with application to all types of Ka-band pulse and continuous wave (CW) radiation in a HWIL simulation facility.
- 12398 - Smart, stealthy, smokeless missile propulsion and smart structures - Completed component maturation of flight type hardware and integrated into a brassboard. Tested a flexible sustainer for long range, survivable, multi-mission capabilities. Completed vacuum aging study for service life prediction for cost avoidance of replacing propulsion systems and increased system safety and performance reliability. Devised methodology for aging assessment of gel propulsion systems.

- Focused technology integration - Designed a digital system manager (DSM) and integrated with the sensor suite to optimize power consumption, and finalized and validated limited failure models for Remote Readiness Asset Prognostics/Diagnostics System (RRAPDS). Completed design to provide real-time targeting for short/medium range indirect fire munitions using a miniature (45-60 centimeter wingspan) aerial vehicle. Selected approach and completed bench test prototype hardware to adapt the Defense Advanced Research Projects Agency (DARPA) Netfires Loitering Attack Munition (LAM) to rotary wing aircraft.
- 4433 - One year Congressional add to complete Low Cost Guidance and Navigation Unit fabrication of a prototype navigator including synchronous sampling, ultra-tightly coupled Global Positioning System/Inertial Measurement Unit (GPS/IMU), and full set of navigator functions able to meet Extended Range Gun Munition (ERGM) and XM982 155mm Extended Range Artillery Projectile form factors as well as those of larger missiles/vehicles.

Total 49990

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602303A - MISSILE TECHNOLOGY

PROJECT
214

FY 2002 Planned Program

- 10300 - CKEM - Fabricate and test subsystems to define a basis for determining risk, achievable performance, and trade-offs between lethality/survivability and missile sizing.
 - CKEM - Perform hardware -in-the-loop simulation testing under flight representative conditions to assess and reduce risk. Achieve a Technology Readiness Level (TRL) of 5.
 - CKEM - - Provide test results and assessments for transition of program to a technology demonstration in FY03.
- 1000 - CKEM - This one year congressional add is to provide risk reduction and develop an alternative design approach for the CKEM IMU.
- 10000 - High-G MEMS IMU - Perform detailed design and analysis of first generation devices, incorporating emerging results from development effort. Construct, evaluate, and refine manufacturability processes to begin production automation and process control maturation.
- 7000 - High-G MEMS IMU - This one year congressional add is to initiate development of a deeply integrated GPS/IMU.
- 8625 - Missile guidance systems - Test MEMS-based angular rate sensors (ARSs) that incorporate technology developed by DARPA. Test in the laboratory and in an extended military environment both the MEMS-based ARS and the single axis roll rate sensor. Design and develop optical test bed to evaluate advancements in uncooled detector technology. Investigate concept designs for uncooled IR sensor for missile applications.
 - High fidelity system level simulations and aerodynamics - Investigate designs for signal generation applicable to HWIL simulation of IR LADAR devices. Implement improved techniques for PC-based massively parallel computation of target RF signatures. Design and build databases of RF and IR target signatures suitable for multispectral HWIL simulation.
- 3635 - Smart, stealthy, smokeless missile propulsion and smart structures - Complete design, fabricate and test brassboard of a deep throttling booster that extends the capabilities of controllable thrust technology to increase range and provide multi-mission capability for a family of FCS and Objective Force weapon systems.
- 7075 - Focused technology integration - Integrate a "full-up" RRAPDS system which will have applicability to all tactical missiles to include CKEM, Common Missile, LAM, and LAM- Aviation (LAM-A). Evaluate RRAPDS as an HTI candidate for a launch platform and a high value conventional munition. Evaluate ability to provide the user with target information on stationary and moving military vehicles using small unmanned aerial vehicles. Define critical technologies for a 2.75 inch Advanced Miniature Multi-Role Precision Guided Missile (AMMPGM).
- 5000 - One year Congressional add to perform prototype testing of a Low Cost Guidance and Navigation Unit which includes a deeply integrated Global Positioning System/Inertial Measurement Unit (GPS/IMU).
- 2000 - One year Congressional add to fabricate and assemble long range loiter missiles airframe and seeker components. Initiate integration of prototype hardware for ballistic flight test.

Total 54635

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602303A - MISSILE TECHNOLOGY

PROJECT
214

FY 2003 Planned Program

- 10000 - High-G MEMS IMU - Provide IMUs for integration into high G Soft Recovery Vehicles and missile airframes for performance verification testing to determine risk and achievable performance. Test results will be one of the factors used to select vendors for continuation into the next phase of the program.
- 9434 - Missile guidance systems - - Integrate MEMS-based angular rate sensors and roll rate sensor into a three-axis rate package, test and transition to FCS and industry. Design geometry transformations for rapid retraining of ATR that will allow precision strike of a target from a different direction than it was originally detected. Devise hardening techniques and algorithms for IR seekers to defeat laser countermeasures. Demonstrate concepts of advanced uncooled infrared seeker and sensor hardware. Model proof of concept devices and construct a one-dimensional array of MEMS temperature sensors for RRAPDS.
 - High fidelity system level simulations and aerodynamics - Design signal generation capability for IR LADAR HWIL simulation; design cold chamber background for IR target simulation; continue design and build of target signature databases.
- 12450 - Smart, stealthy, smokeless missile propulsion and smart structures - Design, fabricate, and static test integrated deep throttling booster that extends the capabilities of controllable thrust technology to increase range and provide multi-mission capability for a family of FCS and Objective Force weapon systems.
 - Focused technology integration - Model two missile types and simulate the missile fire control automatic reconfiguration in a testbed; test a rail launch system to adapt the DARPA Netfires LAM to rotary wing aircraft. Establish best technical approach for key component technologies for AMMPGM.

Total 31884

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602307A - ADVANCED WEAPONS TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	6435	26883	11208	11312	17864	21045	21481
042 HIGH ENERGY LASER TECHNOLOGY	474	16391	11208	11312	17864	21045	21481
04G MINIATURE DETECTION DEVICES & ANALYSIS METHODS	2884	992	0	0	0	0	0
04H ZEUS LASER ORDNANCE NEUTRALIZATION	3077	0	0	0	0	0	0
NA3 MICROELECTRO MECHANICAL SYSTEMS	0	8100	0	0	0	0	0
NA5 RAPID TARGET ACQUISITION & TRACKING SYSTEM	0	1400	0	0	0	0	0

A. Mission Description and Budget Item Justification: Recent advances in solid state laser and other High Energy Laser (HEL) weapons technologies may set the stage for the development of an Army tactical laser weapons capability for the Objective Force. Potential HEL mission areas include counterair munitions defense and airborne electro-optical sensor countermeasures. Technical issues such as lethality; laser fluence degradation due to atmospheric effects; precision optical pointing and tracking; and effectiveness against low-cost laser countermeasures, must be resolved before any weapon system development can commence. To support the resolution of these technical issues, this project will leverage existing laser weapon programs such as the US/Israeli Tactical High Energy Laser Advanced Concept Technology Demonstration, the USAF Airborne Laser Program, and the Department of Energy National Ignition Facility. In addition, this project will develop preliminary system designs to highlight potential sub-system/component issues attributable to technology integration. Current funding will develop a diode-pumped 15 kilowatt (kW) solid-state laser breadboard by FY04. Successful progress in this 15kW effort would initiate the development of a 100kW demonstrator scheduled for completion in FY07. The work in this program element is consistent with the Army Directed Energy Master Plan and the Army Modernization Plan. Work in this program element is related to, and fully coordinated with, efforts in PE 605605A (DOD High Energy Laser Systems Test Facility), PE 0603308A (Army Missile Defense Systems Integration) through FY02, and starting in FY03 PE 0603305A (Army Missile Defense Systems Integration - Non-Space) in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. Work for this project is performed by the US Army Space and Missile Defense Command (SMDC), in Huntsville, AL and the Army Test and Engineering Center, White Sands Missile Range, NM. The major contractors for this effort are Raytheon, El Segundo, CA., and Logitech, Inc., Las Cruces, NM. This PE supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602307A - ADVANCED WEAPONS TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	6632	19043	11234
Appropriated Value	6693	27043	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-160	0
b. SBIR / STTR	-197	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-61	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	-26
Current Budget Submit (FY 2003 PB)	6435	26883	11208

Change Summary Explanation:

Significant Changes:

FY02 - Congressional adds totaling \$14000, as noted below, and a decrement for program growth totalling \$6000 for a total change to the PE of \$7840 (including other minor adjustments).

FY02 Adds:

Congressional adds were made for Microelectro Mechanical Systems, Project NA3 (\$8100); Miniature Detection Devices and Analysis Methods, Project 04G (\$1000); and Rapid Target Acquisition & Tracking System, Project NA5 (\$1400), HELSTF Solid State Heat Capacity Laser (+3500), Project 042.

Projects with no R2A:

- (\$8100) Microelectro Mechanical Systems, Project NA3: The objective of this one year Congressional add is to continue development of a chemical/physical analysis instrument suitable for harsh environments. No additional funding is required to complete this project.
- (\$1000) Miniature Detection Devices and Analysis Methods, Project 04G: The objective of this one year Congressional add is to continue development of signal processing electronics for Mercuric Iodide detector (uncooled) and begin the development of electro-luminescent Xenon gamma radiation

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602307A - ADVANCED WEAPONS TECHNOLOGY

detectors - both for nuclear weapons and potential CB detection. No additional funding is required to complete this project.
- (\$1400) Rapid Target Acquisition & Tracking System, Project NA5: The objective of this one year Congressional add is to design/develop a brassboard with the critical elements of a rapid, passive infrared (IR) acquisition and tracking system for use in detection of fast, low signature threats such as Anti-Tank Guided Missiles (ATGM). No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602307A - ADVANCED WEAPONS TECHNOLOGY

PROJECT
042

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
042 HIGH ENERGY LASER TECHNOLOGY	474	16391	11208	11312	17864	21045	21481

A. Mission Description and Budget Item Justification: Recent advances in solid state laser and other High Energy Laser (HEL) weapons technologies may set the stage for the development of an Army tactical laser weapons capability for the Objective Force. Potential HEL mission areas include counterair munitions defense and airborne electro-optical sensor countermeasures. Technical issues such as lethality; laser fluence degradation due to atmospheric effects; precision optical pointing and tracking; and effectiveness against low-cost laser countermeasures, must be resolved before any weapon system development can commence. To support the resolution of these technical issues, this project will leverage existing laser weapon programs such as the US/Israeli Tactical High Energy Laser Advanced Concept Technology Demonstration, the USAF Airborne Laser Program, and the Department of Energy National Ignition Facility. In addition, this project will develop preliminary system designs to highlight potential sub-system/component issues attributable to technology integration. Current funding will develop a diode-pumped 15 kilowatt (kW) solid-state laser breadboard by FY04. Successful progress in this 15kW effort would initiate the development of a 100kW demonstrator scheduled for completion in FY07. The work in this program element is consistent with the Army Directed Energy Master Plan and the Army Modernization Plan. Work in this program element is related to, and fully coordinated with, efforts in PE 605605A (DOD High Energy Laser Systems Test Facility) and PE 0603308A (Army Missile Defense Systems Integration) through FY02, and starting in FY03 PE 0603305A (Army Missile Defense Systems Integration - Non-Space) in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. Work for this project is performed by the US Army Space and Missile Defense Command (SMDC), in Huntsville, AL and the Army Test and Engineering Center, White Sands Missile Range, NM. The major contractors for this effort are Raytheon, El Segundo, CA., and Logitech, Inc., Las Cruces, NM. This PE supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 474 Completed assessment of existing precision optical pointing and tracking system along with modifications to demonstrate propagation effectiveness of high power, pulsed, solid state lasers. Designed and manufactured improved diode cooler packages which allow for 10 diode bars/cooler packages. Demonstrated a limited quantities of these diode coolers for test and evaluations. Acquired laser diode bars for integration onto diode cooler packages.

Total 474

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602307A - ADVANCED WEAPONS
TECHNOLOGY**PROJECT
042**FY 2002 Planned Program**

- 16391 Begin multi-year development of diode-pumped 15kW solid-state laser breadboard. This breadboard will represent the basic building block for higher power solid state lasers and demonstrate basic technology readiness. Major efforts will include:
 - Laser Diode Development: Produce diode/cooler packages to populate a full-size three-disk laser module using rack & stack technology. Reduce the production cost of laser diode/cooler integrated packages to \$5/W. Demonstrate integration of prime power at the 1kW/kg level.
 - Thermal Management: Demonstrate ability to maintain disk temperature to a delta of < 1 degree C across a single subscale disk. Also will demonstrate (off-line) a 3-minute cooldown system with mist cooling and a 5W/kg cooling capability.
 - Beam Control: Develop a testbed to assess and define atmospheric compensation requirements with closed-loop feedback. Based on detailed wave optic codes, the beam diameter to atmospheric coherence length ratio (D/ro) estimate for propagation is 5. Using this ratio as a basis, demonstrate tilt-only atmospheric correction improvement in the Strehl ratio from 0.18 (non-corrected) to 0.28, and a tilt and focus correction improvement of 0.32.
 - Design Analysis: Determine system parameters required for an effective tactically mobile HEL weapon. Assess atmospheric propagation, system lethality, size constraints and technology maturity for various HEL technology approaches.
 - Engineering Design: Perform first-order-detailed design of a tactically mobile HEL Air Defense Weapon System to include the engineering design and analysis complete with simulation-based feasibility assessments of systems performance as a function of threat. Assess atmospheric effects and compensation, where applicable; system lethality; size constraints; life cycle costs; total system cost-per-kill; logistical burden; and technology maturity. Identify barriers to building a tactically mobile HEL system for airborne and ground deployments.

Total 16391

FY 2003 Planned Program

- 11208 Complete 15kW solid-state laser breadboard development. Major efforts will include:
 - Laser Diode Development: Produce diode/cooler packages to populate a full-size three-disk laser module using a monolithic array process. Reduce the production cost of laser diode/cooler integrated packages to \$2/W.
 - Thermal Management: Demonstrate ability to maintain disk temperature to a delta of < 1 degree C across a single full-scale disk. Will also demonstrate (off-line) a 20-second cooldown system with mist cooling and a 20W/kg cooling capability.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602307A - ADVANCED WEAPONS
TECHNOLOGY**

PROJECT
042

FY 2003 Planned Program (Continued)

- Beam Control: Assess and define atmospheric compensation requirements with closed-loop feedback. Demonstrate atmospheric correction improvement in the Strehl ratio from 0.32 (tilt and focus correction) to 0.45 (tilt, focus and astigmatism). Add correction for coma to improve Strehl ratio up to 0.5.

Total 11208

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602308A - Advanced Concepts and Simulation

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	35334	31333	20634	23000	23298	19788	20358
C90 ADVANCED DISTRIBUTED SIMULATION	13463	16232	13866	12048	12952	13181	13647
C99 ADVANCED CONCEPTS & TECH II (ACT II)	4338	0	0	0	0	0	0
D01 PHOTONICS RESEARCH	4807	2481	0	0	0	0	0
D02 MODELING & SIMULATION FOR TRAINING AND DESIGN	12726	6931	3974	9952	9927	6179	6264
D03 JOINT MODELING & SIMULATION SYSTEM (JMASS)	0	2689	2794	1000	419	428	447
MC8 THREE DIMENSIONAL ULTRASOUND IMAGING	0	3000	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) funds modeling and simulation technology research and applies it to the development, testing and training of the Future Combat Systems and the Objective Force. It develops standards, architecture and interfaces essential to realizing the DoD/Army vision of creating a verified, validated and accredited synthetic "electronic battlefield" environment which can be used to investigate and refine new warfighting concepts, including generation of tactics, doctrine, training techniques, soldier support, systems and system upgrades. It directs and stimulates advances in those technologies required for real time interactive linking within and among constructive, virtual and live simulation and training. U.S. Army Simulation Training and Instrumentation Command (STRICOM), located at Orlando, FL is responsible for Projects AC90, D02 and D03. Project AC90 develops technologies for advanced distributed interactive simulation. Work is performed by the broadest range of the nation's industrial and academic communities. Project DO2 represents a restructure from Project AC90 starting in FY01. This project enables the rapid transfer and development of simulation and training technology research results to the Army from the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. In August, 1999, ICT was designated as a University Affiliated Research Center (UARC) to leverage the entertainment and game industries in advancing the Army's modeling and simulation technology and applications. This project will ensure the transition of the results of the basic research component of the UARC, sponsored through PE 0601104A/Project J08, into the Army tech base and future Army training products. In Project D03, STRICOM will develop components for the Joint Modeling and Simulation system, which is a flexible simulation system that assists model developers, engineers, and analysts in the development of digital models, configuration and execution of simulations, and analysis of simulation results - all at the engineering and engagement levels. These programs are fully coordinated with other Army applied research programs, Defense Advanced Research Projects Agency (DARPA), Defense Modeling and Simulation Office, TRADOC and DoD Project Reliance, with oversight provided by the Joint Directors of Laboratories.

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2 - Applied Research

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Work in these projects is related to and fully coordinated with efforts in PE 0604715A (Non-System Training Devices - Engineering Development). The cited work is consistent with the Army Science and Technology Master Plan (ASTAMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Simulation, Training, and Instrumentation Command (STRICOM). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	36144	20579	17743
Appropriated Value	36479	31579	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-246	0
b. SBIR / STTR	-1041	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	231	0	0
e. Rescissions	-335	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	2891
Current Budget Submit (FY 2003 PB)	35334	31333	20634

Change Summary Explanation:

FY03 (\$2891) added to Project C90 to prototype virtual team member/instructors to support collaborative training, and to experiment and evaluate computer generated forces technology and robotics simulation networks in support of Future Combat System.

FY02 - Congressional adds were made for Photonics Research, Project D01 (\$2500); for STRICOM On-line Contract Document Management, Project C90 (\$1000); Three Dimensional Ultrasound Imaging Project MC8 (\$3000); and for Modeling, Simulation, and Training Infrastructure and Community Development

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Project C90 (\$4500).

Projects with no R2-A:

Project D01

- FY02 funding= \$2500 Photonics Research : The objective of this one year Congressional add is to fund research in technology for night vision and imaging equipment, devices to enable communications while on the move, address Army needs in bio-agent detection and sensitive sensors for imaging and laser sources. No additional funding is required to complete this project.

Project MC8:

FY 02 Funding = \$3000 Three Dimensional Ultrasound Imaging : The object of this one year Congressional add is to improve survival of battlefield trauma through ultrasound telemedicine, including ultrasound miniaturization and wireless connectivity and remotely guided therapeutics. No additional funding is required to complete this project.

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

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602308A - Advanced Concepts and Simulation	PROJECT C90					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
C90 ADVANCED DISTRIBUTED SIMULATION	13463	16232	13866	12048	12952	13181	13647

A. Mission Description and Budget Item Justification: This program researches and applies enabling technologies for advancing distributed interactive simulation in the synthetic environment. C90 provides the representation of the battlefield needed to support the use of modeling and simulation as an acquisition and training evaluation tool. C90 provides a virtual representation of a lethal combined arms environment with the warfighter-in-the-loop that closed-form analysis cannot provide. The environment permits new system concepts, tactics and doctrine and test requirements to be evaluated with a warfighter-in-the-loop in a combined arms battlefield throughout the acquisition life cycle at a reduced cost and time compared to the traditional approach. The research being conducted includes embedded simulation, intelligent forces representation, rapid and cost-effective generation of synthetic environments, simulation interface and linkage technologies, and complex data modeling and interchange. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Simulation, Training and Instrumentation Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4531 - Enhanced the Advanced Tactical Engagement Simulations (A-TES) virtual integration testbed with hybrid simulation and hardware-in-the-loop experiments.
- Established an Embedded Simulation System (ESS) using a Mobile Crew Station Surrogate (MCSSL) at Ft Knox.
- Established a testbed for Embedded Training for Future Combat Systems (FCS) in the areas of Synthetic Natural Environments (SNE), intelligent tutoring and robotics behavioral simulation.
- Studied intelligent behavioral approaches related to FCS robotics. Evaluate prototype capabilities and address technology transfer and implementation issues.
- Extended the distributed architecture to promote interoperability of Army simulation systems including Close Combat Tactical Trainer (CCTT), Warfighters' Simulation (WARSIM), and One Semi-Automated Force (OneSAF).
- 4432 - Prototyped dismounted soldier virtual environment gesture recognition system. Evaluate effectiveness of night operations simulation.
- Tested and evaluated reduced development time/cost for an interoperable SNE.

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February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602308A - Advanced Concepts and Simulation

PROJECT
C90

FY 2001 Accomplishments: (Continued)

- 3500 - Constructed Medical Simulations to evaluate an Advanced Trauma Patient Simulation (ATPS) system triage and After Action Review (AAR) to promote improved readiness for Army medics.
 - Prototyped a web-based, distributed simulation capability to support training of Field Artillery Officers in the employment of indirect fire assets as part of a combined arms team or as a stand-alone training tool using Advanced Distributed Learning (ADL).
 - Demonstrated embedded training technology on multiple combat vehicles interoperating with Close Combat Tactical Trainer (CCTT).
- 1000 - The objective of this one-year Congressional special interest effort is to implement an online contract document management system for STRICOM.

Total 13463

FY 2002 Planned Program

- 4200 - Synthesize data from research and field tests to develop affordable system solutions and minimize impact of force modernization on communications bandwidth, system weight and power packaging requirements of test and training systems (i.e. Combat Training Centers).
 - Validate tools and improve synthetic natural environment development process; test methodology to assess interoperability of linked virtual, constructive, and live systems.
 - Prototype Intelligent Tutoring Systems to provide student "individualized" instructional support of cognitive training tasks in the web-based environment.
 - Complete prototype of the Advanced Trauma Patient Simulator (ATPS) and create an experiment to substantiate that the improved system increases core competency levels. Establish metrics to assess system functionality and the methodology to assess the system's interoperability.
- 3000 - Construct/extend the distributed simulation environment for FCS to promote improved Course of Action Analysis (COAA) and Force Projection Logistics (FPL) capabilities.
 - Advanced Robotics Simulation. Construct/extend computer generated forces technology and prototype robotics simulation and training testbed for Future Combat System (FCS)
- 3532 - Construct/extend immersive simulation technology for distributed simulation networks in support of Objective Force training.
 - Modeling and Simulation for MOUT, Communication and Control (C2), and Human Behavior representation in support of Objective Force training

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

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602308A - Advanced Concepts and Simulation

PROJECT
C90

FY 2002 Planned Program (Continued)

- Identify Embedded Training issues and assess tasks and skills appropriate for embedded training; integrate COTS and Government furnished state-of-the-art hardware components to establish a surrogate Objective Force Warrior (OFW) Embedded Training test bed; begin development and demonstration of advanced simulation software to include web-based interactive simulation and training courseware applications.

- 1000 The objective of this one-year Congressional special interest effort is to implement an online contract document management system for STRICOM.
- 4500 The objective of this one-year Congressional special interest effort is to develop the infrastructure for a Distributed, Networked Modeling and Simulation Community.

Total 16232

FY 2003 Planned Program

- 5834 - Prototype virtual team members/instructors to support collaborative training "anytime-anywhere".
 - Complete the test metrics, incorporate a medical simulator, and test the complete system to verify interoperability.
 - Experiment and evaluate a distributed simulation environment for FCS models and concepts related to Course of Action Analysis (COAA).
 - Experiment and evaluate computer generated forces technology and robotics simulation and training system for Future Combat System (FCS)
- 4967 - Experiment and evaluate a fully immersive simulation technology for distributed simulation networks in support of Objective Force training.
 - Modeling and Simulation for MOUT, C2, and Human Behavior representation in support of Objective Force training
 - Enhance live simulation capabilities to support improved training and testing at the Combat Training Centers, Homestation and Test Ranges.
- 3065 - Increase capabilities to develop and evaluate synthetic environment interoperability for a variety of virtual simulation environments to support SMART concept development, testing and training applications.
 - Integrate state-of-the-art hardware and simulation models into surrogate OFW embedded training testbed.

Total 13866

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

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602308A - Advanced Concepts and Simulation

PROJECT
D02

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
D02 MODELING & SIMULATION FOR TRAINING AND DESIGN	12726	6931	3974	9952	9927	6179	6264

A. Mission Description and Budget Item Justification: This project is a restructure from Project AC90 and enables the rapid transfer and development of simulation and training technology research results to the Army from the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. ICT was designated in August 1999 by DDR&E as a University Affiliated Research Center (UARC) to support Army training and readiness through research into simulation and training technology such as mission rehearsal, leadership development, and distance learning. ICT actively engages industry (multimedia, location-based simulation, interactive gaming) to exploit dual-use technology. ICT serves as a means for the military to learn about, and benefit from entertainment technologies, and enable their transfer into military systems. ICT works with creative talent from industry in order to adapt their concepts of story and character to increasing the degree of immersion experienced by participants in synthetic experiences, and to improving the utility of the outcomes of these experiences. In return, industry leverages the DoD sponsored research being done by the advanced Modeling and Simulation UARC. This project ensures the transition of the research into the Army tech base and future Army training products. Creating a true synthesis of creativity and technology and harnessing the capabilities of industry and the R&D community, it revolutionizes military training and mission rehearsal by making it more effective in terms of cost, time, the types of experiences that can be trained or rehearsed, and the quality of the result. It allows the United States to maintain dominance in simulation and training technologies. The US Army Simulation Training and Instrumentation Command (STRICOM) in Orlando, Florida, develops new Army training systems from the transitioned technology. STRICOM is collaborating with TRADOC to help crystallize requirements for next generation training solutions for Army Transformation. Funding for this program was enhanced in FY 2001 to support applied research on more effective and immersive synthetic environments. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 8811 Developed large-scale virtual environment technology to create a photo-realistic environment, advance the emotion and speech synthesis algorithms to create more realistic virtual humans to populate the virtual environment.
Developed algorithms and techniques for lighting virtual environments and objects that are later placed in the environments.
Integrated all these technologies into a concept demonstration to establish areas needing additional research. These virtual worlds directly support training and mission planning and rehearsal for Army Transformation and preparing the Objective Force for future operations.

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

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602308A - Advanced Concepts and Simulation

PROJECT
D02

FY 2001 Accomplishments: (Continued)

Developed a multi-sensory environment with a curved projections screen and a one of 2-10.2 sound systems.

Advanced Virtual Humans in this environment with natural language and emotions.

Created a general-purpose lighting apparatus for acquiring the reflectance properties and 3D geometry of objective and faces. Developed a Photoshop-like image manipulation program based on high dynamic range imagery.

- 3915 Developed a training solution using PC-Game technology for commanders and low cost game console for Squad Leaders to create virtual worlds that directly support training and mission planning and rehearsal for Army Transformation and preparing the Objective Force for future operations.

Initiated PC-Game and Game Console efforts for training and mission planning.

Total 12726

FY 2002 Planned Program

- 2967 Develop techniques and methods for integrating different sensory cues like smell and sound into virtual environments. Provide concept demonstrations to enhance the education and learning experiences possible through advanced immersive techniques. These environments will impact education and training systems for the legacy and Objective Force.

- 3964 - Accelerate at the University of Southern California's Institute for Creative Technologies (ICT) the exploitation of products from partnership with academia and the entertainment industry, with emphasis on low-cost training platforms using game-based consoles and development techniques.

- Accelerate at the ICT the development of mission rehearsal technologies for Stability and Support Operations (SASO).

Total 6931

FY 2003 Planned Program

- 3974 Apply emerging photo-realistic rendering algorithms and 3D signal processing techniques to advanced experience learning applications for Army training challenges.

Examine computational hardware such as low-cost, ultra-fast, 128-bit computing platforms for possible scalability for the military training and education domain.

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2 - Applied Research

PE NUMBER AND TITLE
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PROJECT
D02

FY 2003 Planned Program (Continued)

Incorporate 3D sound techniques into several virtual environments. The environments will vary from medium sized rooms with high-end graphics and computing systems to low-cost, game console applications using commercial off the shelf speakers. The maturity of these initial techniques will enable training approaches to enhance Army readiness.

Total 3974

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2 - Applied Research

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0602308A - Advanced Concepts and Simulation

PROJECT
D03

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
D03 JOINT MODELING & SIMULATION SYSTEM (JMASS)	0	2689	2794	1000	419	428	447

A. Mission Description and Budget Item Justification: This program element provides for STRICOM development of the Army-specific components for the Joint Modeling and Simulation System (JMASS) for use in modeling and simulation and application in advanced concepts, research and development, test and evaluation, and analysis. JMASS threat models are developed and validated by the intelligence community. DoD testers and decision makers will be able to use the same JMASS models for system evaluation and milestone decisions, as were used during system development. This will reduce the time required for milestone preparation and will increase the probability of a successful milestone decision by eliminating the inconsistent results often obtained when different models are used for development and testing. JMASS models are modular and can easily be modified to meet specific user requirements, thus reducing the need to develop new models. STRICOM will create a Synthetic Environment that supports analysis and real-time simulation. Currently there is no real-time implementation of the JMASS. Establish a real-time simulation framework using the building blocks and toolkits provided by the JMASS with its collection of defined, documented interface standards to which a model should be built. This framework uses real-time distributed standards - Institute for Electrical and Electronic Engineers (IEEE) distributed simulation standards and draft International Standards Organization (ISO) Modeling and Simulation Data Representation Standards. This flexible entity based framework supports correlated multi-sensor real-time environment allowing simulations, which can sustain acquisition; as well as the development of tactics, techniques and procedures for the Future Combat System. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Simulation, Training and Instrumentation Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:
- Program not funded in 2001

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602308A - Advanced Concepts and SimulationPROJECT
D03**FY 2002 Planned Program**

- 2689 - Research and develop baseline for real-time simulation using JMASS models and prior basic research to ensure compatibility and interoperability for multi-sensor real-time simulations.
- Total 2689

FY 2003 Planned Program

- 2794 - Demonstrate and evaluate the baseline for real-time simulation. Test and evolve the baseline to demonstrate that it is interoperable with real-time simulations such as the Close Combat Tactical Trainer (CCTT) and the Objective One Semi-Automated Force (OneSAF) simulation.
- Total 2794

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BUDGET ACTIVITY
2 - Applied Research

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	87009	112957	55763	60728	59452	56005	56910
C05 ARMOR APPLIED RESEARCH	12972	15839	19169	20315	15972	11126	11358
C84 AC84	0	974	978	1946	2907	3078	3165
H77 ADV AUTOMOTIVE TECH	29990	42012	16986	17575	17543	17275	17255
H91 TANK & AUTOMOTIVE TECH	15643	20084	18630	20892	23030	24526	25132
HH7 FUTURE COMBAT SYSTEMS - APPLIED RESEARCH	7681	19475	0	0	0	0	0
HH8 VOICE INTERACTIVE DEVICE	1923	1687	0	0	0	0	0
T21 21ST CENTURY TRUCK (T21)	12071	9909	0	0	0	0	0
T26 HYBRID ELECTRIC HMMWV	6729	2977	0	0	0	0	0

A. Mission Description and Budget Item Justification: The goal of this Program Element (PE) is to develop component technology to improve mobility and survivability capabilities of Army ground vehicle systems for the Objective Force. To achieve the Army's transformation vision, Army systems must be more strategically deployable and agile, with a smaller logistical footprint. The lighter ground vehicle systems required to achieve this vision must be more lethal, tactically mobile and survivable. The focus of the program element is to identify and develop the suite of protection technologies that can be matured and integrated with those developed under this and other PEs to provide protection from a variety of threats for Future Combat Systems (FCS). Technologies matured in this PE usually transition to PE 0603005A to demonstrate their technical feasibility and operational potential. Project HH7 provides a portion of the Army's share of the Army/Defense Advanced Research Projects Agency (DARPA) collaborative FCS program. Other major projects within this PE include: Tank and Automotive Technologies (H91) which provides critical automotive enabling component technologies, such as active protection defeat mechanisms; Armor Applied Research (C05) which investigates and develops advanced, lighter armor technology; and Advanced Automotive Technologies (H77) which funds the National Automotive Center (NAC). The NAC pursues shared automotive-oriented technology programs that have potential to benefit military ground vehicles, leveraging the large commercial investments in automotive technology research and development. This PE adheres to Tri-Service Reliance Agreements on advanced materials, fuels and lubricants, and ground vehicles, with oversight and coordination provided by the Joint Directors of Laboratories. The project is coordinated with the Marine Corps office through the Naval Surface Warfare Center; and with other ground vehicle developers within the Departments of Energy, Commerce and Transportation and the DARPA. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Tank-Automotive and Armaments Command (TACOM) Tank-Automotive Research, Development and Engineering Center (TARDEC), DARPA, contractors and universities. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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BUDGET ACTIVITY
2 - Applied Research

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

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	88274	82441	52762
Appropriated Value	89089	113941	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-984	0
b. SBIR / STTR	-1915	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	650	0	0
e. Rescissions	-815	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	3001
Current Budget Submit (FY 2003 PB)	87009	112957	55763

Change Summary Explanation:

Significant Change: FY02 Congressional Adds totaling \$31.5M (as noted below) were added to this Program Element.

FY02 - The following Congressional adds were made: Combat Vehicle Transportation Technologies Program: Calstar/Westar Electric Hybrid Tech, Project H91 (\$1000); Integration of Army Voice Interactive Device with onboard CPU, Project HH8, (\$1700); Hybrid HMMWV Field Evaluation, Project T26, (\$3000); Hydrogen PEM Fuel Cell Heavy Duty Vehicle Demonstration, Project H77 (\$5000); Smart Truck, Project H77 (\$3400); Advanced Virtual Environments, Project H77 (\$1400); Combat Truck Initiative (COMBATT), Project H77 (\$14000); and National Automotive Research Center, Project H77 (\$2000).

Projects with no R-2A:

Project HH8 (FY02 Funding=\$1700) Integration of Army Voice Interactive Device with Onboard CPU supports and completes enhancements to voice-interactive software capability and interfaces that require less individualized voice training; embeds this capability into a vehicle and/or bench-top demonstrator. No additional funding is required to complete this effort. COMPLETE 4Q02

Project T26 (FY02 Funding=\$3000) Hybrid HMMWV Field Evaluation supports and completes assembly and testing of prototype hybrid electric HMMWVs

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which will be subjected to performance testing in accordance with conventional HMMWV requirements duty cycle including extreme temperature ranges and limited endurance testing. No additional funding is required to complete this effort. COMPLETE 4Q02

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BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
C05

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
C05 ARMOR APPLIED RESEARCH	12972	15839	19169	20315	15972	11126	11358

A. Mission Description and Budget Item Justification: This project investigates potential solutions to critical armor deficiencies for survivability of light weight vehicles for FCS. Emphasis is on development of advanced armor technologies and other means of protection. The armor technologies designed and developed in this project complement innovative non-armor survivability techniques (such as laser and active protection) that are funded in project AH91. In addition, this project (C05) investigates low-burden solutions for the protection of tactical vehicles in war and operations-other-than-war, focusing on appliqué armor for small arms and land mine protection. International cooperative research in mine blast characterization and vehicle response also is conducted. Efforts focus on the weight, space, performance and cost for protection of combat and tactical vehicles against such threats as Kinetic Energy (KE) projectiles, explosively formed penetrators, Chemical Energy (CE) warheads, as well as blast and fragments from land mines. This project draws upon products from Army Research Laboratory programs in PE 0602618A (Ballistic Technology) and PE 0602105 (Materials), as well as innovative armors from industry. This project also includes supporting work in armor materials, bringing together the collective expertise of the Department of Defense, the Department of Energy, industry and academic sources. Supporting work includes researching and maturing armor performance models to assess armor configurations against different threats, with sufficiently high fidelity to make their implementation in vehicles feasible and affordable. Major contractors include: SAIC, Albuquerque, NM; Southwest Research Institute, San Antonio, TX; TPL, Inc., Albuquerque, NM; University of Hawaii, Honolulu, HI; University of Connecticut, Storrs, CT. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 5311 - Tested the capability of armor systems with 30% greater weight efficiency than the 1996 state of the art, against horizontal KE and CE threats, and determined the capability of these armors to withstand the threat debris from a successful Active Protection System (APS) countermeasure intercept.
 - Investigated and tested top attack armor systems to complement future APS with 30% greater weight efficiency than the 1996 state of the art.
- 4421 - Completed investigation of a series of integrated multifunctional armor/structure systems against the heavy machine gun threat that will offer 25% improved weight efficiency over the Composite Armored Vehicle (CAV), at a projected production cost less than 1.5 times that of the CAV.
 - Investigated armor/structure systems with 30% improved weight efficiency against medium caliber KE and CE threats for validation in FY02.

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February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
C05

FY 2001 Accomplishments: (Continued)

- 3240 - Integrated existing physics-based and engineering-based models and design tools to provide industry the capability to design and validate FCS armors without extensive and costly testing.
 - Supported and provided U.S. national leadership to an international cooperative research program for mine blast characterization under The Technical Cooperation Program (TTCP).
 - Conducted safety and user assessments.
 - In partnership with UK, developed a set of design tools to investigate unique electrodynamic defeats.

Total 12972

FY 2002 Planned Program

- 6540 - Research second generation armor systems that will be available for FCS Blocks I and II to defeat medium caliber cannon, hand held infantry weapons, and residual KE behind APS debris to approach meeting a weight efficiency goal of 80 lbs/sq ft; these armor systems will provide light combat vehicles with the survivability required on the future battlefield.
 - Investigate and test top attack armor systems to complement future APS with 30% greater weight efficiency than the 1996 state of the art.
- 4819 - Research second generation of integrated multifunctional armor/structure systems against the heavy machine gun threat, making progress toward meeting a weight efficiency goal of less than 20 lbs/sq ft.
 - Provide armor and model data for defeat of APS residual KE, medium caliber KE and CE threats which meet APS demo weight efficiency goal of 160 lbs/sq ft.
- 4480 - Integrate improved physics-based and engineering-based models and design tools to provide industry the capability to design and validate FCS armors without extensive and costly testing.
 - Acquire experimental data for use in existing mine survivability design codes; provide U.S. national leadership to an international cooperative research program for mine blast characterization under the TTCP.

Total 15839

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BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
C05

FY 2003 Planned Program

- 8408 - Test and evaluate second generation armor systems at Technology Readiness Level (TRL) 5 that will be available to transition to FCS which will defeat medium caliber cannon, Hand Held Infantry Weapon, and APS residual KE debris that will be available for FCS, which approach a weight efficiency goal of 80 lbs/sq ft.
- Extend top attack armor systems to ensure compatibility with armor/structure systems used for flank attack.
- 5166 - Research and test integrated multifunctional armor/structure systems against the heavy machine gun and artillery threats that approach a weight efficiency goal of less than 20 lbs/sq ft at TRL 5 for transition to FCS.
- Provide armor and model data for defeat of residual KE, medium caliber KE and CE threats that meet APS demo weight efficiency goal of 80 lbs/sq ft.
- 5595 - Integrate improved physics-based and engineering-based models and design tools to provide the capability to design and validate FCS armors without extensive and costly testing.
- Collect experimental data for use in existing design codes; conduct verification experiments to validate improved design code accuracy. Provide U.S. national leadership to an international cooperative research program for mine blast characterization under TTCP.

Total 19169

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A - Combat Vehicle and Automotive Technology	PROJECT H77					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H77 ADV AUTOMOTIVE TECH	29990	42012	16986	17575	17543	17275	17255

A. Mission Description and Budget Item Justification: This project funds the National Automotive Center (NAC), which leverages large commercial investments in automotive technology research and development and initiates shared technology programs that focus on benefiting military ground vehicle systems. The dual use technologies being developed support the Army's wheeled vehicles fleet that may comprise a substantial segment of the FCS and the Objective Force. Improvements in the legacy force are expected to rely heavily on dual-use technologies for advances in operational, performance and cost characteristics. The NAC, located at TACOM, is part of TARDEC. The NAC serves as the catalyst linking industry, academia and government agencies for the development and exchange of automotive technologies. The NAC executes collaborative research and development (R&D) contracts, cooperative agreements, and other initiatives to leverage commercial industry's investment in well-defined, high return-on-investment areas tied to key Army science and technology objectives for advanced land combat. The NAC focuses collaborative R&D contracts on key military automotive technology thrust areas to include: fuel efficiency, vehicle modernization, crew safety, maintenance, and logistics improvement and manufacturing innovation with the goal of (a) improving the performance and endurance of ground vehicle fleets, and (b) reducing ground vehicle design, manufacturing, production, and operating and support costs. Two-way industry/government technology transfer is pursued under Cooperative Research and Development Agreements (CRADAs). The 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. The NAC performs basic research in PE 0601104A, project BH73 (National Automotive Center). The following Congressional FY02 adds have been placed in this project for implementation: Hydrogen PEM Fuel Cell Heavy Vehicle Demo (\$6000); Combat Truck Initiative (\$14000); National Automotive Research Center (\$2000); Advanced Virtual Environments (\$1400); Smart Truck (\$3400). Major contractors include: FOCUS: Hope, Detroit, MI; Oshkosh Truck Corporation, Oshkosh, WI; Lockheed Martin Inc., Lexington, MA; Cummins Engine Company, Columbus, IN; ICRC Energy Inc., Oakton, VA; Radian, Inc., Alexandria, VA; Baum, Romstedt Technology Research Corp. (BRTRC Inc.), Fairfax, VA; Southwest Research Institute, San Antonio, TX; Electronic Data Systems, Troy, MI; University of Wisconsin, Madison, WI; University of Iowa, Iowa City, IA; Evans and Southerland Inc., Salt Lake City, UT; IITRI, Chicago, IL; Lockheed Martin Control Systems, Johnson City, N.Y; Ford Motor Company, Dearborn, MI; Sunline Services Group, Thousand Palms, CA; Mobile Medical International, St. Johnsbury, VT; Oakland University, Rochester, MI; General Dynamics Land Systems (GDLS), Muskegon, MI; Electricore, Indianapolis, IN; Engineered Machine Products, Inc, Escanaba, MI; Ovonic Battery Company, Troy, MI; United Defense LP, Santa Clara, CA; Univ of MI, Ann Arbor, MI; XCELLSIS Corp, Poway, CA.; and Parametric Technologies Corp, Waltham, MA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602601A - Combat Vehicle and Automotive
Technology**PROJECT
H77**FY 2001 Accomplishments:**

- 5765 - Investigated and tested automotive technologies in the areas of fuel efficiency, vehicle modernization, manufacturing, automotive logistics and maintenance improvement.
- 5581 - Integrated key commercial automotive technologies (engine, brakes, air conditioning, diagnostics, crash protection) into the light and heavy wheeled demonstrators and engine, air conditioning, diagnostics technologies into the tracked vehicle demonstrator.
- 4682 - Completed integration plan for hardware, software, informational, and human interfaces for the selected technologies.
- 3369 - Executed the one-year congressional special interest program to demonstrate various advanced automotive technologies pertaining to Smart Truck.
 - Produced initial and final designs for the electronic architecture and vehicle integration.
- 2888 - Executed the one-year congressional special interest program to develop Solid Oxide Fuel Cell technology.
- 7705 - Executed the one-year congressional special interest program to research and develop improved techniques for reforming JP-8 and related fuels to make hydrogen for vehicle fuel cell propulsion systems.
 - Addressed areas on sulfur tolerance, startup and transient response times, efficiency, and operation in hot, dry climates.
 - Initiated the development and operation of fuel cell power heavy vehicle power systems.
 - Built two additional fuel cell powered trucks for in-service evaluations, one in military environment, and one in a commercial environment.

Total 29990

FY 2002 Planned Program

- 10210 - Investigate and test automotive technologies in the areas of fuel efficiency, vehicle modernization, manufacturing, automotive logistics and maintenance improvement.
- 4002 - Integrate key commercial automotive technologies (engine, brakes, air conditioning, diagnostics, crash protection) into the light and heavy wheeled demonstrators and engine, air conditioning, diagnostics technologies into the tracked vehicle demonstrator.
- 2000 - Perform simulation based modeling and analysis in support of all areas of technology under investigation.
- 5000 - This one year Congressional add for Hydrogen PEM Fuel Cell Heavy Duty Vehicle Transportation supports and completes development of a hydrogen PEM fuel cell powered heavy duty vehicle for demonstration in California. Demonstrates and quantifies reduction of emissions. No additional funds are required to complete this project.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
H77

FY 2002 Planned Program (Continued)

- 14000 - This one year Congressional add supports and completes the Combat Truck Initiative (COMBATT) to develop, design and perform performance/endurance testing of commercial vehicles converted to hybrid electric propulsion. No additional funds are required to complete this project.
 - Commercial trucks will be procured and converted to hybrid propulsion testbeds.
- 2000 - This one year Congressional add for the National Automotive Research Center formulates and matures advanced modelling and simulation strategies for the Army's vehicle fleet; experimentally validates advanced propulsion and mobility simulation models. No additional funds are required to complete this effort.
- 1400 - This one year Congressional add for Advanced Virtual Environments supports and completes development of a suite of 3D graphic simulation tools and displays which will allow users to operate within a computer generated collaborative virtual environment on a real-time basis. No additional funds are required to complete this project.
 - Provide simulation tools and displays to experience life-like systems/systems-of-systems that appear real but only exist in a computer-based environment.
- 3400 - This one year Congressional add for Smart Truck supports and completes adaptation of commercially available digital technology for improved operation and safety of Army trucks. No additional funds are required to complete this project.
 - Evaluate current, advanced, and emerging automotive technologies installed on commercial long bed pickup truck testbed.

Total 42012

FY 2003 Planned Program

- 12850 - Investigate and test automotive technologies in the areas of fuel efficiency, automotive vehicle modernization, automotive crew safety enhancement, automotive maintenance and logistics improvement, and automotive manufacturing innovation.
- 4136 - Research collaborative research and development efforts to include fuel efficiency, antilock braking system, safety, engines, and modeling and simulation.

Total 16986

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601A - Combat Vehicle and Automotive Technology	PROJECT H91					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H91 TANK & AUTOMOTIVE TECH	15643	20084	18630	20892	23030	24526	25132

A. Mission Description and Budget Item Justification: This project provides innovative vehicle concepts and enabling technologies for the FCS and the Objective Force needed to achieve the critical mobility, survivability and sustainability enhancements required to meet the Army Vision. Project funds conceptual designs, virtual prototyping, performance analyses and battlefield wargaming of ground vehicle systems and uses the results to quantify benefits, burdens and trade-offs related to applying the ground vehicle technologies in operational scenarios. The project includes ten areas: vehicle concepts; mobility; integrated survivability (including active protection); vehicle electronics (VETRONICS) and intra-vehicle digitization; advanced vehicle structures; simulation/analysis; military fuels and lubricants; water purification technology; mechanical (as opposed to electronic) countermeasure technology and gap/obstacle crossing technology. Technologies are being pursued to address advanced mobility, survivability, advanced structures, and lethality requirements of lighter, digitized, more deployable vehicles requiring less Petroleum, Oil and Lubricants (POL). Activities are closely coordinated with TRADOC's Mounted and Dismounted Battlespace Battle Labs and the Directorate of Combat Developments for Transportation and Quartermaster; Program Executive Office for Ground Combat and Support Systems; Army Research Laboratory (ARL); and the Defense Advanced Research Projects Agency (DARPA). Virtual prototyping provides seamless sharing of databases and engineering models, allowing more rapid and efficient integration, assessment and transfer of Department of Defense and commercial vehicle technologies. Vehicle electronics are based on adapting commercial electronic standards and architectures for combat vehicle battlefield unique requirements. The survivability technologies, which include non-armor approaches such as signature reduction, countermeasures, active protection, damage reduction, and laser protection, complement, but do not duplicate, work performed under the armor exploratory development project (DC05) in this PE. The sustainability technologies focus on reducing the logistics footprint, enhancing unit agility and leverage basic research being conducted by DARPA. Other government agencies include: DARPA, Arlington, VA; Army Research Laboratory, Aberdeen, MD; Red River Army Depot, Texarkana, TX. Major contractors include: Detroit Diesel Corp., Redford, MI; Cadillac Gage Textron, New Orleans, LA; Soucy International, Drummondville, Quebec; Pentastar, Huntsville, AL; Michigan Technological University, Houghton, MI; United Defense Limited Partnership, San Jose, CA; University of Texas, Arlington, TX; Oakland University, Rochester Hills, MI; Gonzales Engineering, Troy, MI; Boeing Corporation, St. Louis, MO; Monterey Technologies Inc., Monterey, CA; DCS Corp, Alexandria, VA; Texas Instruments, Dallas, TX; Southwest Research Institute, San Antonio, TX;, , Mesosystems Technology Inc .Albuquerque, NM, MIOX Corp, Albuquerque, NM; Scientific Systems, Boston, MA; University of California, Berkley, CA; General Dynamics Land Systems Division, Sterling Heights, MI; Chang Ind., Salt Lake City, UT, & Laverne, CA; TRW, Redondo Beach, CA, Sanders Lockheed Martin, Nashua, NH; Raytheon, Danbury, Conn., New Mexico Tech., Socorro, NM, Talking Lights Company, Cambridge, MA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
H91

FY 2001 Accomplishments:

- 5570 - Jointly with DARPA, performed effectiveness, performance, cost and tradeoff analysis of innovative FCS system concepts to support the evaluation of the FCS contractor alternative concepts.
 - Matured system concepts validating the performance of manned and robotic vehicles in multiple roles that are available for FCS which supported a major user FCS experimentation program; developed concepts for potential insertion to the Objective Force.
 - Established and addressed emerging combat support requirements for tactical vehicles necessary to support the Objective Force; conducted trade-off studies and supporting performance and supportability analysis of heavy tactical vehicle concepts supporting the Objective Force and User Integrated Concept Team; conducted simulation experiments using Army Materiel Command Research and Development Engineering Center Federation Architecture in conjunction with FCS and Objective Force efforts.
- 4468 - Completed electromechanical active suspension testing showing an 80% improvement in cross-country mobility with potential for over 100%; completed final 4-stroke demonstrator diesel engine design and initiated build; conducted performance and durability optimization on screening engine to achieve the high power density, low heat rejection and improved fuel economy goals established in the memorandum of understanding. (Cooperative Research Program with Japan.)
 - Demonstrated in laboratory increased vehicle range through fuel additives.
 - Conducted materials comparison studies of composites versus metallics and their applicability towards military bridging technologies and began Virtual Prototyping simulations and studies of new and unique bridge launching techniques that will be available for the Objective Force.
 - Investigated, tested and characterized obstacle marking and vehicle guidance systems based on FY2000 analysis; performed detailed assessments in vehicle interoperability, system deployability and cost to prepare for FY2002 test bed demonstration.
- 3795 - Integrated and evaluated Natick Research and Development Engineering Center laser protection materials into retrofittable wide-angle optical viewing system incorporating laser-limiting materials.
 - Developed Full Spectrum Active Protection (FSAP) system engineering model and initiated system simulations against tube launched tube launched KE and HEAT.
 - Designed improved FSAP countermeasure proximity fusing system for notional delivery system.
 - Assessed armor/structure concepts developed under project DC05 to deal with adaptive threats.
 - Designed and fabricated miniaturized FSAP proximity fuse for installation into delivery system.
 - Conducted laboratory tests to determine proximity fuse effectiveness.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
H91

FY 2001 Accomplishments: (Continued)

- 1810 - Completed workload modeling & analysis to investigate embedded unmanned system control from manned platforms to provide required capability for FCS.
- Reduced the size of the water production subsystem of the drinking water recovery from engine exhaust system by 40%.

Total 15643

FY 2002 Planned Program

- 5121 - Assess emerging requirements of FCS, including the role of robotics and tactical vehicles; refine Government concepts and perform analysis in support of FY03 technology readiness decision and User experimentation; complete independent evaluation of FCS industry team concepts through the Integrated Product Team process.
- Mature engineering-level of detail ground vehicle models and terrain databases to evaluate mobility and dynamic stability of highly mobile manned and robotic vehicles operating in complex terrain; perform validation studies of motion effects on soldier performance.
- 4683 - Complete final 100 hour high output, low heat rejection compact 4-stroke diesel engine durability and performance demonstration to achieve the high power density, low heat rejection and improved fuel economy goals. (Cooperative Research Program with Japan.)
- Complete laboratory demonstration of enhanced lubricants for fuel economy and with increased oil sump temperature; evaluate candidates on second series of multi-cylinders engine tests; determine formulations that can be evaluated in field tests.
- Conclude materials studies of composites versus metallics; refine virtual prototype simulations of launching techniques; conduct Finite Element Modeling of weight reduction and enhancement studies.
- Finalize design based on FY01 detailed assessments of obstacle marking and vehicle guidance systems in the areas of vehicle interoperability, system deployability and cost; participate in Joint Area Clearance Advanced Concepts Technology Demonstrator.
- 1035 - Evaluate/validate performance levels via component structural and ballistic tests; perform structural and weight analysis of candidate FCS vehicle designs.
- 3245 - Evaluate cognitive decision aids to reduce workload on multi-mission capable systems such as FCS; mature approach/architecture for implementation of cognitive decision aids in ground systems.
- Construct FSAP subsystem models based on successful countermeasure demonstrations.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
H91

FY 2002 Planned Program (Continued)

- Complete HMMWV system level design for a mounted, integrated water-from-exhaust system, fabricate and validate components in a relevant environment; investigate materials/components to illustrate humidity concentrator concepts to reduce the size and energy requirements of a water from air generator.
- 5000 - Fabricate and conduct field tests of robust active protection kill mechanisms (e.g., multi-explosively formed penetrators) to protect light-medium weight ground vehicles (i.e., FCS) against anti-armor threats, including kinetic energy penetrators and high explosive anti-tank rounds.
- 1000 This one year Congressional add for Combat Vehicle Transportation Technologies Program: CalStart/WestStart Electric Hybrid Technologies demonstrates hybrid electric component technologies in various vehicles used for public transportation and/or military purposes. No additional funds are required to complete this program. COMPLETE 4QFY02

Total 20084

FY 2003 Planned Program

- 5646 - Provide technical input, concepts, characteristics, performance predictions and trade-off analysis in support of the Army Milestone B for FCS.
 - Conduct initial advanced technology and subsystem studies to assess potential product improvements to the base FCS family to attain Objective Force capabilities.
 - Perform trade-off analysis in support of Future Tactical Truck Systems acquisition milestone; perform innovative lightweight and robotic tactical vehicle concept studies.
 - Mature physics-based mobility models for design evaluation of small, lightweight ground vehicle platforms; perform studies to determine the most effective soldier interfaces for control of robotic vehicles while on the move; evaluate passive and active motion-effect mitigation techniques.
- 5020 - Fabricate advanced ceramic in-cylinder components for high output, low heat rejection, diesel engine dynamometer. Test high temperature lubricants and coolants.
 - Conduct field evaluation of enhanced Petroleum, Oil & Lubricants (POL) products; prepare report on POL field tests; revise/develop specification for implementation of the enhanced POL products.
 - Implement obstacle marking hardware and vehicle guidance software improvements and participate in the Joint Area Clearance Advanced Concepts Technology Demonstrator; conclude virtual prototype simulations of launching techniques and Finite Element Modeling for weight reduction and enhancement studies.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
H91

FY 2003 Planned Program (Continued)

- 2731 - Determine optimal active protection (AP) sensor/ countermeasure performance matches based on simulations and field test data.
- 1733 - Evaluate alternative (helmet mounted, projection, curved) display technologies and input mechanisms to reduce the size of multi-mission crewstations to meet FCS transportability requirements; mature approach for multi-modal crew stations for FCS.
- 3000 - Reduce water distribution requirements (~106 stons/day), projected to be 40% of the total daily sustainment requirement of the Interim Brigade Combat Team, through the development of new water production capabilities in two thrust areas: 1) purification of traditional water sources and 2) water recovery generation from non-traditional sources
- 500 - Fabricate silicon carbide switching devices for high efficiency inverters and converters for FCS hybrid electric power system.

Total 18630

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
HH7

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
HH7 FUTURE COMBAT SYSTEMS - APPLIED RESEARCH	7681	19475	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project provides a part of the Army's share of the Army/DARPA collaborative FCS Program. (See PE 0603005A, Projects 440 and 53G for a description of the FCS Program and for information on other Army funding provided for the collaborative FCS Program in FY03.) Funds in this project support contractual and government concept design efforts in accordance with the FCS Memorandum of Agreement (MOA) signed February 2000. Competing designs will be evaluated for their ability to perform combat missions across the full spectrum of operations. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 7681 - Provided funds in support of DARPA to research and define initial force concepts as a result of tradeoff assessment process.
- Matured and evaluated innovative system concepts that reflect the force in a system of systems context; developed operational and technical models to represent the best system of systems concepts for FCS.
- Performed effectiveness, performance, cost and technology tradeoff analyses on innovative system concepts developed in support of a strategically deployable, agile, survivable and tactically mobile force for the Army. Provided information to support the development of requirements and enabling technology for FCS.
- Identified key enabling technologies to support FCS based Objective Force concept architectures.
- Performed technical and operational experimentation in support of system of systems design.

Total 7681

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602601A - Combat Vehicle and Automotive
Technology**PROJECT
HH7**FY 2002 Planned Program**

- 3000 - Provide funds for Army share of DARPA's FCS Concept Development efforts in accordance with the MOA.
- 16475 - Provide funds toward the Army share of the Army/DARPA development of FCS Enabling Technologies (\$62436 in PE 0603005A, Project 53G , also supports this effort) in accordance with the MOA.
 - Mature new and novel modeling and simulation techniques to support network-centric force architectures for a FCS equipped Objective Force.
 - Evaluate novel cooperative engagement, cooperative survivability, and command and control strategies for FCS-based tactics, techniques and procedures.

Total 19475

FY 2003 Planned Program

This effort transitions to PE 0603005A projects 440 and 53G starting in FY 03.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
T21

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T21 21ST CENTURY TRUCK (T21)	12071	9909	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this project is to provide a collaborative government and commercial truck manufacturing industry research and development initiative to investigate automotive component technologies for trucks that will be much more fuel efficient, less polluting, and safer to operate. These most promising components from this research will be incorporated into test vehicles and evaluated in commercial and military operational environments.

FY 2001 Accomplishments:

- 7291 - Researched and investigated high power density engines, lightweight engine/components, high temperature engine materials, engine coatings, coolants and cooling systems computer controlled energy management systems, electric traction motors, electric generators, high power motor controllers, integrated gate bipolar transistors, and advanced energy storage systems.
- 1748 - Integrated and tested vehicle intelligence technologies that involve both information and control technology to improve fuel efficiency, driving efficiency, safety and quality of driving trucks.
- 1767 - Evaluated the use of alternative fuels to meet military requirements for fuels with high stored energy density, reduced emissions and that will facilitate the use of Solid Oxide Fuel Cell propulsion systems.
- 779 - Tested and evaluated the application of current and new commercial materials technologies that result in increase payload, corrosion resistance, vehicle life cycle, durability and mobility
- 486 - Conducted research in fuel cell technologies to include alternatives to diesel reformers and improvements in propulsion density, weight and cube of present generation fuel cells.

Total 12071

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
T21

FY 2002 Planned Program

- 8000 - Integrate and test high power fuel efficient engines, lightweight engine/components, high temperature engine materials, engine coatings, coolants and cooling systems, computer controlled energy management systems, electric traction motors, electric generators, highpower motor controllers, integrated gate bipolar transistors, and advanced energy storage systems.
- 954 - Integrate and test vehicle intelligence technologies involving information and control technology to improve fuel efficiency, driving efficiency, safety and quality of driving trucks.
- 955 - Integrate and test the use of alternative fuels to meet military requirements for fuels with high stored energy density, reduced emissions and that will facilitate the use of Solid Oxide Fuel Cell propulsion systems. This supports more stringent emissions protocols.

Total 9909

FY 2003 Planned Program

Project not funded in FY 2003

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	52245	60948	74094	65408	67445	61385	62905
H03 ROBOTICS TECHNOLOGY	13933	24016	19013	21971	22938	19307	19655
H75 ELECTRIC GUN TECHNOLOGY	9374	4973	8325	9100	10971	10647	11084
H80 BALLISTICS TECHNOLOGY	28938	31959	46756	34337	33536	31431	32166

A. Mission Description and Budget Item Justification: This program element (PE) provides ballistic technologies required for armaments and armor to support the Future Combat Systems (FCS) and the Objective Force and to allow US dominance in future conflicts across a full spectrum of threats in a global context. Project H75 focuses on pulsed power technologies for electric armaments which offer the potential to field leap-ahead capability in providing hypervelocity and hyperenergy launch well above the ability of the conventional cannon. It also includes work in hypervelocity penetrator effectiveness and electrothermal chemical (ETC) technology that will greatly increase anti-armor capabilities. Project H80 is focused on applied research in ballistics technology to enhance the lethality and survivability of future weapons. Focus areas included advanced solid propellants, launch and flight dynamics, weapons concepts for light forces, warheads and projectiles, armor and munition/target interactions. Project H03 is a restructure from Project H80 to conduct applied research for advanced autonomous mobility technology for future land combat systems of the Objective Force. Included in H03 is a total \$43.4M in funding transferred from OSD to the Army's Robotics Program from FY01 to FY05. Projects AH03 and AH80 will enable lethality and survivability technologies for the Future Combat Systems (FCS). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	53258	61502	56705
Appropriated Value	53750	61502	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-554	0
b. SBIR / STTR	-1113	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	100	0	0
e. Rescissions	-492	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	17389
Current Budget Submit (FY 2003 PB)	52245	60948	74094

Change Summary Explanation:

FY03 (+13276) - Project H80 (+10170) increased to investigate advanced componentry necessary to implement revolutionary armor technology for the Future Combat Systems; Project H75 (+3103) increased to fabricate and prove critical components for electromagnetic gun.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY

PROJECT
H03

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H03 ROBOTICS TECHNOLOGY	13933	24016	19013	21971	22938	19307	19655

A. Mission Description and Budget Item Justification: This project advances autonomous mobility technology for the Future Combat Systems (FCS) and the Objective Force. It will investigate robotics technology critical to the development of future Army systems, including unmanned elements of the FCS and crew aids for future manned systems. It provides the basis for a tri-service research consortium joining researchers from DOD, other Government agencies, industry, and academia in a concerted, collaborative effort to advance key enabling technologies. Achieving these goals will provide future land combat forces with significant new operational capabilities permitting paradigm shifts in the conduct of ground warfare, providing significantly greater survivability and deployability. Technical efforts will be focused towards advancing perception for autonomous ground mobility, intelligent vehicle control and behaviors, and human supervision of unmanned ground systems. Research will be conducted at the Army Research Laboratory, other DOD laboratories and research centers, NIST, NASA and DOE research laboratories, as well as industry and academic institutions. The applied research conducted in this program will be transitioned to technology development, demonstration and materiel acquisition programs being conducted by the OSD Joint Robotics Program and each of the Services. Robotics Technology (Project H03) was previously funded in Project H80 prior to FY2001. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2000 - Established Collaborative Technology Alliance, an external research consortium, involving Industry, Academia and Historically Black Colleges and Universities and Minority Institutions (HBCU/MI's) to conduct applied research on the topics of perception, intelligent control and man/machine interfaces supporting development of the Future Combat Systems.
- 11933 - Designed and integrated multi-sensor perception technology, including stereo and LADAR, required to implement baseline follower operation by unmanned ground vehicles (UGVs).
 - Showed robotic follower operation at speeds of 20 MPH on-road and 10 MPH off-road.
 - Devised and integrated machine perception technologies and color classification based algorithms to enable rapid classification of a baseline set of terrain types required for high-speed autonomous mobility.
 - Devised intelligent control strategies and implemented a multi-level (spatial and temporal) World Model to enable UGVs to execute a basic set of military behaviors.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGYPROJECT
H03**FY 2001 Accomplishments: (Continued)**

- Integrated perception and control technologies into a group of four UGV testbed platforms. Showed semi-autonomous cross-country mobility at speeds of up to 20 MPH (day), corresponding to 50% of the speed of a manned High Mobility Multipurpose Wheeled Vehicle (HMMWV), terrain dependent.

- Integrated new perception techniques (LADAR and Stereo Imaging) with advanced on-board intelligent vehicle control architecture to attain major increases in autonomous vehicle performance. Performance increases were evaluated on rugged, complex terrain at Ft. Knox, KY and on even more challenging terrain at Ft. Indiantown Gap, PA. Made all technical and logistical preparations necessary for Demo III, which comprises a set of technical and tactical evaluations to examine the maturity of autonomous mobility technologies (scheduled for 1Q FY02 at Ft. Indiantown Gap).

Total 13933

FY 2002 Planned Program

- 7928 - Execute industry/academic consortium for advanced perception, control/behavior and man-machine interface technology required for high-speed mobility (including robotic follower operations) and basic tactical behaviors common to multiple military missions.
- 8160 - Devise simulation based design tools for the development of tactical behaviors for UGVs.
 - Devise and integrate mid-range perception technology and control architecture required for development of tactical behaviors.
 - Integrate technology on testbed platforms and conduct engineering and troop experimentation to assess performance of perception and intelligent control algorithms.
- 7928 - Adapt and characterize sensors for autonomous navigation and mobility application in the ground combat environment with emphasis on affordability.
 - Expand test-bed infrastructure to enable accelerated autonomous mobility technology development through comprehensive field data collection and experiments.
 - Expand modeling and simulation infrastructure to enable accelerated autonomous mobility algorithm development and evolution.

Total 24016

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY

PROJECT
H03

FY 2003 Planned Program

- 8034 - Execute industry/academic consortium for advanced perception, control/behavior and man-machine interface technology to permit semi-autonomous cross-country mobility at speeds of up to 35 MPH during daylight and future implementation of complex tactical behaviors.
- 10979 - Integrate perception and control technology required for an intelligent follower vehicle capable of achieving 35 MPH on-road and 20 MPH off-road mobility (chassis limited) with a time delay between passage of the manned leader vehicle and unmanned follower of up to 12 hours.
 - Devise and implement baseline hard-coded tactical behaviors.
 - Integrate technology on testbed platforms, conduct engineering and troop experimentation for assessment of technology maturity, particularly with regard to inclusion in core FCS. Show tactical behaviors for "preceder" missions such as the autonomous utilization of terrain to mask movement and minimize vulnerability over multi-kilometer routes.

Total 19013

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY

PROJECT
H75

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H75 ELECTRIC GUN TECHNOLOGY	9374	4973	8325	9100	10971	10647	11084

A. Mission Description and Budget Item Justification: This project funds applied research for the Army Electromagnetic (EM) armaments technology program. To achieve the objectives of the Army Vision, future armored combat vehicles, including the Future Combat Systems (FCS), will require more lethal, yet compact main armament systems capable of defeating protection levels greatly in excess of currently experienced values. The goal of this project is to evaluate the potential of EM Armaments to field a leap-ahead capability by providing adjustable velocities, including hypervelocity, greatly above the ability of the conventional cannon. EM armaments potentially can be fully integrated with electric propulsion and electromagnetic armor systems to provide the efficient, highly mobile, and deployable armored force required by the nation. This project focuses on addressing technical barriers associated with an EM armament, in particular with pulsed power for electromagnetic (EM) launches. This project funds a new contractual effort to devise and evaluate an efficient pulsed power technology for electromagnetic (EM) launch. The goal is to provide pulsed power technology (rotating machines) with energy density of ten Joules per gram (J/g) and to identify a clear potential for growth required for future combat systems, expected to be greater than fifteen J/g. Efforts in EM pulsed power systems are conducted by Lockheed Martin - Missile and Fire Control - Dallas, TX; CEM - University of Texas - Austin, TX; Kaman Aerospace Corp. - Boston, MA; IAP - Dayton, OH; Maxwell - San Diego, CA; GE - NY; and LMCS - NY. This project funds applied research for the Army Electrothermal Chemical (ETC) gun technology program with contractual efforts by SAIC - San Diego, CA; UDLP - Minneapolis, MN; and Thiokol - Ogden, UT, in close collaboration with the Armaments Research, Development, and Engineering Center, Picatinny NJ, applying ETC technology to potential armament systems for the Future Combat System (FCS) in both medium and large caliber with the FY02 goal of increasing muzzle energy by 25%. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4674 - Completed design of EM armament system including projectile, launcher, and pulsed power system.
- Conducted experiments showing material properties of pulsed power components (composite bandings and arbors, conductors, thermal management components, and semi-conductors) for the pulsed alternator machine.
- Devised initial switch array for multi-phase, multi-pole control of pulsed power machine and built converter prototype for field energy recovery.
- Devised model of integrated EM gun system and applied to prediction of anticipated machine performance.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002****BUDGET ACTIVITY
2 - Applied Research****PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY****PROJECT
H75****FY 2001 Accomplishments: (Continued)**

- 2700 - Designed and built prototype EM launchers at 60-mm equivalent scale to demonstrate robust, lightweight performance
- 2000 - Showed controlled step-up toward increased muzzle energy goal of 25% in medium caliber ETC cannon using tailored solid propellants.
 - Proved ETC injector technology compatibility with cased telescope cartridges.
 - In coordination with ARDEC verified 40% reduction in recoil forces using ETC and Fire-Out-of-Battery technology.

Total 9374

FY 2002 Planned Program

- 3982 - Generate advanced high power switches for converters for EM pulsed power system.
 - Design and evaluate controller for multi-phase, multi-pole operation of pulsed power machine.
 - Conduct experiments on full-scale medium caliber launcher and launch package designs demonstrating robust, field-worthy attributes.
 - Utilize EM Gun technology component models for conducting system level simulations
- 991 - Show an optimal increase in muzzle kinetic energy with ETC for an FCS Multi-Role Armament System.
 - Identify fieldable ETC tailored propellant.

Total 4973

FY 2003 Planned Program

- 8325 - Finalize design of EM gun system and procure long-lead items.
 - Fabricate and prove full scale critical components and evaluate at design limits.
 - Fire fieldworthy 60-mm launcher and integrated launch packages to full muzzle energy at 2300 meters/second.
 - Analyze combat utility of EM equipped platforms.

Total 8325

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602618A - BALLISTICS TECHNOLOGY	PROJECT H80					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H80 BALLISTICS TECHNOLOGY	28938	31959	46756	34337	33536	31431	32166

A. Mission Description and Budget Item Justification: The goal of this project is to provide key technologies required for armor and armaments that will enable U.S. dominance in future conflicts across a full spectrum of threats. The program supports the Army Vision by focusing on more lethal and more deployable weapons and on survivability technologies to lighten and protect Future Combat Systems (FCS) and the Objective Force. The barrier to this challenge is to insure combat overmatch and the survivability of the FCS in spite of its light weight (less than 20 tons). Specific technology thrusts include: lightweight armors and structures to defeat existing and emerging ballistic threats; Kinetic Energy (KE) Active Protection (KEAP) to defeat/degrade threats before they reach the combat platform; crew and component protection from ballistic shock, mine-blast, and fuel or ammunition fires; insensitive high energy propellants/munitions to increase lethality of compact weapon systems and to reduce propellant/munition vulnerability to attack; novel KE penetrator concepts to maintain/improve lethality while reducing the size/mass of the penetrator; novel multi-function warhead concepts to enable defeat of full-spectrum of targets (anti-armor, bunker, helicopter, troops); smart projectile technologies for launch, flight, and precision strike; physics-based techniques, methodologies, and models to analyze combat effectiveness of future technologies for improved ballistic lethality and survivability. Prior to FY01, this project also provided key technologies for a new class of vehicle control that will enable an unmanned land combat vehicle to intelligently follow a manned combat vehicle (technology is funded and executed in Project H03 beginning in FY01). This new capability will enable a manned crew in a lightly armored vehicle to simultaneously expand its survivability and area of influence, maneuvering and engaging enemy forces without disclosing its own location. The work is conducted at the Army Research Laboratory, Aberdeen Proving Ground, MD and provides required technologies for advanced development programs at the Armaments Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ; the Tank and Automotive Research, Development and Engineering Center (TARDEC), Warren, MI; and the Aviation and Missile Research, Development and Engineering Center (AMRDEC), Huntsville, AL. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 22112 - Designed and characterized innovative, lightweight armor technologies and survivability concepts at FY01 goal weight to enable survivable Future Combat Systems (FCS).
 - Evaluated multi-disciplinary design tools that couple structural analysis, aerodynamics, and guidance, navigation, and control (GN&C) technologies and applied to novel flight control designs for precision munitions, missiles, and rockets.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY

PROJECT
H80

FY 2001 Accomplishments: (Continued)

- Implemented selected gun propellant formulations (sample sizes) in scaled ballistic studies to show improved performance and propellant integrity with reduced vulnerability for ARDEC Advanced Technology Demonstration Program.
- Evaluated and characterized muzzle flash sensor suites for threat cueing and radar tracking of KE penetrator in support of TARDEC-ARL-ARDEC Full Spectrum Active Protection Program; performed full-scale experiments and modeling optimization studies resulting in improved robustness of candidate KE counter-munition concepts.
- Devised physics-based models and conducted experimental evaluations of jacketed KE penetrator and unitary Warhead lethal mechanisms, which will improve FCS lethality while reducing size and mass.
- 409 - Proved out the feasibility of future large caliber ETC guns in joint US/GE firings. Evaluated 3 ETC igniter concepts and 2 ETC propellant technologies based on FY00 downselect.
- 6417 - Implemented experimentally derived penetration and behind-armor debris algorithms to predict the lethality of U.S. medium caliber munitions against foreign tanks and personnel carriers.
- Implemented empirically based combined blast and fragment algorithms to more accurately model the effects of high explosive incendiary projectiles on the survivability of the Objective Force, including ground combat systems and helicopters.

Total 28938

FY 2002 Planned Program

- 25155 - Evaluate second-generation lightweight armor technologies and apply modeling and simulation tools for improved performance of FCS armors and survivability concepts.
- Apply multi-disciplinary design tools, coupled with weapons effectiveness analyses, and maturing guidance, navigation and control (GN&C) technologies (DARPA, COTS, etc) to evaluate concepts for FCS precision munitions, missiles, and rockets.
- Characterize performance of high energy/acceptable vulnerability propellant formulation (GEN II) and transition to Armament Research Development & Engineering Center for implementation in advanced multi-role armament for FCS.
- Down-select optimum KE counter-munition defeat and sensor suite configurations for transition to full-scale KEAP breadboard demonstration.

- Improve fidelity of predictive models and perform optimization studies of selected gun and missile KE/Warhead lethal mechanism concepts.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602618A - BALLISTICS TECHNOLOGY

PROJECT
H80

FY 2002 Planned Program (Continued)

- 6804 - Characterize the ballistic-induced deformation of select composite armors and structural materials to predict the penetration and blast survivability of the FCS.
- Devise engineering-based predictions of crew acceleration and detonation/explosive reactions of stowed ammunition for Objective Force ground vehicles impacted by moderately overmatching ballistic munitions.

Total 31959

FY 2003 Planned Program

- 27769 - Optimize lightweight armor technologies for transition to FCS vehicle designers.
- Optimize multi-disciplinary design tools and fully characterize high-g GN&C components for application to future precision munitions, missiles, and rockets.
- Evaluate and characterize insensitive high-energy propellant candidates (ETC-specific) required for improving the performance and reducing the vulnerability of future missile and gun systems.
- Integrate selected KE counter-munition and sensor suite into breadboard KEAP system and commence testing to optimize system performance and improve compactness/hardening of KE penetrator defeat technologies.
- Breadboard selected KE/Warhead lethal mechanism components and transition to FCS armament designers for integration into KE missile or multi-role ETC ammunition.
- 7285 - Implement first generation advanced armor penetration algorithms in survivability/lethality analysis codes for sophisticated multi-layering schemes for multi-hit protection of U.S. Army ground systems and the Objective Force.
- Provide the survivability/lethality analysis code framework to dynamically model the interaction of an incoming conventional ballistic threat versus a ground combat vehicle equipped with an active protection system.
- 10902 - Investigate advanced componentry necessary to implement revolutionary armor technology onto a lightweight FCS armor platform.
- Optimize logic and control system to minimize space and weight claims of FCS armor system.
- 800 - Funds Reprogrammed for ARL lab management support.

Total 46756

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	3840	6529	3675	3940	3904	4461	4605
552 SMOKE/NOVEL EFFECT MUN	3840	3529	3675	3940	3904	4461	4605
BA1 BIOTECHNOLOGY	0	2000	0	0	0	0	0
CA1 THERMOBARIC WARHEAD DEVELOPMENT	0	1000	0	0	0	0	0

A. Mission Description and Budget Item Justification: The goal of this Program Element (PE) is to increase personnel and platform survivability by researching and investigating enhanced smoke and obscurant technologies. The PE funds applied research in materials science and dissemination technologies to counter enemy weapon target acquisition systems and to provide the ability to degrade enemy surveillance capability. Improved multispectral obscurant materials are sought that will 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. The material and dissemination systems will be designed to be safe and environmentally acceptable. Efforts under this PE transition to Program Definition and Risk Reduction (PDRR), and System Development & Demonstration (SDD) programs. Work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This PE contains no duplication with any effort within the Military Departments. This work is performed by the U.S. Army Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD. This work supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	3497	3561	3589
Appropriated Value	3530	6561	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-32	0
b. SBIR / STTR	-77	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	420	0	0
e. Rescissions	-33	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	86
Current Budget Submit (FY 2003 PB)	3840	6529	3675

Change Summary Explanation:

Significant Change: FY02 congressional adds totaling \$3M (as noted below) were added to this program element.

FY02 - Congressional adds were made for Thermobaric Warhead Development, Project CA1 (\$1000); and Biotechnology, Project BA1 (\$2000).

No R-2A required:

- (\$1000) Thermobaric Warhead Development, Project CA1: The objective of this one year Congressional add is to evaluate blast and thermal effects of prototype thermobaric munitions. No additional funding is required to complete this project.
- (\$2000) Biotechnology, Project BA1: The objective of this one year Congressional add is to support basic and applied research in emerging biotechnology areas with high potential for future Army applications. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602622A - Chemical, Smoke and Equipment Defeating Technology	PROJECT 552					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
552 SMOKE/NOVEL EFFECT MUN	3840	3529	3675	3940	3904	4461	4605

A. Mission Description and Budget Item Justification: Project 552 researches and investigates smoke and obscurant technologies to increase personnel/platform survivability and to provide the ability to degrade enemy surveillance sensor capability. Improved multi-spectral smokes/obscurants are explored to enhance survivability by providing effective, affordable, and efficient screening of deployed forces from threat force surveillance sensors and effective defeat of target acquisition devices, missile guidance, and directed energy weapons. These systems will be designed to be safe and environmentally acceptable. Modeling and simulation will be investigated to predict performance and analyze strategic use of obscurants on the battlefield. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2000 - Researched advanced Infrared (IR) obscurants for potential use in IR smoke pots and IR projected munitions, capabilities that the Army does not have currently. The goal is to achieve 4 times the extinction performance of current materials in order to meet performance, logistics, and affordability criteria for the obscurant applications.
 - Researched particle characteristics for optimal IR obscurant performance utilizing theoretical models; solicited Materials Science solutions from industry for IR obscurants; developed a cooperative work plan that includes foreign emissive and pyrotechnic IR and multi-spectral concepts as part of an International Task Force on Obscurants.
- 1840 - Evaluated obscurant concepts for Distant Smoke System.
 - Evaluated IR propellant dissemination in smoke pot configuration. Investigated additional smoke pot dissemination techniques.
 - Investigated smoke simulation in Combined Arms Tactical Trainer and OneSAF models. Conducted case study in maneuver operations and initiated one case study in urban operations.
 - Investigated novel propellant dissemination technology to provide enhanced vehicle obscuration protection in support of FCS.
 - Analyzed data and documented results of initial prototype field evaluations of the cloud characteristics produced from obscurant propellant dissemination technologies.

Total 3840

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

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

PROJECT
552

FY 2002 Planned Program

- 2000 -Continue investigation of advanced IR obscurants leading to improved performance for use in IR smoke pots and projected munitions. Continue to solicit new IR materials from industry and academia. Identify defeat mechanisms of IR sensors. Develop new laboratory/chamber measurement techniques.

- 1529 - Continue development of Distant Smoke System in preparation for demonstration in FY03.
 - Assess performance of promising smoke pot configurations.
 - Continue to investigate and upgrade simulation tools to evaluate Smoke/Obscurant systems in urban environment.
 - Continue to investigate technology to provide enhanced vehicle obscuration protection in support of FCS.

Total 3529

FY 2003 Planned Program

- 2100 - Investigate laboratory dissemination techniques for new advanced IR obscurants; evaluate promising candidate IR obscurants. Prepare to transition results for FCS application.

- 1575 - Conduct Distant Smoke System demonstration. Transition technology to Program Development/Risk Reduction.
 - Incorporate IR obscurants into Smoke Pot configuration.
 - Conduct modeling and simulation case studies to predict and analyze performance of Distant Smoke, Smoke Pot, and other obscurant technologies.

 - Perform field experiments to provide enhanced vehicle obscuration protection in support of FCS.

Total 3675

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602623A - JOINT SERVICE SMALL ARMS PROGRAM	PROJECT H21					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H21 JT SVC SA PROG (JSSAP)	5223	5560	5812	5891	6208	6411	6720

A. Mission Description and Budget Item Justification: This Program Element (PE) investigates and researches key individual and crew-served weapon technologies that will enable the Army Transformation to the Objective Force by enhancing the fighting capabilities and survivability of dismounted battlefield personnel of the Services. Funded efforts include component technologies for: the Objective Crew-Served Weapon (OCSW); the Objective Individual Combat Weapon (OICW) System Enhancements; Light Fighter Lethality; and Advanced Medium Machine Gun Technology. OCSW provides the next generation crew-served weapon with improved combat effectiveness, including bursting munitions technology to provide 500%+ increase in probability of target incapacitation at extended range (to 2000m) with the capability to hit protected personnel targets in defilade (obscured or non-visible), and a 65-75% reduced weight over weapons it replaces. The OCSW is designed to replace selected M2 machine guns, MK19 grenade machine guns and M240 machine guns. The OICW System Enhancement efforts develop lethality-enhancing and cost-reducing technologies for OICW. The Light Fighter Lethality effort provides smart munition based weapon system technologies that will reduce dramatically warfighter system weight (25-50% weapon weight reduction), provide near 100% lethality, and maximize operational utility and survivability for the Objective Force. The Advanced Medium Machine Gun Technology effort provides technologies for a lighter, more effective and versatile replacement for current 7.62mm medium machine guns. The technology enhancement efforts of this PE will assure that the Objective Family of Small Arms (OFSA), the next generation of weapons systems, continues to overmatch the evolving threat and address the needs of the Objective Force. All Joint Service Small Arms Program (JSSAP) efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP), Mission Needs Statements and Operational Requirements Documents of the Services. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program is primarily managed by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey. Work in this PE is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), and PE 0603607A (Joint Service Small Arms Program). Transition paths have been established in coordination with Product Manager (PM) Small Arms, USMC Director Ground Weapons and US Special Operations Command (SOCOM). This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602623A - JOINT SERVICE SMALL ARMS
PROGRAM**PROJECT
H21**FY 2001 Accomplishments:**

- 2811 - Evaluated OCSW gun launched (burst mode), fully functional, precision airburst fuze with target practice-spotter function (without point detonation and self destruct function); demonstrated Land Warrior interface and thermal module interface of OCSW; conducted initial planning and preparations for OCSW Advanced Technology Demonstration (ATD) technical and troop testing.
- 1415 - Tested and evaluated breadboard MEMS safe and arming design, employing Micro Energetic Initiation (MEI) for OICW System Enhancement to confirm feasibility of reduced fuze cost, weight and volume in preparation for technology insertion to OICW development.
- 997 - Conceptualized preliminary individual system designs addressing substantial lethality increases for Light Fighter Lethality.

Total 5223

FY 2002 Planned Program

- 2216 - Conduct User training with virtual OCSW simulator; complete plan and preparations for OCSW ATD technical and troop testing (Early Operational Assessment).
- 3344 - Complete design and verification of Light Fighter Lethality critical sub-system designs through constructive simulation, individual and force on force empirical performance, leading to final design selection and fabrication of test hardware.

Total 5560

FY 2003 Planned Program

- 1609 - Complete design and build of Light Fighter Lethality course correcting seeker projectile for potential advances in lethality.
- 1808 - Test and evaluate Light Fighter Lethality course correcting seeker projectile performance for improved hit probability and target effects.
- 1373 - Conduct Early Operational Assessment/User testing of OCSW.
- 1022 - Conduct initial secondary armament interface effort in support of Future Combat System.

Total 5812

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602623A - JOINT SERVICE SMALL ARMS PROGRAM

PROJECT
H21

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	5365	5611	5775
Appropriated Value	5415	5611	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-51	0
b. SBIR / STTR	-142	0	0
c. Omnibus or Other Above Threshold Reduction	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-50	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	37
Current Budget Submit (FY 2003 PB)	5223	5560	5812

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	46722	65197	38090	37961	42422	41266	44052
H18 ARTY & CBT SPT TECH	11883	16355	12930	13238	16008	15386	16634
H19 CLOSE COMBAT WEAPONRY	17429	10250	10680	10570	12713	12964	13350
H1A WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	2884	0	0	0	0	0	0
H28 MUNITIONS TECHNOLOGY	14526	25692	14480	14153	13701	12916	14068
WA2 GREEN ARMAMENTS TECHNOLOGY	0	5200	0	0	0	0	0
WA3 CORROSION MEASUREMENT AND CONTROL	0	4300	0	0	0	0	0
WA4 ARMAMENT SYSTEMS NETWORK IA CENTER	0	3400	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) researches improved weapon and munitions technologies to enable combat overmatch for the Objective Force. Efforts are focused on meeting requirements of the Future Combat Systems (FCS). This PE funds applied research that will result in increased system lethality and survivability with the potential for better affordability, lower weight and reduced size. Specific projects within the PE include: the FCS Multi-Role Armament and Ammunition System (MRAAS) Advanced Technology Demonstration (ATD) and associated enabling technologies; advanced sensors for smart munitions; Agile Target Effects systems for the battlefield; and the Responsive Accurate Mission Module (RAMM). The MRAAS will be a direct and indirect fire system for FCS designed to exceed the lethality of the Abrams main battle tank with a lighter and more advanced 105mm cannon system. It uses advanced materials, advanced recoil techniques, and Electrothermal-Chemical (ETC) propulsion to overcome the challenges of creating a smaller, lighter armament system with lethality equaling or exceeding that of current systems. The current government baseline for FCS Multi-Role Ammunition is a three-cartridge suite that provides overwhelming lethality at ranges up to 50 km, with increased weapon delivery accuracy. Specific efforts in explosives, propellants, fuzing, and warhead technology are the pacing technologies in support of the ammunition suite. Advanced Sensors for Smart Munitions will enhance current smart sensors for use in the ammunition suite. RAMM provides technologies for an advanced mortar for FCS manned or tele-operated ground vehicles. The PE funds development of modeling and analytic codes for thermal analysis and high impetus, low flame temperature propellants to reduce wear on gun tubes (which degrades accuracy and increases the system cost); advanced armament fire control, decision aids and software architecture; advanced laser radar/infrared (LADAR/IR) sensor technology to enhance performance of smart munitions; technology advances in acoustic sensors; advanced wear and erosion resistant barrel coatings to increase service life and provide an environmentally friendly barrel coating process; thermal management of high performance, high rate of fire, large caliber guns; ways to make artillery systems more flexible and deployable through range extension and weight reduction technologies; and smart materials to improve accuracy and reduce operational and support (O&S) costs.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology

The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. The U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey primarily manages this program. Work in this PE is related to, and fully coordinated with, efforts in PE 0602618A (Ballistics Technology) and PE 0602623A (Joint Service Small Arms Program (JSSAP)), and its technologies typically transition to PE 0603004A (Weapons and Munitions Advanced Technology) and PE 0603802A (Weapons and Munitions Advanced Development). This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	47817	35549	33255
Appropriated Value	48261	65649	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-452	0
b. SBIR/STTR	-1095	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-444	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	4835
Current Budget Submit (FY 2003 PB)	46722	65197	38090

Change Summary Explanation:

Significant Change: FY02 congressional adds totaling \$30.1M (as noted below) were added to this program element.

FY02 - Congressional adds were made for Corrosion Measurement and Control, Project WA3 (\$4300); Future Combat System Propellant and Survivability, Project H28 (\$2800); Green Armaments Technology, Project WA2 (\$5200); Liquidmetal Alloy-Tungston Alloy Penetrator, Project H28 (\$3400); Multiple Explosively-Formed Penetrators, Project H28 (\$1000); Single Crystal Tungston Alloy Penetrator, Project H28 (\$2000); Smart Coatings, Project H18

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002****BUDGET ACTIVITY
2 - Applied Research****PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology**

(\$1000); Armament Systems Network IA Center, Project WA4 (\$3400); Army COE Acoustics, Project H18 (\$3500); and Cooperative Energetics Initiative, Project H28 (\$3500).

No R-2A required:

- (\$4300) Corrosion Measurement and Control, Project WA3: The objective of this one year Congressional add is to develop methods to inhibit corrosion on Army materiel. No additional funding is required to complete this project. COMPLETE 4QFY02
- (\$5200) Green Armaments Technology, Project WA2: The objective of this one year Congressional add is to develop "green" (environmentally friendly) ammunition as well as to fund UXO prevention and detection technology. No additional funding is required to complete this project. COMPLETE 4Q02
- (\$3400) Armament Systems Network IA Center, Project WA4: The objective of this one year Congressional add is to develop a secure communication system for fire control applications. (This is a cooperative program with CECOM on cyber security.) No additional funding is required to complete this project. COMPLETE 4Q02

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology

PROJECT
H18

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H18 ARTY & CBT SPT TECH	11883	16355	12930	13238	16008	15386	16634

A. Mission Description and Budget Item Justification: This project focuses on applied research of technologies for multi-role cannon, mortar weapon, smart cargo projectile, and fire control and combat support systems in support of FCS and the Objective Force. Specific efforts include FCS MRAAS; RAMM; Combat Decision Aids Software (CDAS); QuickLook; Advanced Sensors for Smart Munitions; Advanced Acoustic/Seismic Systems; and Extended Range Mortar Cartridge (ERMC). Recoil management and lightweight materials technologies are being investigated to create a more lethal, lightweight FCS Multi-Role Armament, utilizing ETC propulsion. The objective of the system is to provide multi-mission lethality that is air transportable in a C-130 aircraft. Also being pursued is the corresponding FCS Multi-Role Ammunition suite, which includes technologies for achieving both revolutionary fire support lethality and precision point target defeat at extended ranges in lighter and smaller configurations. The RAMM lightweight mortar concept will be developed to a maturity level suitable for insertion into FCS. Development of CDAS supports the FCS multi-mission fire control systems. This software will enable groups of fighting vehicles and attack helicopters to fight in unison by coordinating their fires against targets, substantially improving battlefield survivability and operations tempo. With the CDAS, targets can be assigned automatically to individual shooters, based on the most effective pattern to ensure rapid first-shot execution and progression to the next target assignment. QuickLook will provide the brigade commander with real time target imagery, target coordinates, and battle damage assessment (BDA). This system will utilize an artillery launched loitering munition that flies out to a maximum range of 50 km, acquires the target and transmits targeting information, such as video and/or Global Positioning System (GPS) coordinates, back to the tactical operations center via a wireless link. Advanced acoustic sensors will be investigated for providing non-line of sight target cueing for a variety of weapons platforms. The application of light-weight, high-strength composites to mortar projectiles is being pursued to extend range significantly while providing increased lethal effectiveness, such as the ERMC program. Technologies for reducing artillery target location error and for providing to fire direction centers real time targeting and battle damage assessment data are being matured to support information dominance strategies for FCS. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4531 - Conducted system trade-off studies, fabricated sensor hardware for captive flight tests and performed tower tests on alternate sensor designs with a common aperture LADAR/IR transducer for detection of low observable; further identified and investigated critical technologies; updated and matured models; validated virtual simulations for stability, precision and accuracy; pursued evaluation of ER recoil management, isogrids and load out of battery technologies in support of FCS Multi-Role Armament; performed a system concept analysis of the RAMM lightweight mortar design for integration into a FCS platform or the Robotic Follower.

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2 - Applied Research

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PROJECT
H18

FY 2001 Accomplishments: (Continued)

- 3154 - Completed concept evaluation of an architecture-based software component factory process for rapid generation of embedded fire mission application software at the Depth and Simultaneous Attack Battle Lab; completed CDAS multi-shooter algorithms maturation; analyzed and optimized the algorithms in a CDAS dedicated Modular Semi-Automated Forces (ModSAF) emulation environment; characterized multi-shooter algorithm performance; collected acoustic signatures of Multiple Launch Rocket System (MLRS), cruise missiles and mortars to expand detection data base capability; evaluated modeling for target location and tracking capabilities using non-real time data and assess improvements in operational effectiveness; investigated advanced detection, classification and tracking algorithms for advanced acoustic/seismic sensors.
- 4198 - Integrated QuickLook system components and performed integrated captive flight test; exhibited improved cannon wear life (Crusader) in wear testing; verified design improvements for stockpiled ammunition; fabricated prototype hardware and conducted limited short range flight test of the ERMIC; conducted review of mission requirements; conducted concept analysis, design trades and preliminary concept design of a smart cargo projectile for FCS Multi-Role cannon.

Total 11883

FY 2002 Planned Program

- 6426 - Conclude system trade-off studies and sensor suite packaging analysis; finalize design and begin fabrication of tactical sensor hardware for smart munitions; complete virtual model, design and fabrication of lightweight cannon system components for verification of key technologies and integration into a turreted armament demonstrator for FCS; finalize the hardware design of the RAMM mortar system and autoloader/magazine.
- 2232 - Evaluate integrated acoustic cuers on Strikers for AN/TPQ-36/37 (Fire Finder radar) and transmit detection messages to the fire director center; incorporate advanced detection, classification and tracking algorithms/ software into acoustic sensor testbeds, then validate the modeling predictions with sensor improvements.
- 3197 - Conduct an evaluation demonstration of the QuickLook system, detecting and locating targets in real-time, using battlefield imagery and GPS coordinates; prove concept effectiveness for the smart cargo projectile; perform aeroballistic simulations and in-flight update analyses, and conduct sub-scale wind tunnel test of airframe.
- 1000 - This one year Congressional add (Smart Coatings) will develop (and complete development of) coatings for Army materiel that are self-healing and have advanced attributes such as providing camouflage. No additional funding is required to complete this project.
- 3500 - This one year Congressional add (Army COE Acoustics) will develop (and complete development of) acoustic sensor systems for FCS applications. No additional funding is required to complete this project.

Total 16355

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
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H18**FY 2003 Planned Program**

- 6245 - Fabricate smart sensor component hardware and perform high-Gee test; complete generation of system simulation models; establish a virtual battlefield model and conduct a performance analysis of the RAMM mortar system.
- 2298 - Integrate acoustic and seismic modeling capabilities; provide critical acoustic sensor components for artillery delivery; implement advanced acoustic sensor networks.
- 4387 - Fabricate smart cargo projectile test hardware for high-Gee testing and full-scale wind tunnel testing; conduct maneuverability analysis and preliminary guidance and control design for laboratory testing; complete fabrication of hardware and conduct breadboard demonstration of a Multi-Purpose Extended Range Munition (MP-ERM) air frame projectile; fabricate hardware for maneuver mechanism and guidance and control airgun tests.

Total 12930

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602624A - Weapons and Munitions Technology	PROJECT H19					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H19 CLOSE COMBAT WEAPONRY	17429	10250	10680	10570	12713	12964	13350

A. Mission Description and Budget Item Justification: This project focuses on applied research of technology for maneuver and fire support cannon armament systems in support of FCS and the Objective Force. The project funds research in technologies that will result in significantly greater lethality with more accurate delivery, significantly reducing logistics footprint while reducing life cycle costs for ground and air combat platforms. This project provides opportunities for longer range, more accurate and more lethal cannon systems for armored vehicles, to include enabling technologies to support FCS. Principal efforts support the ammunition suite for the FCS MRAAS and MP-ERM for rapid extended range defeat of high value targets out to 8km+, expanding the maneuver commander's battle area 7-fold. This project funds modeling and simulation of advanced armament systems leading to application for FCS. Cannon design technologies include: recoil mitigation techniques for use of large caliber cannons on lightweight (less than 20 ton) vehicles and novel chamber configuration, leading to overall compact armament system configurations. Advanced barrel coating technology, utilizing cylindrical magnetron sputtering (CMS) of refractory alloys, is being pursued to provide extended barrel life for tanks, artillery and FCS cannon systems, with potential to provide an environmentally friendly process as a future replacement for chrome plating. This PE will develop advanced multi-mode fuzing technologies including some lower cost, self-destruct technologies for submunitions that could reduce unexploded ordnance on the battlefield and provide low cost electronic safe and arm devices for single and future multi-mode warheads. The project also develops extended range munitions and alternative mechanisms to defeat advanced armor systems. Both hardware and analytical tools will be developed and used to assess system performance, identify problem areas and develop solutions. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 1467 - Completed first phase of CMS process to apply tantalum cannon bore coatings to full-length medium (25mm) and full length large (120mm) caliber gun barrels; conducted firing tests and completed correlation of results to analytical modeling; transitioned CMS process to industry for medium caliber applications and to on-going Manufacturing Technology Objective (MTO) for large caliber scale-up for application to tank, artillery, Naval Fire Support, and FCS.
- 1894 - Completed testing to characterize effects of combined directed energy sources on threat targets; completed detailed design of Agile Target Effects weapon system for tactical range FCS secondary armament application against sensors and UAVs.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002****BUDGET ACTIVITY
2 - Applied Research****PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology****PROJECT
H19****FY 2001 Accomplishments: (Continued)**

- 4384 - Completed fabrication of lightweight/low impulse launcher for FCS; completed a proof-of-principle demonstration of recoil mitigation technology of 50% reduction in recoil force; completed detailed design of lightweight/low impulse launcher for FCS Multi-Role Cannon System; determined feasibility of propulsion and launch system to launch a surrogate family of munitions at desired velocities in sub-scale firing; established best technical approaches for Multi-Role Cannon Munition development.
- 2145 - Completed electronic safe and arm fuzing design for multi-mode warhead for missiles and smart munitions FCS application; completed concept design for advanced kinetic energy (KE) munitions configuration for defeat of advanced armors to 4km.
- 700 - Matured enhanced target defeat mechanism for light armor targets using novel penetrators for increased penetration and behind armor effects.
- 2885 - This one year Congressional add conducted component demonstrations of technologies (sensors, diversion thrusters, etc.) providing significantly lower cost course correction of conventional direct fire ammunition, eliminating most system accuracy errors for ground/air platform. No additional funding is required to complete this effort.
- 3954 - This one year Congressional add demonstrated, through experimental testing, increased armor penetration of co-linear Explosively Formed Penetrators (EFP) warheads. No additional funding is required to complete this effort.

Total 17429

FY 2002 Planned Program

- 5400 - Complete fabrication of lightweight, low impulse Multi-Role Cannon for FCS and conduct non-firing functional demonstration.
- 500 - Complete medium caliber novel KE penetrator target effects evaluation and downselect to best technical approach.
- 1709 - Fabricate Agile Target Effects Weapon System directed energy sources for FCS secondary armament ground/air vehicle sensor personnel, unmanned air vehicle defeat.
- 2641 - Validate FCS KE Munition launch package (novel penetrator with composite sabot) function from FCS ammo configuration; conduct electronic safe and arm fuzing initiation accuracy for multi-point detonations.

Total 10250

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2 - Applied Research

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PROJECT
H19

FY 2003 Planned Program

- 3985 - Complete fabrication of Agile Target Effects Weapon System directed energy sources; complete brassboard integration with surrogate power supply
- 6695 - Complete FCS KE Munition function and armor tests at extended ranges; complete integrated function tests of electronic safe and arm fuzing on inert warhead.

Total 10680

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602624A - Weapons and Munitions Technology	PROJECT H28					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H28 MUNITIONS TECHNOLOGY	14526	25692	14480	14153	13701	12916	14068

A. Mission Description and Budget Item Justification: This program advances the state of the art for enabling technologies supporting the FCS and the Objective Force. The project focuses on achieving increased lethality using smaller and lighter weapon systems with smaller and lighter armaments. The project funds development of: warheads, both shaped charge (SC) and EFP; high energy explosives; large-caliber gun propellants with barrel wear reducing additives; insensitive munitions (IM); energetics; advanced materials/processes for warheads; and techniques/processes to address material corrosion. Advanced warhead design, novel initiation techniques and advanced material technologies are being applied to produce smaller, lighter, more effective, multi-role warheads having advanced warhead liners to defeat existing and projected targets more efficiently. High-energy, high-density explosives are being developed to increase lethality and optimize design performance. New improved energetic materials developed provide numerous transition opportunities for weapon system upgrades and FCS. Developmental high-impetus propellant formulations, optimized for ETC initiation, offer increased muzzle kinetic energy, precision ignition and unmatched repeatability. The integrated propellant and explosive insensitive munitions (IM) developed will increase the battlefield survivability of land combat systems and enhance overall safety at manufacturing plants, storage depots, and during air and sea transport. Analysis and development of Multiple-EFP warheads support the Army's Full Spectrum Active Protection System (APS) research and development, performed by the Tank Automotive and Armaments Command's Tank Automotive Research Development and Engineering Center (TACOM-TARDEC) under Program Element (PE) 0603005A. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 2389 - Fabricated two high-energy and high-blast explosive candidate formulations to optimize FCS multi-purpose warhead.
- 4091 - Optimized the compact SC warhead concept design for a shorter/lighter munition. Optimized the collinear EFP warhead prototype for enhanced performance.
- 1920 - Matured ETC Generation II propellant formulations for FCS ETC applications. Initiated charge designs for the FCS Cased-Telescoped cartridge configuration and propulsion performance test and evaluation in scaled (30mm) and large caliber (105mm) test beds.
- 1800 - Conducted dynamic testing of modified multiple EFP warhead designs against slow-moving chemical energy (CE) and fast-moving KE threats as the kill mechanism for APS system applications.
- 4326 - The purpose of this one year Congressional add was to evaluate the viability and affordability of single crystal tungsten alloy material as a KE penetrator. Validated ballistic performance comparable to depleted uranium (DU) along with a viable manufacturing process.

Total 14526

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology

PROJECT
H28

FY 2002 Planned Program

- 2178 - Select, fabricate and deliver high-energy and high-blast insensitive explosive formulations for FCS multi-purpose warhead concept testing. Continue formulation insensitivity improvements and testing.
- 4642 - Conduct laboratory demonstration of the multi-purpose SC warhead and the maturing Collinear EFP warhead concepts.
- 1541 - Prove feasibility of Generation II ETC gun propellant for FCS cartridge applications providing a 25% increase in performance.
- 1631 - Prove feasibility of an enhanced multiple EFP warhead for APS applications against both CE and KE threats, with the goal of producing zero residual penetration (i.e., penetration potential remaining after active protection system intercept penetration on target).
- 3000 - Conduct laboratory demonstrations of revolutionary Generation II EFP and Compact SC warhead designs for FCS multi-role ammo suite and common missile; show greater than 3 times penetration increase in reduced size warhead; show compact SC size reduction by 1/2 while maintaining penetration capability.
- 2800 - This one year Congressional add (Future Combat System Propellant and Survivability) develops (and completes development of) advanced propellants to meet the propulsion and survivability requirements of the MRAAS. No additional funding is required to complete this project.
- 3400 - This one year Congressional add (Liquidmetal Alloy-Tungsten Alloy Penetrator) demonstrates (and completes demonstration of) an alternative material to replace depleted uranium (DU) for use in medium caliber KE penetrator munitions for the Army, Navy and Air Force. No additional funding is required to complete this effort.
- 1000 - This one year Congressional add (Multiple Explosively-Formed Penetrators) develops (and completes development of) a unique EFP warhead capable of breaching obstacles, concrete walls and other targets from a man-portable system. No additional funding is required to complete this project.
- 2000 - This one year Congressional add (Single Crystal Tungsten Alloy Penetrator) evaluates (and completes evaluation of) the viability and affordability of single crystal tungsten alloy material as a KE penetrator and validates ballistic performance compared to that of DU; explores viability of a manufacturing process. No additional funding is required to complete this project.
- 3500 - This one year Congressional add (Cooperative Energetics Initiative) allows the Army to leverage applicable ARDEC technologies with mining, construction and drilling industries research and development for Dual-Use Science and Technology applications. No additional funding is required to complete this project.

Total 25692

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February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology

PROJECT
H28

FY 2003 Planned Program

- 3435 - Prove feasibility of an environmentally friendly, pilot-scale process for selected explosive formulation. Deliver 200 pounds of the candidate high-energy and high blast insensitive explosive formulations for testing in FCS warheads.
- 4789 - Tailor selected multi-purpose SC and EFP warhead designs for fabrication in the optimum FCS munition configuration.
- 1593 - Fabricate, characterize and assemble developmental FCS propellant charges for full-up firing demo of ETC propulsion capability in FY04.
- 1663 - Conduct dynamic tests of APS warhead design to validate warhead effectiveness against both CE and the more challenging KE threats.
- 3000 - Research smaller, more lethal EFPs. Conduct form, fit and function of potential EFP warheads tailored for FCS Mid-Range Munition for FCS; fabricate hardware, perform analyses and proof-of-principle demonstration on small scale EFP samples.

Total 14480

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602705A - ELECTRONICS AND ELECTRONIC DEVICES

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	40144	49965	27448	30167	31664	32618	35831
EM4 ELECTRONIC DISPLAY RESEARCH	0	9000	0	0	0	0	0
H11 BATTERY/IND POWER TECH	20621	17849	4689	4567	4811	4982	5085
H94 ELEC & ELECTRONIC DEV	19523	23116	22759	25600	26853	27636	30746

A. Mission Description and Budget Item Justification: The work under this program element provides enabling capabilities for the Objective Force by researching and investigating technologies to perform precision deep fires against critical mobile and fixed targets, to provide exceptional all-weather, day or night, theater air defense against advanced enemy missiles and aircraft, and to provide electronic components, power components, and low-cost, lightweight, high-energy density power sources for communications, target acquisition, and miniaturized displays, for applications such as the Future Combat Systems (FCS) and soldier systems. This program consists of research in the physical sciences essential to all land combat systems that contain electronics, photonics, magnetic materials, ferroelectrics, microwave and millimeter-wave components, batteries, electromechanical systems (engine generator sets) and fuel cells. Supported systems include FCS, soldier systems, autonomous missile systems, advanced land combat vehicles, smart anti-tank munitions, electric weapons, secure jam-resistant communications, automatic target recognition (ATR), foliage-penetrating radar, combat identification, and digitizing of the battlefield. This program supports the in-house applied research effort at a single Army site, which serves as both the center for display technology and the center for frequency control and timing for the Army, Navy, Air Force, and Ballistic Missile Defense Organization. It supports all of the science and technology thrust areas that employ electronic and portable power-source technology. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory and the Army Communications and Electronics Research Development and Engineering Center Fort Monmouth NJ. This PE supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602705A - ELECTRONICS AND ELECTRONIC DEVICES

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	40891	27819	27312
Appropriated Value	41269	50319	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-354	0
b. SBIR / STTR	-747	0	0
c. Omnibus or Other Above Threshold Adjustments	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-378	0	0
Adjustments to Budget Years Since FY2001 PB	0	0	136
Current Budget Submit (FY 2003 PB)	40144	49965	27448

Change Summary Explanation:

Significant Changes:

FY02 - Congressional adds totalling \$22500 (as noted below) were added to this PE in FY02.

FY02 Congressional Adds:

Cylindrical Zinc-Air Battery for Land Warrior System, Project H11 (\$1800); Electronic Display Research, Project EM4, (\$9000); Fuel Cell Power Systems, Project H11 (\$2500); Improved High Rate Alkaline Cell, Project H11 (\$1000); Logistics Fuel Reformer, Project H11 (\$1000); Low Cost Reusable Alkaline Manganese-Zinc, Project H11 (\$600); Polymer Extrusion/Multilaminate (Battery Research), Project H11 (\$2600); Rechargeable Cylindrical Cell System, Project H11 (\$1500); TOW ITAS Cylindrical Battery Replacement, Project H11 (\$1500); Heat actuated Coolers for Portable Mil Apps, Project H11 (\$1000).

Projects with No R-2A:

Project EM4 (\$9000) Electronic Display Research - The objective of this one year Congressional add is to investigate high definition Flat Panel Electronic Displays for military applications. No additional funds are required to complete this project.

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February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602705A - ELECTRONICS AND ELECTRONIC
DEVICES**

PROJECT
H11

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H11 BATTERY/IND POWER TECH	20621	17849	4689	4567	4811	4982	5085

A. Mission Description and Budget Item Justification: This project conducts applied research to improve power generation and management technologies for the Objective Force. Researches advancements in energy conversion, electrochemistry, and signature suppression technologies including battery (primary and rechargeable), fuel cell, thermoelectric, hybrid, and electromechanical power sources. This project investigates small, low-cost, environmentally compatible, high energy density sources of power for communications, target acquisition, miniaturized displays, silent watch and future soldier systems. These technologies support reduced acquisition and operation and support costs. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 875 - Established the most cost effective, safe, high performance primary battery with greater than 300 watt-hours per kilogram; completed initial applied research of a high energy rechargeable lithium-ion battery with non-flammable electrolyte for C4IEWS applications; completed research and tested manpack metal-air battery powered recharging system with universal smart charging cable for light infantry C4IEWS equipment.
- 730 - Completed integration of power components/subassemblies in a 5 kilowatt engine driven generator system design; implemented tests to ensure proper operation of power electronics subsystems; integrated the power electronics subsystem into a power-on-the-move tactical vehicle.
- 1286 - Characterized battery/battery hybrid for size, weight, and cost; designed and built kinetic energy harvesting system for charging soldier system batteries; designed efficient 500 watt TPV system for soldier support applications; tested and demonstrated hydride fuel cell model for soldier system.
- 840 - Evolved design tools for low power system design; matured power management techniques for reducing power consumption for Land Warrior.
- 144 - Integrated model power source for an uncooled infrared sensor into a 3 pound weapon sight prototype.
- 1444 - Achieved objective of this one-year Congressional add for Portable Hybrid Electric Power Research and Polymer Extrusion: matured a fuel cell/battery hybrid power source.
- 1925 - Achieved objective of this one-year Congressional add for AA Zinc Air Battery Production: matured a low cost primary battery for forward area recharging.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602705A - ELECTRONICS AND ELECTRONIC
DEVICES**PROJECT
H11**FY 2001 Accomplishments: (Continued)**

- 1155 - Achieved objective of this one-year Congressional add for Improved High Rate Alkaline Cell: matured high rate, low cost AA, D cells for night vision devices.
- 866 - Achieved objective of this one-year Congressional add for Lithium Carbon Monofluoride Coin Cell: matured a primary battery for memory backup/extended power.
- 1540 - Achieved objective of this one-year Congressional add for Rechargeable Cylindrical Cell Systems: matured lithium ion cells for soldier systems.
- 481 - Achieved objective of this one-year Congressional add for Low Cost Reusable Alkaline Manganese-Zinc: matured low cost rechargeable batteries for training.
- 1829 - Achieved objective of this one-year Congressional add for AA Zinc Air Battery for Military Applications: matured high speed fabrication techniques for zinc-air batteries.
- 962 - Achieved objective of this one-year Congressional add for Portable Hybrid Electric Power Research and Polymer Extrusion: matured extrusion technologies for polymer electrolytes.
- 1925 - Achieved objective of this one-year Congressional add for Extrusion of Polymer Electrolytes and Polymer Multilaminate Materials: matured extrusion technologies for polymer electrolytes and polymer multilaminate materials.
- 1925 - Achieved objective of this one-year Congressional add for Logistics Fuel Reformer Technology: matured a logistics fuel reformer for portable fuel cells.
- 2694 - Achieved objective of this one-year Congressional add for Phase III of Intelligent Power Control for Sheltered Systems and Vehicles: matured a power management/load leveling system for shelters.

Total 20621

FY 2002 Planned Program

- 1261 - Test, in the field, a forward area battery charging system comprised of a high energy metal-air battery and smart charging cables; provide a prototype battery with energy density greater than 300 watt hours/kilogram, and evaluate a proof-of-concept electrochemical capacitor for hybrid digital pulse C4I applications with 10 times power density and two to four times energy density, integrated into a hybrid power source for field testing in digital pulse C4I and high-power vehicle applications that lasts more than three times the battery alone in the same envelope.

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February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602705A - ELECTRONICS AND ELECTRONIC
 DEVICES**

PROJECT
H11

FY 2002 Planned Program (Continued)

- 795 - Test, in the field, a scalable power electronics package in a five kilowatt engine generator set; test, in the laboratory, power on-the-move capabilities.
- 1311 - Test, in the field, a battery/battery hybrid; test, in the field, a kinetic energy harvesting system; integrate components for a stand-alone 500 watt TPV proof-of-concept unit.
- 982 - Enhance the initial low power design tool for additional power consumption reductions in soldier systems; implement and test power management techniques for soldier systems on a distributed test bed.
- 1800 - This one year Congressional add investigates a cylindrical zinc-air battery for Land Warrior applications. No additional funding is required to complete this project.
- 2500 - This one year Congressional add investigates fuel cell power systems. No additional funding is required to complete this project.
- 1000 - This one year Congressional add investigates an improved high rate alkaline cell. No additional funding is required to complete this project.
- 1000 - This one year Congressional add investigates a logistics fuel reformer. No additional funding is required to complete this project.
- 600 - This one year Congressional add investigates low cost reusable alkaline manganese-zinc batteries. No additional funding is required to complete this project.
- 2600 - This one year Congressional add investigates polymer extrusion/multilaminate processes. No additional funding is required to complete this project.
- 1500 - This one year Congressional add investigates a rechargeable cylindrical cell system. No additional funding is required to complete this project.
- 1500 - This one year Congressional add investigates a cylindrical battery replacement for a tube-launched optically-tracked wire-guided missile, improved target acquisition system. No additional funding is required to complete this project.
- 1000 - This one year Congressional add investigates heat actuated coolers for portable military applications. No additional funding is required to complete this project.

Total 17849

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602705A - ELECTRONICS AND ELECTRONIC
DEVICES**PROJECT
H11**FY 2003 Planned Program**

- 1048 - Investigate next generation forward area high-rate battery charging mechanisms and improvements in life cycle and energy density of lithiumion rechargeable batteries for use in a platoon level recharging system.
- 2141 - Identify and mature advanced materials (metamaterials) and their application to hybrid excitation machines and combustion enhancement devices (catalytic igniters, electrostatic fuel injectors) to enhance tactical generator set performance, reduce weight and increase survivability.
- 1500 - Identify and evaluate high payoff technologies that can be integrated into a compact fuel cell system capable of meeting the power and high energy (+2000 watt hours/kilogram) threshold of Objective Force Warrior.

Total 4689

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602705A - ELECTRONICS AND ELECTRONIC DEVICES

PROJECT
H94

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H94 ELEC & ELECTRONIC DEV	19523	23116	22759	25600	26853	27636	30746

A. Mission Description and Budget Item Justification: This project supports applied research in the application of the physical sciences of physics, electrochemistry, biotechnology and electronics for the Future Combat Systems (FCS) and the Objective Force. These technologies support thrusts aimed at enhanced battlefield situational awareness, increased vehicle mobility, reduced acquisition cost, and reduced operations and support costs; they are critical to the realization of the vision of a medium weight force with the capability to detect, target, and engage the enemy of the future. The technical areas addressed under this project are: frequency control; electro-optic sensors to include eye safe laser radar and midwave infrared (MWIR, 3- to 5-micron) and longwave (LWIR, 8- to 12-micron) bands; microelectromechanical systems (MEMS) for multi-function radio frequency (RF) applications as well as smart munitions (e.g., inertial measurements); advanced 16-18, 35, and 95 GHz (Ku, Ka and W-band) modules for RF applications; high temperature high power inverter circuits for all-electric vehicles; rechargeable lithium-ion batteries, and methanol fuel cells for individual soldier applications. Technical barriers include: more stable oscillators for frequency control in communications and location finding, more complete understanding of fundamental properties, growth techniques, and processing of new materials and their exploitation in electronic devices for uncooled infrared detectors, high voltage and high power control electronics; MEMS device design and fabrication techniques; RF microcircuit design; high power and high voltage power materials and device design. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2669 - Demonstrated improved (temperature compensated and lower sensitivity to vibration) SAW LGT resonator design, Ka-band low phase noise OEO, and lower sensitivity to vibration (2x10-10/g) quartz resonators and newer materials (LGT) for clock architectures to provide highly stable high data rate communications and Global Positioning Systems (GPS) to meet FCS and Objective Force requirements (e.g., network centric force).
- 5877 - Demonstrated ladar with detector/mixer line array.
- Proved feasibility of long range scannerless ladar at eye-safe wavelength.
- Demonstrated growth of 3 - 5 micron and 8 - 12 micron HgCdTe showing feasibility for low cost, large area dual color focal plane array on silicon substrates.
- 8436 - Integrated Rotman lens with PIN diode switch array and developed MEMS switch for affordable 1-D electronic scanning.
- Designed direct digital synthesizer module into testbed architecture for the multi-function RF systems.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602705A - ELECTRONICS AND ELECTRONIC
DEVICES**

PROJECT
H94

FY 2001 Accomplishments: (Continued)

- Developed design for smaller, lighter weight advanced transmit and receive modules for separate transmit & receive antenna apertures.
- Designed X-band ferroelectric true time delay beamformer and initiated extension to Ka-band for low-cost planar electronic scanning antennas.
- Optimized circuit for all-electric vehicle drive circuit for operation at high temperature (400 degrees C) to provide increased mobility.
- 2541 - Formulated lithium-ion cells with new flame -retardant electrolyte additives and demonstrated low flammability for FCS hybrid power sources.
- Performed initial evaluation of oxyhalide electrolyte stability for reliable battery for self-destruct fuze and other smart munitions.
- Developed improved anodic electrocatalyst for direct methanol fuel cells for power source with 5X greater energy density than batteries for extended Soldier System missions.

Total 19523

FY 2002 Planned Program

- 2334 - Prove out ultra low phase noise millimeter wave optoelectric oscillator for radar and communication.
Construct and show low-insertion-loss narrow-bandwidth anti-jam filter for GPS.
- 4979 - Build and test a breadboard ladar sensor for robotics navigation, collect relevant data and begin analysis.
 - Investigate AOTF cells for the 3- to 5-micron and 8- to 12-micron bands with potential for less than 50% diffraction efficiency.
 - Integrate laser range finding and target profiling on same detector array.
 - Determine optimum growth conditions for superlattice and quantum dot IR detectors.
- 10127 - Integrate vertically scanned Ka-band array with Rotman lens antenna to form 2D electronically scanned antenna for high performance multi-function RF systems for FCS and the Objective Force.
 - Integrate silicon germanium (SiGe) direct digital synthesizer module into multi-function RF testbed for rapid flexible waveform generation.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602705A - ELECTRONICS AND ELECTRONIC
DEVICES**

PROJECT
H94

FY 2002 Planned Program (Continued)

- Incorporate multilevel construction using InP & GaAs MMICs and MEMS technologies to design and fabricate a transmit/receive array for a multi-port radar and communication system using an electronically scanned antenna.
- Show improved SAW L-band filter design.
- Design a MEMS based low-loss RF switch with active open/close drive using lead zirconium titanate to enable electronic antenna scanning capabilities for RF systems.
- Design a metamorphic heterojunction bipolar transistor to enable low-cost production of highly linear active devices for use in multi-function RF systems.

- 2704 - Evaluate additives to stabilize capacity retention of lithium-ion batteries for hybrid power FCS and Objective Force missions.
- Develop analytical procedures for predicting long-term storage reliability of batteries for smart munitions.
- Evaluate methanol-tolerant cathodic electrocatalysts for high efficiency direct methanol fuel cell for future Soldier System Applications.

- 2972 - Enhance millimeter wave (MMW) devices for weapon systems through investigations of indium phosphide and indium phosphide like technologies for higher performance, higher efficiency and lower cost.

Total 23116

FY 2003 Planned Program

- 2828 - Design a compact, fiberless X-band and Ka-band optoelectric oscillator for radar and communication.
- 7978 - Optimize MEMS based low-loss RF switch with active open/close drive using lead zirconium titanate to enable electronic antenna scanning capabilities for multi-function RF systems.
- Design two-layer circuit using heterogeneous integration techniques for multi-function RF applications.
- Integrate high speed CMOS direct digital synthesizer into multi-function RF testbed and quantify performance for rapid flexible waveform generation.
- 9976 - Prove scannerless eye-safe FMCW radar and AOTF hyperspectral imagers operating in conjunction with two-color, large-area infrared focal plane array sensors for long-range target acquisition and identification.
- Assess large area two-color 3-5 micron/8-12 micron infrared detector array operating at increased operating temperature.
- 1977 - Explore ultra-high energy lithium/air battery formulations for Land Warrior power.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602705A - ELECTRONICS AND ELECTRONIC
DEVICES**

PROJECT
H94

FY 2003 Planned Program (Continued)

- Design direct methanol and reformer-gas fuel cells using new electrocatalysts and catalysts for very compact Land Warrior power.
- Formulate lithium-ion batteries and capacitors with low flammability and good high-temperature capacity retention for FCS and Objective Force hybrid power.

Total 22759

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602709A - NIGHT VISION TECHNOLOGY					PROJECT H95	
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H95 NIGHT VISION & EO TECH	24935	22993	22333	22434	23718	23594	24585

A. Mission Description and Budget Item Justification: This Program Element (PE) researches, investigates and applies core night vision, and electronic sensor technologies to improve the Army's capability to operate in the dark, i.e., "own the night." The technologies covered in this PE have the potential to provide the Army with new, or enhanced, capabilities to see farther on the battlefield, operate in obscured conditions, and maintain a higher degree of situational awareness (SA). It also potentially provides cost savings, performance reliability, and reduction in the size and weight of sensor and data display systems. In addition, technologies are being investigated to reduce the power consumption of the electronics. The use of thermal, acoustic, magnetic, micro-sensors, and micro-laser sources also will be investigated. The micro-lasers will have the potential to provide the individual soldier with high performance tactical laser range-finding, target designation, obstacle avoidance, and laser radar. Innovative near infrared (NIR) and short wavelength infrared (SWIR) sensors will possibly provide increased range for target identification. Solid state SWIR sensors also have the potential to passively detect and image high velocity, kinetic energy munitions under low light conditions. In addition, imaging sensors will be designed and fabricated for the Anti-Personnel Landmine Alternative program. This PE will address the design and fabrication of advanced electronics in order to improve the contrast and brightness of miniature flat-panel displays that will be used by infantry, armored, aviation, and field maintenance organizations. Aided/Automatic Target Recognition (ATR) technologies will be researched to dramatically reduce the time necessary to acquire targets, detect landmines, and collect intelligence data. Sensor models will be created to accomplish trade studies, performance predictions, and also support constructive simulation/wargaming for analysis of alternatives. Multispectral sensor simulations will likely support end-to-end predictive modeling and evaluation of new technologies in a virtual environment. Work in this PE contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0602712A (Countermines Technology) and PE 0603710A (Night Vision Advanced Technology). Work in this PE is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on Sensors and Electronic Devices. This program is managed by the Communications-Electronics Research, Development and Engineering Center, Night Vision Electronic Sensors Directorate (NVEDS), Fort Belvoir, VA. Contractors include: Boeing, Anaheim, CA; EOIR, Spotsylvania, VA; Fermionic, Simi Valley, CA; Fibertek, Herndon, VA; Kaiser, San Jose, CA; Litton, Orlando, FL; Lockheed Martin, Lexington, MA; Planar Systems, Beaverton, OR; Raytheon, Dallas, TX; Rockwell, Thousand Oaks, CA; SAIC, San Diego, CA; Sarnoff, Princeton, NJ; TRW, Fairfax, VA; and VG Semicon, Beverly, MA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602709A - NIGHT VISION TECHNOLOGY

PROJECT
H95

FY 2001 Accomplishments:

- 4125 - Researched a prototype process for fabricating micro-lenses on focal planes to focus incident radiation on small pixel detectors. Provided improvements in detector sensitivity and sensor performance.
 - Investigated and tested prototype advanced lithography process in order to reduce the number of fabrication steps for infrared focal plane arrays (FPAs).
 - Fabricated and tested alpha-silicon wafer in-situ contacts using NVESD microfactory facilities.
- 1536 - Investigated a prototype semiconductor process for integrated circuits that will be required to simultaneously readout the response from high speed, large area (640x480 and 1024x1024 element) dual color FPAs. Limited capacity readout circuits are a major technical barrier to higher performing next generation infrared (IR) devices.
 - Designed next generation mid wavelength infrared and long wavelength infrared FPA devices to provide high performance at elevated operating temperatures (120K vs. current 77K).
- 4550 - Completed testing and evaluation of near IR solid state cameras based on alternative detector materials. Characterized performance and defined manufacturing yield issues for the alternative materials.
 - De-fined design parameters for a low cost, uncooled near IR and far IR sensor for dismounted soldier applications. Provided a fused output of the two spectral bands to enhance the operator's perception of "color" contrast, shadows, and depth.
- 3370 - Extended development of search and target acquisition sensor predictive modeling. Transitioned algorithms to constructive modeling and wargaming community.
 - Completed performance prediction models of multispectral sensor systems and target acquisition for specific targets.
 - Improved model prediction for environmental effects impact on sensor performance.
 - Incorporated additional sensor simulation capabilities that better represent complex urban terrain and the battlefield environment.
 - Established initial simulation tool set to support maturation of systems which use advanced, integrated, distributed, and networked sensors. Transitioned tool set for use in Battle Lab experiments.
 - Performed sensor simulation validations.
- 863 - Constructed an open "heterogeneous" ATR processor architecture capable of hosting ATR software/algorithms designed for unique or propriety hardware. Reduced the time and cost required to integrate ATR capability into new platforms.
 - Established standardized methods and procedures for mine detection ATRs.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602709A - NIGHT VISION TECHNOLOGY

PROJECT
H95

FY 2001 Accomplishments: (Continued)

- 1490 - Investigated emerging sensor technologies and ATR performance evaluation technology and methods.
- Evaluated small scale integrated network of acoustic, seismic, and IR imaging micro-sensors in order to provide a significant unattended tactical sensing capability. Detected, tracked, and classified time critical mobile and stationary targets.
- Evaluated low power consumption micro-sensors and support electronics that permit unattended micro-sensor operation for up to 60 days.
- Performed experiments utilizing prototype micro-sensor nodes in various configurations.
- 2100 - Completed full color, 640 x 512 pixel, flat panel display technology in order to enhance dismounted soldier performance through the use of color maps and symbology.
- Completed color, 800 x 600 pixel, flat panel display technology for mounted and aviation applications.
- 1100 - Designed eyesafe micro-lasers capable of 2500 meter range performance and more than 5 shots per second.
- 237 - Performed final demonstration in the Cooperative Eye-Safe Laser Radar Program.
- 700 - Completed on-chip neomorphic processing, hyperspectral spatial and temporal signature processing for development of compact, high performance sensors.
- 4864 - Constructed, analyzed, and evaluated, fully portable prototype of combustion driven eyesafe, self-powered laser, and its control electronics. This was a Congressional interest program.

Total 24935

FY 2002 Planned Program

- 4612 - Research alternate readout circuit electronic technology to achieve small pixel geometry without performance reductions.
- Investigate analog-to-digital conversion techniques suitable for incorporation on FPA to improve sensitivity and dynamic range. Enable target identification at current detection ranges.
- Investigate high operating temperature modes of IR FPAs against performance requirements.
- Establish new techniques for etching detector material for high aspect ratios in order to achieve larger collection efficiency in multi-color detector stacked photodiodes and better pixel-to-pixel isolation.
- Examine anti-reflection structures on micro-lenses for improved collection efficiency.
- 1502 - Establish baseline ATR performance for multi and hyperspectral sensors including those having advanced filtering and processing capability.
- Investigate optimal human use of intelligent sensors for military applications.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602709A - NIGHT VISION TECHNOLOGY

PROJECT
H95

FY 2002 Planned Program (Continued)

- Research ATR hardware/software business plan to address the acquisition and life cycle support requirements associated with introduction of ATR technology into Army tactical systems.
- Show real-time reconfiguration of adaptable processor hardware which could reduce the size, weight, and power requirements typical for ATR processors.
- Host target cueing algorithms on real-time commercial-off-the-shelf (COTS) hardware. Evaluate performance.
- Collect additional ATR problem set data to support algorithm maturation and evaluation.
- 3632 - Leverage clutter metric and shape characterization efforts for maturation and evaluation of a performance predication capability useful for specific targets.
 - Complete modeling of multispectral sensor systems.
 - Integrate environmental effects into model.
 - Complete validation of 8-12 micron thermal sensor simulation.
 - Continue validation of other sensor simulation bands.
 - Advance state-of-the-art for simulation of distributed networked sensor simulation. Transfer improvements to battlelabs.
 - Complete sensor simulation for better representation of complex urban terrain and the dirty battlefield environment. Begin development of dynamic terrain representations.
- 4048 - Research extremely low power IR imaging micro-camera with instant-on capability.
 - Investigate alternate components in a set of micro-sensors (acoustic, seismic, magnetic, IR tripwire, laser tripwire, etc.). Optimize ATR function in an isolated network of micro-sensors.
 - Investigate low power, compact micro-sensor network for field experimentation.
 - Research high frame rate (small time constant) material structures in alpha-silicon.
- 4860 - Research 1920x1080 pixel, high-brightness, monochrome Active Matrix Liquid Crystal Display (AMLCD) for aviation platforms.
 - Investigate electrical optic attenuator for active sunglass tinting of helmet mounted displays.
 - Characterize performance of 640x512 pixel, full color, flat panel displays for the soldier.
- 939 - Integrate micro eyesafe solid state laser devices with receiver. Evaluate 2500 meter ranging at 5 hertz, using low cost laser technology.
- 800 - Investigate multispectral and polarization imaging phenomenology as part of a fused sensor suite, with an active laser ranging sensor.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602709A - NIGHT VISION TECHNOLOGY

PROJECT
H95

FY 2002 Planned Program (Continued)

- 2600 - This one year Congressional add investigates dual band detector imaging technology. Specifically, research improved processes to fabricate small-pixel, two color, large format FPAs. No additional funding is required to complete this project.

Total 22993

FY 2003 Planned Program

- 5248 - Show/evaluate multi-color, small pixel FPAs, with 16 bit digital read-outs.
- Investigate optical interconnects for extremely high rate transfer of digital data off the FPA.
- 1540 - Extend ATR evaluation capability to smart focal plane sensor systems.
- Evaluate real-time execution of target cueing algorithms in non-ruggedized COTS hardware in support of Army mission requirements. Evaluate performance. Integrate suitable cueing algorithms into real-time ruggedized hardware to support ATR technology insertion into Army tactical systems.
- 4360 - Complete search and specific target model developments.
- Leverage metric effort and perform perception studies to support moving target modeling effort.
- Incorporate model upgrades into Acquire for use in constructive simulation.
- Complete dynamic terrain developments in the sensor simulation tool set.
- Complete validation of 3-5 micron, thermal and monochrome, visible sensor simulation bands.
- Transition distributed networked sensor simulation tool set to support the Army Transformation efforts.
- Implement spectral based targets and hyperspectral sensor simulation capability.
- 3966 - Show/evaluate a deployable, integrated, network of micro-sensors with target identification at the node and low bandwidth alerting to command center at a distance.
- Conduct field experimentation with the integrated microsensor network.
- 4586 - Research 1280x1024 pixel, full-color, flat-panel Active Matrix Electro-Luminescent, or AMLCD, prototype for the mounted warrior.
- Research curved substrates for low power, visor displays for the dismounted soldier.
- Complete testing and evaluation of full-color, 1280x1024 pixel, flat-panel displays.
- 1189 - Show/evaluate multispectral/polarization/laser radar sensor suite for high altitude UAV applications.
- 1444 - Investigate a high definition television format, uncooled FPA, with 15 micron pixels for navigation and vehicle self-protection and surveillance.

Total 22333

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602709A - NIGHT VISION TECHNOLOGY

PROJECT
H95

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	23746	20598	20340
Appropriated Value	23965	23198	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-205	0
b. SBIR / STTR	-310	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	1500	0	0
e. Rescissions	-220	0	0
f. OSD Realignment	0	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	1993
Current Budget Submit (FY 2003 PB)	24935	22993	22333

Change Summary Explanation:

FY02 - A Congressional add was made for Dual Band Detector Imaging Technology, Project H95 (\$2600).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602712A - Countermines Systems

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	17228	22889	13186	15804	14111	12550	12807
H24 COUNTERMINE TECH	14907	20437	10612	13082	11265	9606	9805
H35 CAMOUFLAGE TECHNOLOGY	2321	2452	2574	2722	2846	2944	3002

A. Mission Description and Budget Item Justification: This Program Element (PE) researches and investigates advanced technologies to improve countermines, signature management and deception capabilities for the Army's Transformation to the Objective Force. Countermines research focuses on system concepts and technologies that improve mine detection and neutralization from standoff man-portable, ground and air platforms. The goal is to increase mine detection probability, while also reducing false alarm rate, to maintain high operational tempo in the Objective Force. In addition, wide area airborne countermines sensor concepts are being developed for higher altitude, wide area coverage and higher probability of detection and lower false alarm rate for airborne mine detection. This PE addresses emerging mine threats in both the conventional and electronically activated categories. A Center of Excellence for Landmines has been established to coordinate and standardize land mine signature models; maintain a catalogue of mine signatures; and support the evaluation of mine detection sensors and algorithms. This PE also researches deception and robust signature management techniques that will potentially alter an adversary's perception of friendly force capabilities and intentions. This effort is completely coordinated with the Marine Corps. The work in this PE is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. It adheres to Tri-Service/Project Reliance Agreements on conventional air/surface weapons and ground vehicles. This PE contains no duplication with any other effort within the Army, or the Department of Defense. It also is fully coordinated with PE 0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermines and Barrier Development) and PE 0603710A (Night Vision Advanced Technology). This PE is managed by the Night Vision Electronic Sensors Directorate, Communications-Electronics Research, Development and Engineering Center. (Contractors include: EOIR, Spotsylvania, VA; IMT, San Jose, CA; SAIC, San Diego, CA; and TRW, Fairfax, VA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602712A - Countermine Systems

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	17721	16689	12944
Appropriated Value	17886	23089	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-200	0
b. SBIR / STTR	-494	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-164	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	242
Current Budget Submit (FY 2003 PB)	17228	22889	13186

Change Summary Explanation:

Significant changes:

FY02: Congressional adds totaling \$6.4M (as noted below) were added to this PE.

FY02 - Congressional adds were made for Acoustic Mine Detection, Project H24 (\$2000); Integrated Countermine Testbed and Training Project, Project H24 (\$1400); Standoff Mine Detection, Project H24 (\$2000); Landmine Detection Tech/Seismic Energy, Project H24 (\$1000).

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A - Countermine Systems					PROJECT H24	
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H24 COUNTERMINE TECH	14907	20437	10612	13082	11265	9606	9805

A. Mission Description and Budget Item Justification: This project supports the Objective Force by researching new countermine technologies for standoff detection and discrimination of individual mines and minefields from man-portable, ground-vehicular, and airborne platforms. Mines include both conventional and electronically activated mines. Data collections will be used to assess the ability of various sensor combinations and signal processing/fusion algorithms to consistently detect mines with reduced false alarms for increased force operational tempo. Forward-looking mine detection and neutralization technologies will be emphasized to allow for rapid movement of forces. Additionally, this project develops sensors for the detection of off-route mines. The project sponsors the Center of Excellence for Unexploded Ordnance established to coordinate and standardize land mine signature modeling, maintain a catalogue of mine signatures, and support the evaluation of mine detection sensors and algorithms. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 3800 - Investigated and evaluated algorithms and sensor fusion processing for mine data collection systems in field experiments and evaluation.

 - Conducted and evaluated experiments using chemical sensors against realistic explosive concentrations to establish the prototype's operational envelopes as a function of target type, environment, and operational speed.
 - Tested and evaluated acoustic/laser, ground penetrating - synthetic aperture radar (SAR), and advanced electromagnetic detection sensors for increased mine detection and discrimination capabilities.
- 292 - Enhanced mine signature simulations, updated database of mine signatures, and established methodology for evaluation of detection algorithms in support of landmine detection of the Joint Unexploded Ordnance Coordinating Office (JUXOCO).
- 5528 - Evaluated brassboard forward-looking sensors for the detection of surface and buried anti-tank mines to improve probability of detection and reduce false alarms to provide faster rates of advance and survivability for the Objective Force.

 - Evaluated aided target recognition (ATR) and sensor fusion algorithms for forward looking detection sensors, which improve the probability of detection and reduce false alarm rates while increasing operational tempo.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602712A - Countermines Systems

PROJECT
H24

FY 2001 Accomplishments: (Continued)

- Evaluated potential of acoustic and time domain electromagnetic induction sensors and advanced mine detection sensors for inclusion in ongoing downward and forward looking mine detection programs as primary detection sensor.
- Performed analysis on candidate standoff mine neutralization technologies to identify promising approaches for maturing spot (rather than area) neutralization, providing enhanced survivability while reducing size, weight and logistics burdens.
- 965 - Investigated, modeled and applied nonlinear acoustic techniques for phenomenology assessment of imaging surface and buried anti-tank/anti-personnel land mines.
- 2401 - Investigated, modeled and applied acoustic/seismic energy for detection and discrimination of anti-tank/anti-personnel landmines from downward and forward-looking sensor modalities.
- 1921 - Assessed forward looking radar technologies for detection and discrimination of anti-tank landmines at distances of greater than 10 meters on routes.

Total 14907

FY 2002 Planned Program

- 7223 - Investigate and evaluate electronically scanned ground penetrating-synthetic aperture radar (GP-SAR) and forward looking acoustic sensors for phenomenology assessment of mine detection data collection systems.
 - Investigate and evaluate algorithms and sensor/data for the GP-SAR, infrared, and acoustic sensors for fusion processing to reduce false alarms while increasing the probability of detection.
 - Conduct field experiments using forward looking mine detection data collection systems to evaluate target type, environment, and operational speed to enhance rate-of-advance and survivability of the Objective Force.
 - Modify, evaluate and validate modeling of forward looking mine detection sensors.
 - Investigate candidate standoff neutralization technologies for precision neutralization of surface and buried mines.
- 508 - Continue to enhance mine signature simulations and update database of mine signatures.- Establish methodology for evaluation of detection algorithms in support of landmine detection of JUXOCO.
 - Establish methodology for evaluation of detection algorithms in support of landmine detection of JUXOCO.
- 2306 - Apply and investigate sensor technologies for trip wire, off-route, and side-attack mine detection.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602712A - Countermines SystemsPROJECT
H24**FY 2002 Planned Program (Continued)**

- Investigate nonlinear and imaging acoustics for anti-tank and anti-personnel mine detection for ground vehicles and robotic platforms.

- 4000 - Investigate and assess sensor technologies and collect sensor data for signal processing/clutter rejection to support trip wire, off-route, and side attack wide area minefield detection and surveillance from airborne platforms.
- Candidate sensor technologies include multi-spectral long wave infrared fused with short wave infrared laser polarization, hyper-spectral infrared, and ultra-wideband GP-SAR.
- 2000 - This one year Congressional add researches linear/non-linear acoustic sensor technologies for detection of anti-personnel/anti-tank landmines. No additional funding is required to complete this project.
- 1400 - This one year Congressional add researches neutralization and robotic technologies for detection of anti-personnel/anti-tank landmines. No additional funding is required to complete this project.
- 2000 - This one year Congressional add researches forward looking ground penetrating radar sensor technologies for detection of anti-personnel/anti-tank landmines. No additional funding is required to complete this project.
- 1000 - This one year Congressional add researches non-linear, downward looking/close-in sensor technologies for detection of anti-personnel/anti-tank landmines. No additional funding is required to complete this project.

Total 20437

FY 2003 Planned Program

- 7791 - Refine algorithms and sensor fusion assessments of forward looking mine detection data collection systems in field experiments to support the Objective Force.
- Conduct and evaluate field experiments using forward looking mine detection data collection systems to establish metrics for probability of detection, false alarm rates and rates of advance as a function of target type, environment, and operational speed.
- Modify, evaluate and validate modeling of forward looking mine detection sensors.
- Conduct field testing of standoff neutralization technologies for assessment of probability of kill and location accuracy of land mines located by forward looking detection sensors.
- Transition forward looking mine detection and neutralization technologies to advanced development to demonstrate enhanced capability for the Objective Force.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602712A - Countermine SystemsPROJECT
H24**FY 2003 Planned Program (Continued)**

- 515 - Continue to enhance mine signature simulations, update database of mine signatures, and establish methodology for evaluation of detection algorithms in support of land mine detection.
- 2306 - Conduct and assess sensor, algorithms, and automatic target ATR technologies in field environments of trip wire, off-route, and side-attack mine detection.

Total 10612

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602712A - Countermining Systems

PROJECT
H35

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H35 CAMOUFLAGE TECHNOLOGY	2321	2452	2574	2722	2846	2944	3002

A. Mission Description and Budget Item Justification: This project researches and investigates advanced signature management and deception technologies for masking friendly force capabilities and intentions, thereby increasing Objective Force unit survivability. Specific research areas include (1) advanced materials and processes for countering visual and infrared sensors, (2) simulation of key radar and communications signatures using electronic deception modules, (3) advanced modeling and simulation of proposed signature management and deception technologies, and (4) advanced materials, coatings, patterns and appliquéés for suppressing electro-optical signatures of combat units. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 2321 - Matured three-dimensional image projection techniques in the laboratory to improve deception capabilities for combat units.
 - Evaluated effectiveness of signature management and deception system design alternatives through modeling and simulation in laboratory experiments and force-on-force simulations.
 - Evaluated effectiveness of improved signature management coatings, materials and patterns in visual and thermal bands through lab and field testing.
 - Investigated signature management materials having improved spectral performance against advanced threat multi-spectral sensors.
 - Evaluated requirements and technologies for communications deception systems to defeat threat electronic intelligence collection assets.

Total 2321

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602712A - Countermines SystemsPROJECT
H35**FY 2002 Planned Program**

- 2452 - Incorporate improved visual, thermal and spectral coatings and materials into signature management components for field experiments.
- Evaluate performance of signature management and deception suites for the high value assets using predictive modeling and force-on-force simulations.

- Investigate techniques that combine physical decoys with signature management technologies to improve survivability of combat and combat support units.

Total 2452

FY 2003 Planned Program

- 2574 - Investigate technologies to reduce logistics and deployment burdens associated with camouflage and deception systems for use by the Objective Force.

- Investigate adaptable materials to extend performance envelopes of signature management treatments and improve effectiveness in multiple backgrounds.

- Investigate advanced deception technologies that replicate key multi-spectral signatures of high value assets and enable replacement of physical decoys with rapidly deployable low-weight and volume devices.

Total 2574

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602716A - HUMAN FACTORS ENGINEERING TECHNOLOGY

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost		17911	19791	17415	17132	17607	18309	19016
H34	RURAL HEALTH TECH	2404	2481	0	0	0	0	0
H70	HUMAN FACT ENG SYS DEV	15507	17310	17415	17132	17607	18309	19016

A. Mission Description and Budget Item Justification: The primary objectives of this program are to maximize the effectiveness of soldiers in concert with their materiel so that they may survive and prevail on the battlefield in the context of the Army Transformation to the Objective Force. 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 Congressionally directed program on Rural Health Technology focuses on the researching, field testing, and empirical validation of methods for improving the coordinated functioning of civilian and military emergency medical teams. Rural Health Technology was transitioned to the Armed Forces Institute of Pathology in 4Q FY01. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602716A - HUMAN FACTORS ENGINEERING
 TECHNOLOGY**

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	18119	16466	16501
Appropriated Value	18286	19966	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-175	0
b. SBIR / STTR	-222	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	15	0	0
e. Rescissions	-168	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	914
Current Budget Submit (FY 2003 PB)	17911	19791	17415

Change Summary Explanation:

FY02 - Congressional adds were made for MedTeams, Project H34 (\$2500)and Soldier Centered Design Tools For the Army Project H70 (\$1000).

Projects with no R2-A:

Project H34:

- FY02 funding = \$2500 MedTeams : The objective of this one year Congressional add was to expand Med Teams into a broader base of medical settings, including integration with advanced life support algorithms and advanced cardiac life support technology. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602716A - HUMAN FACTORS ENGINEERING TECHNOLOGY	PROJECT H70					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H70 HUMAN FACT ENG SYS DEV	15507	17310	17415	17132	17607	18309	19016

A. Mission Description and Budget Item Justification: The goal of this program is to maximize the effectiveness of soldiers in concert with their equipment, in order to survive and prevail on the battlefield in the context of the Army Transformation to the Objective Force. The barriers to achieving the goal include incomplete soldier performance data and models of the new missions, organizations, and new and complex technologies transforming the Army. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of soldiers, with particular attention on soldier and equipment interaction. The resulting data are the basis for weapon systems and equipment design standards, guidelines, handbooks and soldier training and manpower requirements to improve equipment operation and maintenance. Application of advancements yields reduced workload, fewer errors, enhanced soldier protection, user acceptance, and allows the soldier to extract the maximum performance from the equipment. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4499 - In cooperation with CASCOM, analyzed human factors (HF) study results, identified areas for improvement, and formulated research plan for additional research.
 - Identified nine major MANPRINT challenges for Future Combat Systems and worked with FCS contractors to define their plans for resolution of the challenges. Worked with TARDEC to identify soldier-performance issues for CAT ATD in June 01 demo of visual system; in process of analyzing results.
 - Completed data analysis and reports from baseline study of indirect driving for VTT STO; provided initial drafts to TARDEC.
 - Completed evaluations of tasks by crew position to establish baseline crew design and provided recommended distribution of tasks for CAT ATD.
 - Provided support to PM Aircrew Integrated Systems (PM ACIS) in identifying appropriate auditory systems for use in virtual and real cockpit studies in FY 02.
 - Provided design guidelines to SBCCOM-NSC, the Infantry School and Dismounted Battlespace Battle Lab on the effects of advanced audio display technologies on dismounted soldier tasks performance.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602716A - HUMAN FACTORS ENGINEERING
 TECHNOLOGY**

PROJECT
H70

FY 2001 Accomplishments: (Continued)

- Conducted pilot studies to ensure that the soldier day paradigm was appropriate for evaluating soldier equipment interface and compatibility.
- Transitioned validated paradigm to SBCCOM-NSC and Infantry School for standardization of methods.
- Light Fighter Lethality program was canceled. Conducted a study to define the trade-offs of the Objective Individual Combat Weapon (OICW) weight versus Soldier Performance in support of OICW acquisition decisions.
- 3053 - Identified optimum configuration of staff and digitization capabilities during contingency, joint, strategic operations to TPIO-ABCS, and Joint and Army Vision 2010 doctrinal elements. (Cognitive Engineering STO)
- Conducted follow-on human factors evaluation of ABCS functionality in the division command post exercise (DCX) to improve system integration in the first digital division. Provided Human Factors inputs to the TRAC report.
- Validate the intelligence production model (IPM) in intelligence field units at varying command levels. Delayed until FY02.
- 6718 - Experimentally showed the application of cognitive modeling to military domain by evaluating situation awareness of individual soldier battlespace as a function of helmet-mounted information display.
- Conducted an investigation of the integrated system behavior between the mobility interface device and the control systems for the dismounted soldier combatant simulation. Transition results to STRICOM and the Army Research Institute (ARI). (Virtual Environment for the Dismounted Soldier STO)
- Provided HFE and MANPRINT support to AMC, AMC RDECs, TRADOC Centers, Schools and Battle Laboratories, ATEC and other service laboratories.
- 1237 - Leverage Initial Brigade planning and experimentation to address cognitive engineering of battle command operations.
- Transitioned final visualizations for multi-modal sensory computer control algorithms to the Agile Commander ATD.

Total 15507

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602716A - HUMAN FACTORS ENGINEERING
TECHNOLOGY**

PROJECT
H70

FY 2002 Planned Program

- 5729 - Complete human factors concept evaluations with CASCOM and transition Roller Platform for Air Delivery and Palletized Loading System Shoe to TACOM.
 - Conduct field concept evaluations of new intermodal handling concepts at ammunition supply chain nodes for Defense Ammunition Logistics Agency (DALA) and Combined Arms Support Command (CASCOM) to create most effective and efficient ammunition deployment and sustainment operations.
 - Design more accurate tool to predict maintenance manpower, personnel, and training requirements for future weapons systems based on validated measures from FY00-01 field studies and data analysis.
 - Assist PM Objective Force define, monitor, and assess the contractors' MANPRINT programs for phase 2. Provide co-lead for Soldier-Systems Integration Product Team. Define additional research needed to meet objective force requirements for incorporation into CAT STO demo in FY 04.
 - Conduct preliminary studies investigating operations-on-the-move impact on soldier performance using the TARDEC ride motion simulator.
 - Conduct experiments and field studies, using validated dismounted soldier metrics, to fill identified data voids and transition the results to the SBCCOM-NSC WSMT STO.
 - Prototype a comprehensive Dismounted Warrior Critical Task List using previously collected behavioral performance data and leverage NATO and USMA related work.
 - Conduct studies addressing audio and visual information presentation loads and their effects on soldier shooting performance.
- 2846 - Refine models and tools for adaptive performance and document implications for their use in the development of training and support systems. (Cognitive Engineering STO)
 - Provide definitive guidelines for using C2 soldier performance predictive models in conjunction with C2 measures used in live exercises to guide experimentation planning and analysis for primary ABCS related Battle Labs (BCBL, MMBL, DSABL).
 - Refine a framework for assessing the human factors aspects of digitization to support Army force modernization efforts.
 - Apply IPM to assess Intelligence Analyst of the Future initiatives.
- 6159 - Provide cognitive processing models that better represent the details of soldier performance than simple task performance modeling alone, that are suitable for both stand-alone and linked modeling frameworks, and that include advanced performance shaping functions such as individual soldier characteristics and environmental stressors, all for the purpose of higher fidelity system design evaluation.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602716A - HUMAN FACTORS ENGINEERING
TECHNOLOGY**

PROJECT
H70

FY 2002 Planned Program (Continued)

- Conduct studies to determine adverse effects of the use of night vision devices on human ability to use unaided night vision for similar military missions.

- Collect and compare pre-attentive and computationally descriptive models of human vision; collect militarily relevant target images; apply vision models to target images, evaluate strengths and weaknesses of each model.
- Include indoor firing (firing from enclosures) analysis into the auditory hazard model to predict safe use of weapons in urban environments.

- Provide HFE and MANPRINT support to AMC, AMC RDECs, TRADOC Centers, Schools and Battle Laboratories, ATEC and other service laboratories.
- 1576 - Complete the transition of Cognitive Engineering of the Digital battlefield (STO) products to CECOM, DARPA, and TRADOC battlelabs.
- Complete the installation, instruction, and documentation of FEDLAB products to DARPA and CECOM Agile Commander ATD.
- 1000 This one year Congressional add is for Soldier Centered Design Tools that will allow Soldier specific design constraints to be evaluated in the design process. No additional funding is required to complete this project.

Total 17310

FY 2003 Planned Program

- 6779 - Integrate existing ammunition logistics task workload models to create factory-to-foxhole model of ammunition logistics, capable of analyzing and optimizing soldier requirements at all nodal operations and transition to Defense Ammunition Logistics Agency.
- Research a prototype tool to predict maintenance manpower, personnel, and training requirements for future systems, which accounts for soldier attributes and enabling technology solutions for improved diagnostics and prognostics.
- Provide soldier performance criteria and data collection strategies to CAT ATD for use in the FY 04 demonstrations.
- Conduct evaluations of controlling a remote moving vehicle from another moving vehicle; examine command and control issues while on the move.

- Conduct Verification and Validation of the Dismounted Warrior Critical Task List, develop modeling and simulation performance inputs and transition to SBCCOM-NSC (WSMT STO).
- Assess the effects of known physiological and cognitive stressors on shooter accuracy and target engagement times and transition to SBCCOM-NSC and TACOM-ARDEC.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602716A - HUMAN FACTORS ENGINEERING
TECHNOLOGY**PROJECT
H70**FY 2003 Planned Program (Continued)**

- 3806 - Validate models and tools for adaptive performance and apply to prototype Objective Force organizations.
- Identify and quantify soldier visualization principles for COA predictions, adapting to novel situations, risk management and automated battlefield issues for Objective Force full spectrum Army missions and transition to TPIO-ABCS.
- Verify and validate framework for assessing the human factors aspects of digitization to support Army force modernization efforts.
- Investigate the extension and application of IPM to error prone decision-making tasks in other battlefield functional areas.
- 6030 - Provide user-accessible cognitive modeling capability to combat and material developers so that the full range of soldier cognitive and task performance can be considered in a cost-effective manner in all phases of acquisition.
- Conduct experiment to examine target and obstacle detection, depth and distance estimation, and size and depth perception with color night vision goggles. (Delayed from FY01 due to equipment development)
- Validate vision model performance and integrate strengths of each model into the ARL-HRED computational vision model.
- Develop and utilize an improved auditory test manikin to determine effects of non-linear protection on human hearing.
- Provide HFE and MANPRINT support to AMC, AMC RDECs, ATEC and other service laboratories.
- 800 - Funds Reprogrammed for ARL lab management support.

Total 17415

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	58745	23569	23018	25521	26860	27935	30676
048 IND OPER POLL CTRL TEC	2269	1311	2883	3397	3585	3739	3824
835 MIL MED ENVIRON CRIT	2738	2361	3056	3306	3695	3807	3883
896 BASE FAC ENVIRON QUAL	5019	2891	7804	8589	7662	6574	6726
91G TECHNOLOGIES TO REDUCE NON- HAZARDOUS WASTE	4807	0	0	0	0	0	0
946 ELECTRONIC EQUIPMENT DEMANUFACTURE	12017	0	0	0	0	0	0
947 SUSTAINABLE GREEN MANUFACTURING	5287	0	0	0	0	0	0
EM1 WASTE MINIMIZATION AND POLLUTION RESEARCH	0	2000	0	0	0	0	0
EN8 MOLECULAR & COMPUTATIONAL RISK ASSESSMENT	0	1400	0	0	0	0	0
EN9 TRANSPORTABLE DETONATION CHAMBER VALIDATION	0	6000	0	0	0	0	0
F25 MIL ENV RESTOR TECH	3536	3339	9275	10229	11918	13815	16243
F28 RANGE SAFETY TECH DEMO	4807	4267	0	0	0	0	0
F31 ENVIRONMENTAL CLEANUP AT PORTA BELLA	2884	0	0	0	0	0	0
F35 ENVIRONMENTAL QUALITY TECHNOLOGY	5768	0	0	0	0	0	0
F36 ARMY HEAVY METALS OFFICE	5768	0	0	0	0	0	0
F37 PROTON EXCHANGE MEMBRANE (PEM) FUEL CELL	3845	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to provide technologies that will improve the Army's ability to comply with regulations mandated by all Federal, state and local environmental/health laws and to reduce the cost of this

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

compliance. Examples of key laws include the Superfund Amendments and Reauthorization Act of 1986 and the Defense Environmental Restoration Act (the Department of Defense equivalent of this law), in addition to the Resource Conservation and Recovery Act of 1984, as amended. This program element 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. This program element 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 program element develops pollution control technology, which assists installations in complying with environmental regulations at less cost. The program element also provides technology to mitigate noise impacts and maneuver area damage resulting from Army training activities. The work in this program element is aligned with the Army's vision for the Objective Force 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. The cited work is also consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center and the U.S. Army Armament Research, Development and Engineering Center (ARDEC). This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	60434	16150	16764
Appropriated Value	60994	23700	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-131	0
b. SBIR / STTR	-1688	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-561	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	6254
Current Budget Submit (FY 2003 PB)	58745	23569	23018

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002****BUDGET ACTIVITY
2 - Applied Research****PE NUMBER AND TITLE
0602720A - Environmental Quality Technology**

Change Summary Explanation:

FY02 (+\$7419) - Congressional adds were made for Waste Minimization and Pollution Research, Project EM1 (+\$2000); Molecular and Computational Risk Assessment, Project EN8 (+\$1400), Transportable Detonation Chamber Validation, Project EN9 (+\$6000); and Rangesafe Demonstration Project, Project F28 (+\$4300). Congressional reductions totalling \$6281 were made to this Program Element.

FY03 (+\$6254) - Project 048 (+\$199) was increased for civilian personnel plus-ups. Project 835 (-\$30) received a general reduction in funding. Project 896 (+\$2549) and Project F25 (+\$3536) funding was increased to address high priority Army training range environmental quality technology requirements, and for civilian personnel plus-ups.

Projects with no R-2As include:

- (\$2000) Waste Minimization and Pollution Research, Project EM1: The objective of this one year Congressional add is to develop and demonstrate innovative technologies that create operational cost reductions and compliance in the areas of waste minimization and pollution research. No additional funding is required to complete this project.
- (\$1400) Molecular and Computational Risk Assessment, Project EN8: The objective of this one year Congressional add is to perform molecular and computational risk assessment research. No additional funding is required to complete this project.
- (\$6000) Transportable Detonation Chamber Validation, Project EN9: The objective of this one year Congressional add is to demonstrate and validate a transportable detonation chamber for destruction of unexploded chemical ordnance. No additional funding is required to complete this project.
- (\$4300) Rangesafe Demonstration Project, Project F28: The objective of this one year Congressional add is to develop and evaluate technologies for remediation of Army firing ranges. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

PROJECT
048

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
048 IND OPER POLL CTRL TEC	2269	1311	2883	3397	3585	3739	3824

A. Mission Description and Budget Item Justification: The objective of this project is to research and investigate technologies to enable the Army to reduce or eliminate the effects of legal and regulatory environmental restrictions, as well as avoiding fines and facility shutdowns. These new technologies are essential for the effective control and reduction of unique hazardous and non-hazardous wastes on military installations. Efforts include a focus on new materiel that will enter the Army inventory within the next decade due to Army Transformation. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2269 - Developed measures and criteria to predict and avoid negative community response to noise.
- Investigated modified absorbent/biosorbent technology as a more effective method to treat Army waste streams containing heavy and toxic metals and explosives.
- Established guidelines for fluidized-bed granular activated carbon bioreactor to replace carbon absorption for water contaminated with explosives to prevent violations and production stoppage.
- Investigated reductive electrochemical treatment for destruction of nitroaromatics, nitramine or nitrate esters to ensure compliance with effluent regulations.

Total 2269

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602720A - Environmental Quality TechnologyPROJECT
048**FY 2002 Planned Program**

- 1311 - Determine physical and chemical interactions between selected energetic materials and building materials under long-term exposure situations, to prevent contamination and minimize hazardous waste.

Total 1311

FY 2003 Planned Program

- 2883 - Develop and test methodology to avoid the confounding influences of ground reflections for large weapon systems that do not have adequate acoustic source data to predict noise levels in the far field.
- Verify decision trees for both contaminated and uncontaminated excess structures to allow for the safe disposal of buildings during deconstruction.

Total 2883

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

PROJECT
835

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
835 MIL MED ENVIRON CRIT	2738	2361	3056	3306	3695	3807	3883

A. Mission Description and Budget Item Justification: The objective of this project is to provide quantitative means to determine the environmental and human health effects resulting from exposure to explosives, propellants, and smokes produced in Army industrial 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 the environment and human health from adverse effects. The main product of this research is the Army Risk Assessment and Modeling System (ARAMS). This PC-based platform links models of fate and transport to the exposure and the effects models and databases of explosives and their degradation by-products on endpoint organisms in both aquatic and terrestrial ecosystems. This will reduce the uncertainty associated with both the probability of exposure and the ultimate effect if exposed. Interim products are U.S. Environmental Protection Agency approved health advisories and criteria documents to be used in risk assessment procedures. 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 cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Center for Health Promotion and Preventive Medicine (CHPPM), and the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 376 - Determined effects of relevant environmental parameters of Earth media on Unexploded Ordnance (UXO) chemical signatures.
- Designed predictive tools for UXO multi-contaminant transport processes in various Earth media.
- 2362 - Constructed comprehensive risk assessment model and database modules for explosives and their byproducts to be linked with the ARAMS.

- Established effects information to input into comprehensive ARAMS.
- Constructed population model for assessment of environmental effects and link to ARAMS.
- Linked contaminant fate and transport with effects databases for multiple endpoints.
- Completed design of a comprehensive link between contaminant fate and transport with effects databases for multiple environmental endpoints for incorporation into ARAMS.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602720A - Environmental Quality TechnologyPROJECT
835**FY 2001 Accomplishments: (Continued)**

- Enhanced the overall performance and real-world simulation of the ARAMS by development of risk assessment prediction methods for whole populations of plants and animals.

Total 2738

FY 2002 Planned Program

- 381 - Design a comprehensive model for how the various UXO constituents move and chemically transform through the ground (fate and transport) and prepare this quantitative model for inclusion into the ARAMS.
- 1980 - Complete the determination of how explosives accumulate and enter land-based populations of plants and animals (bioaccumulation) and the reference amounts and rates by which explosives become toxic (toxicity) to marine-based organisms. The specific explosives include: TNT, Royal Demolition explosive (RDX), and High Melting explosive (HMX).
 - Describe the ways and means by which the toxic effects of contaminants are transferred into the human body through the skin (dermal uptake) for ultimate use in the ARAMS.
 - Design a comprehensive predictive model of bioaccumulation and toxicity for site scenarios multiple species of organisms and multiple pathways by which the contaminants can reach the organisms.
 - Develop hazard/risk assessment procedures for both land-based and aquatic ecosystems which link exposure, accumulation and the toxic effects of explosives and their byproducts to the organisms.
 - Improve the user interface with the ARAMS by the design of a multi-media version.

Total 2361

FY 2003 Planned Program

- 118 - Complete the design of a comprehensive model for how the various UXO constituents move and chemically transform through the ground (fate and transport) and integrate this quantitative model into the ARAMS.
- 2938 - Integrate the dynamic mechanisms (kinetics) by which explosives accumulate and enter land-based populations of plants and animals (bioaccumulation) with those factors that determine how toxic the chemicals are to the specified organisms (toxicity) into the ARAMS.
 - Develop and complete a comprehensive predictive model of bioaccumulation and toxicity for site scenarios, multiple species of organisms, and multiple pathways by which the contaminants can reach the organisms.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602720A - Environmental Quality TechnologyPROJECT
835**FY 2003 Planned Program (Continued)**

- Develop hazard/risk assessment procedures for both land-based and aquatic ecosystems which link exposure, accumulation and the toxic effects of explosives and their byproducts to the organisms.
- Improve the user interface with the ARAMS by the development of a multi-media version.

Total 3056

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

PROJECT
896

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
896 BASE FAC ENVIRON QUAL	5019	2891	7804	8589	7662	6574	6726

A. Mission Description and Budget Item Justification: The objective of this project is to provide assessment, monitoring, and modeling technologies to support sustainable use of the Army's training facilities, lands, firing ranges, and airspace to reduce or eliminate environmental restrictions on military uses. The Army will have the technical capability to protect and improve the biophysical characteristics of training and testing areas needed for realistic ranges and training lands to accommodate force transformation, and to support the Objective Force. Technologies within this project will enable users to match mission events and schedules of training forces with the capabilities of specific land areas. It will also provide advanced methods to restore lands damaged during training activities. Technologies will allow operation and maintenance of installation facilities and training range resources, complying with the many environmental requirements without interrupting operations or training activities. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4299 - Validated the use of remote monitoring instrumentation and methods to evaluate changes in animal activity that may be caused by military activities.
 - Incorporated information on the potential of land (soils and vegetation) to be effectively rehabilitated to reduce erosion and sustain land resources into decision support processes for land rehabilitation and maintenance.
 - Formulated management and recovery protocols for endangered species that are consistent with an adaptive ecosystem management approach.
 - Identified the proximate effects and protocols to determine effects of smokes and obscurants on endangered species.
 - Investigated impact of contaminated lumber on the recyclability/reusability of deconstructed material.
- 720 - Provided hazardous air pollutant (HAP) control technologies for toxic combustion sources to maximize incinerator capacity.

Total 5019

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602720A - Environmental Quality TechnologyPROJECT
896**FY 2002 Planned Program**

- 2460 - Establish methodological and statistical protocols for determination of endangered species population viability to prevent training restrictions.
 - Identify adaptive mitigation techniques to reduce constraints on mission activities as a result of endangered species.
- 431 - Create technologies for controlling and/or recycling organic hazardous air pollutant emissions to ensure continuation of coating operations.

Total 2891

FY 2003 Planned Program

- 4591 - Develop techniques to analyze endangered species population goals to determine critical spatial thresholds that will not impede sustainment of training.
 - Develop particulate matter emission estimation models for tactical vehicle engines and chemical/physical PM control technologies for unpaved surfaces.
- 204 - Complete analysis of rotating sponge media biofilter technology as an effective Army high volume method to mitigate low volatility hazardous air pollutant concentration air streams.
- 1821 - Develop a risk assessment quantification methodology and apply this methodology to evaluate environmental risk of training range design elements.
- 1188 - Expand impact assessment protocols developed for the Red-cockaded Woodpecker to examine habitat impacts from land management practices.

Total 7804

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

PROJECT
F25

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
F25 MIL ENV RESTOR TECH	3536	3339	9275	10229	11918	13815	16243

A. Mission Description and Budget Item Justification: The objective of this project is to provide cost effective technologies required to clean up Department of Defense (DoD) hazardous waste sites, including active installations under the Installation Restoration Program, those indicated for closure under the DoD Base Realignment and Closure Program and the Formerly Used Defense Sites Program. Technologies focus on cost-effective and efficient remediation of active training ranges that support enhanced readiness for the Objective Force. The thrust of this effort is to expedite site cleanup, reduce the cost of cleanup of contaminated soil, groundwater, and structures, and ensure that human health and the environment are protected. Research is conducted in several major areas: innovative and cost-effective site identification, characterization, and monitoring technologies, groundwater systems; and treatment technologies to remediate soil and groundwater contaminated with military-unique contaminants such as explosives/energetics, chemical agents, heavy metals, and other organics. Emphasis is placed on the development of in-situ remediation technologies and real or near real-time sensing technologies for Unexploded Ordnance (UXO). Development of existing technologies provides near-term solutions while adding to the knowledge base applicable to successful development of more complex in-situ technologies. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3536 - Developed predictive models for advanced UXO detection sensors (multi-frequency/multi-channel time domain electromagnetic, Ground Penetrating Radar (GPR), vector magnetic, and seismic/acoustic) and conduct advanced UXO sensor data collection effort at a well-documented site.
- Conducted first-phase of pilot-scale evaluation of in-situ biodegradation for TNT and in -situ reactive barriers and/or reactive barriers coupled with biodegradation for explosives in groundwater.
- Conducted evaluation of advanced electro-kinetic treatment technologies for lead and evaluate prototype instrumentation for on line detection of metal contaminated unsaturated soils and groundwater.
- Investigated aggressive chemical metal treatment alternatives for unsaturated soils and groundwater at small arms training ranges.
- Evaluated processes for the recycling of metal from contaminated unsaturated soils and groundwater treatment systems with emphasis on electro-kinetic treatment extracts.

Total 3536

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602720A - Environmental Quality TechnologyPROJECT
F25**FY 2002 Planned Program**

- 918 - Construct predictive tools for UXO multi-contaminant transport processes in various earth media.
 - Design a predictive model to determine explosives toxicity for avian and marine species.
 - Complete advanced UXO sensor data collection effort at a well documented site.
 - Construct advanced UXO sensor fusion analysis algorithms to be applied to developing UXO detection/discrimination sensing capabilities.

- 941 - Prepare an integrated suite of UXO detection/discrimination multi-sensing and processing modes to be optimized for site-specific environmental characteristics.
- 418 - Prepare an integrated set of web based hazard/risk assessment models.
- 1062 - Determine the dynamic mechanisms (kinetics) by which explosives accumulate and enter land-based populations of plants and animals (bioaccumulation) with those factors that determine how toxic the chemicals are to the specified organisms (toxicity).
 - Complete advanced visualization and model development supporting on-site hazard/risk assessment during all cleanup phases providing a 50% reduction in time (reduce from months to weeks) for data analysis and treatment selections.

Total 3339

FY 2003 Planned Program

- 786 - Complete construction of predictive tools for UXO multi-contaminant transport processes in various earth media.
 - Complete a predictive model to determine explosives toxicity for avian and marine species and apply to the Army Risk Assessment and Modeling System.

- 861 - Evaluate advanced UXO sensor fusion analysis algorithms to be applied to developing UXO detection/discrimination sensing capabilities.
 - Complete detailed evaluation of an integrated suite of UXO detection multi-sensing and processing modes to be optimized for site-specific environmental characteristics.

- 1498 - Optimize multi-sensor and data fusion analysis UXO detection/discrimination capabilities.
 - Conduct pilot-scale evaluation of an optimized multi-sensor and data fusion analysis UXO detection/discrimination system.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602720A - Environmental Quality Technology

PROJECT
F25

FY 2003 Planned Program (Continued)

- 2772 - Conduct final phase of pilot-scale evaluation of in-situ biodegradation for TNT and in-situ reactive barriers and/or reactive barriers coupled with biodegradation for explosives in groundwater.
 - Conduct pilot-scale demonstration of advanced electro-kinetic treatment technologies for lead and of prototype instrumentation for on line detection of metal contaminated soils.
 - Down-select aggressive chemical metal treatment alternatives for small arms training ranges.
 - Evaluate processes for the recycle of metal contaminated extracts for soils treatment systems.
- 2620 - Conduct integrated assessment and evaluation of distributed source contamination on live fire training ranges.
 - Quantify and laboratory evaluate predictive model for distributed source contamination impacts on live fire training ranges.
 - Assess adapting hazardous wastes site restoration processes and techniques for application to distributed contamination sources on live fire ranges.
 - Conduct laboratory scale evaluation of distributed source contamination restoration on live fire ranges.
- 738 - Complete web based hazard risk assessment modeling tools.

Total 9275

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602782A - Command, Control, Communications Technology

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	22987	24123	21821	22349	23519	24009	24609
779 C2 & PLAT ELEC TECH	9601	8022	10296	10348	11310	11639	11905
H92 COMMUNICATIONS TECH	13386	16101	11525	12001	12209	12370	12704

A. Mission Description and Budget Item Justification: This program element (PE) researches advanced communications technologies and expands scientific knowledge of command and control (C2), and electronics systems/subsystems. The intent is to provide the Army's Objective Force with enhanced capabilities for secure communications and assured information delivery and presentation. This will be achieved by improving the command, control, and communication systems (e.g. man-machine interface, mobility, security, capacity, safety, reliability, and survivability) for both air and ground platforms, including the dismounted soldier. Commercial technologies are continuously investigated and leveraged where possible. Research includes the investigation of infrastructures that allow timely distribution, display, and use of C2 data on Army platforms. This research also includes enhancements to the Global Positioning System (GPS) user equipment to minimize registration errors, and improvements to man-machine interfaces and decision aids for a network-centric battlefield environment. This PE will provide Objective Force field commanders the ability to communicate on-the-move (OTM) to/from virtually any location, in a seamless, secure, self-organizing, self-healing, network. Integrated networks of unmanned remote sensors, maneuver and fire support elements, and situational awareness (SA) tools will allow the Objective Force to achieve overmatch with agility and versatility. In addition, portions of the research are directed to supporting the Joint Tactical Radio System (JTRS). The cited work is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. Work in this PE is related to and fully coordinated with efforts in PE 0603006A (Space Applications Advanced Technology), PE 0603008A (Command, Control and Communications Advanced Technology), PE 0602783A (Computer and Software Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and PE 0603734A (Military Engineering Advanced Technology). The PE contains no duplication with any effort within the Military Departments. Work is performed by the US Army Communications-Electronics Command, Fort Monmouth, NJ. This program supports the Objective Force transition path of the TCP.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602782A - Command, Control, Communications Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	23101	24342	20290
Appropriated Value	23314	24342	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-219	0
b. SBIR / STTR	-378	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	264	0	0
e. Rescissions	-213	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	1531
Current Budget Submit (FY 2003 PB)	22987	24123	21821

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A - Command, Control, Communications Technology	PROJECT 779					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
779 C2 & PLAT ELEC TECH	9601	8022	10296	10348	11310	11639	11905

A. Mission Description and Budget Item Justification: This project researches and applies new concepts and techniques in C2 to achieve new and enhanced military functional capabilities. Emphasis is on mission planning, rehearsal, execution and monitoring; precision positioning and navigation; and C2 technologies to support the Objective Force. New enabling technologies that support the current thrusts are also explored, such as advanced displays, multi-modal interactive technology, visualization, decision aids and tactical planning tools, data transfer, distributed data bases, advanced open system architectures, and integration concepts which contribute to more mobile operations. The project serves as a direct technology feed to Advanced Warfighting Experiments (AWEs), Advanced Technology Demonstrations (ATDs), Advanced Concept Technology Demonstrations (ACTDs) and Defense Technology Objectives (DTOs), including the following: Logistics C2 (Log C2) ATD; Agile Commander ATD; Consistent Battlespace Understanding DTO; Forecasting, Planning, and Resource Allocation DTO; Integrated Force and Execution Management DTO; and Future Command Post Technologies DTO. This project supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 2050 - Researched and lab-tested a real-time prototype of the navigation sensor/database registration error minimization algorithm.
- 2294 - Evaluated improved C2 protect capabilities in a virtual environment to support maturation and training for C2 protect capabilities.
- 323 - Researched, adapted and enhanced a prototype collaborative logistics planning capability that covers two logistics asset classes and operates within the emerging framework of the Defense Advanced Research Projects Agency's (DARPA) Advanced Logistics Project(ALP).
- 1800 - Conducted laboratory experiments of a squad-based collaborative planning software tool for whiteboarding, mapping and text collaboration; specified software intelligent agent architecture and tested mobile agent technology at the squad level; enhanced man-machine interface concepts through speech recognition and voice control integration of software applications; selected a portable testbed; evaluated concepts toward feasible solutions for smaller, lighter, energy efficient, soldier-worn computing systems. Concepts showed proof-of-principle improvement in battlespace SA and decision-making processes for commanders from battalion to squad levels.
- 2653 - Determined the upper-level knowledge-based interfaces for a distributed analysis and visualization infrastructure (DaVinci) for command, control, communications, computers and intelligence (C4I). Specified the initial critical requirements for course of action (COA) development and analysis, intelligent agents, information visualization, knowledge management, modeling and simulation, and adaptive applications
- 481 - Conducted flight test evaluation for command, control, communications, computers, intelligence, and electronic warfare (C4IEW) systems.

Total 9601

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602782A - Command, Control, Communications
 Technology**

PROJECT
779

FY 2002 Planned Program

- 1000 - Conduct lab test and prepare for field test, with a Battle Lab, PM or DARPA partner, to determine the benefit of GPS anti-jam, GPS pseudolite and navigation/electro-optic system integration technologies matured in the preceding two years.
- 1000 - Integrate brigade and above communications models in the core Distributed Interactive Simulation (DIS) Facilities (CDFs); conduct a distributed simulation at the Training & Doctrine (TRADOC) Analysis Center, Fort Leavenworth, KS using live troops and multiple sites to support maturation and training for integrated C2 protect capabilities; extend network and information operations security architecture to small unit operations by conducting virtual experiments using the modeling and simulation/stimulation capabilities in the CDFs.
- 1000 - Conduct proof-of-principle evaluation and laboratory tests of C2 applications at battalion to squad levels for mobile software agent SA, distributed battle planning and visualization, decision support aids, and human-machine interfaces through enhanced speech recognition.
- 4522 - Investigated a task expansion engine as a component within DaVinci to provide low level detail and synchronization data within a COA. Mature intelligent agents to enable linkage of different intelligent agents by action officers and end-users to provide enhanced C2 capabilities. Mature proper provisioning and filtering of information to support the commander in the decision making process.
- 500 - Conduct flight test evaluation for C4IEW systems.

Total 8022

FY 2003 Planned Program

- 1000 - Conduct field test, with a Battle Lab, PM or DARPA partner, to determine the benefit of GPS anti-jam, GPS pseudolite and navigation/electro-optic system integration technologies matured in the preceding three years.
- 2000 - Test, in the laboratory, a C2 SA subsystem for the dismounted tactical commander; conduct early user field experiment and assessment of the C2 SA subsystem and refine prototype hardware and software.
- 5156 - Investigate and test a robust tool set optimized for the commander and staff informational needs, capable of operating in a distributed environment, using a variety of structured and unstructured data sources; develop bi-directional links between these tools, intelligent agents, and other analytical or course of action tools to provide an integrated tool suite for the command and staff. Complete on-going technology efforts and transition products and concepts into DaVinci, the primary software environment for the Agile Commander ATD.
- 754 - Create detailed design plan and C2 data framework/protocol design to test automated, knowledge-based capabilities enabling critical C2 SA information retrieval and assessment and presentation in a manner that enhances the commander's ability to use remote unattended sensors and unmanned system assets.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602782A - Command, Control, Communications
Technology**

PROJECT
779

FY 2003 Planned Program (Continued)

- 1386 - Conduct flight test evaluation for C4IEW systems.

Total 10296

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602782A - Command, Control, Communications
 Technology**

PROJECT
H92

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H92 COMMUNICATIONS TECH	13386	16101	11525	12001	12209	12370	12704

A. Mission Description and Budget Item Justification: This project researches and applies communications and network technologies to meet the network-centric battlefield needs of the Objective Force, including the dismounted soldier. The strategy is based on leveraging and adapting commercial technology to the maximum extent possible and focusing maturation efforts on those areas not addressed by the commercial industry (e.g. mobile radio based infrastructures and backbones, security in narrowband environments, multiband OTM transmit and receive antennas, adaptive protocols and low probability of interception/low probability of detection (LPI/LPD)). Maximum use is made of the Dual Use Science & Technology (DUST) program through FY02. Key areas of research include: adaptation of mobile wireless technologies for hostile mobile environments; quality of service techniques for mobile wireless internet protocol (IP) and IP networks; the adaptation of and interface with commercial personal communications technology leveraging DARPA and commercial technologies for sensor networking; and development of realistic models for emerging communications services systems in dynamic field environments. In addition, this project investigates tactical antenna technologies; ferroelectric materials for phased array antennas; open systems design for wideband networking waveforms; and mobile internet protocols operating across different networks. This project also partially funds the communications networking for Network Sensors for the Objective Force (NSOF) ATD, to provide the Objective Force with the ability to task unmanned sensors and transport data and images from them to data fusion points and tactical commanders. NSOF will leverage a variety of efforts including the DARPA Sensor Information Technology (SensIT) program as well as technologies developed by Army Research Laboratory (ARL). These efforts directly support the information systems and DTOs outlined in the Defense Technology Area Plan. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 5352 - Conducted detailed technical assessment and high level design of mobile agent based dynamic addressing algorithms and protocols, dynamic network constitution and reconstitution algorithms, and protocols for tactical survivable dynamic mixed networks.
- Designed a distributed network management architecture, using intelligent "super agents" for semi-automated end-to-end network management, targeted for the lower Tactical Internet (TI) and Objective Force.
- Tested JTRS multiband OTM antenna prototypes and downselected to three promising designs.
- Continued maturation of the Ka band subarray, for wideband on-the-move affordable antenna.
- Successfully fabricated and tested positioner/tracker for EHF OTM low profile antenna.
- Achieved TRL 4 for VHF prototype soldier body borne antenna into soldier's vest; and reduced size and weight of L Band helmet array antenna.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602782A - Command, Control, Communications
Technology**

PROJECT
H92

FY 2001 Accomplishments: (Continued)

- 2277
 - Characterized performance of Broadband Antennas on Soldier Platform for wearable and chassis mounted installations.
 - Conducted sensor communications needs analysis and developed sensor communications architecture for Network Sensors for the Objective Force ATD. Investigated DARPA Global Mobile (GloMo) and Small Unit Operations (SUO) protocols and waveforms for applicability to extreme low power conditions required by unmanned sensor communication networks.
 - Assessed Information Dissemination Management-Tactical (IDM-T) architecture and implemented Defense Information Systems Agency (DISA) dissemination tools into an Army beta solution; transitioned to Program Executive Office (PEO) Command, Control & Communications Systems (C3S) .
 - Researched architecture and first order evaluation of adaptive optics for laser communications over 1 mile airpath.
- 5757
 - Evolved protection techniques for the tactical networks with focus on automated security management. Improved host based intrusion detection, lowered false alarm rate, enhanced alarm reporting framework for tactical networks, and provided security passphrase design.
 - Continued ongoing analysis of SUO/Situational Awareness System (SAS) design to support technology for JTRS software communications architecture; complete in FY02.
 - Acquired DARPA SUO/SAS engineering models for independent government tests and evaluation in laboratory and modeling environments.
 - Validated SUO/SAS radio frequency (RF) communications agility, network formation and routing manager functions, modem adaptability, and featureless waveform cover in laboratory environment.
 - Matured wireless radio chip breadboard for application to dismounted soldier interface.
 - Continued analysis of peer-to-peer waveforms integrated into a secure personal communication system (PCS) handset.
 - Evolved IP Quality of Service (QoS) implementation to provide multihop wireless communications across dissimilar networks.

Total 13386

FY 2002 Planned Program

- 5134
 - Evolve and verify the design of the active networks and mobile agent based dynamic re-addressing protocols and algorithms. Conduct analytic modeling, emulation and simulation to fully assess the proposed dynamic re-addressing protocols and algorithms.
 - Research an intelligent system that reasons based upon data supplied by mobile agents and security management tools. This will provide the tactical network manager with assistance and suggested courses of action with respect to fault analysis, performance, configuration and security. Target environments are the Objective Force.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602782A - Command, Control, Communications
 Technology**

PROJECT
H92

FY 2002 Planned Program (Continued)

- Conduct an RF safety assessment of body borne antennas and mature slow wave spiral antenna technologies to achieve antenna size reduction with substantial bandwidth.
- Complete maturation and evaluation of an X band subarray.
- Complete maturation (fabrication and test) of the single beam K band (20GHz) receive subarray.
- Begin maturation (design and initial fabrication) of a three beam K band (20 GHz) receive phased array antenna; apply thin film ferroelectric technology to reduce phase shifter losses in K band phased array antenna.
- Investigate JTRS On-the-Move (OTM) airborne multiband antenna options.
- Create and test JTRS OTM multiband, ground vehicle antenna prototype brassboards.
- 1528 - Extend sensor communications architecture to include maneuver layer interoperability including relays and gateways.
- Refine sensor communications requirements; integrate protocols and waveforms into prototype hardware.
- Conduct early laboratory experiments to establish performance against program goals and evaluation criteria.
- Mature a subsystem design for adaptive optics communications.
- 4439 - Evolve protection techniques for the tactical networks with emphasis on data mining and security event cross correlation.
- Complete analysis of SUO/SAS design for applicability to JTRS. Begin independent government test and evaluation in lab and field environments of SUO/SAS engineering model units; integrate with MOSAIC ATD FY02 demonstration.
- Evaluate wireless radio chip breadboard and conduct lab test for application to dismounted soldier.
- Evaluate PCS and peer-to-peer Universal Handset breadboard and demonstrate in laboratory environment.
- Complete maturation and begin integration of IP QoS into Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC) systems architecture.
- 5000 - Integrate multiple networking and wireless technologies into a coherent mobile architecture for demonstration of C3 on the move capabilities to support the Army Transformation decision.

Total 16101

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602782A - Command, Control, Communications
Technology**

PROJECT
H92

FY 2003 Planned Program

- 6403 - Implement dynamic re-addressing protocols and algorithms and evaluate in a lab environment.
 - Demonstrate, an automated self-healing network capability that can reconfigure network elements, to overcome failures caused by network anomalies, via automated means in a limited field environment.
 - Research a safety approved body borne antenna design.
 - Complete dual beam Ka band phased array antenna.
 - Fabricate JTRS OTM multiband antenna (airborne).
- 1270 - Validate sensor communications breadboard models in a limited network with anti-jam (AJ), low probability of intercept (LPI), low probability of detection (LPD) and secure modes.
 - Test adaptive optics communications in a Subsystem Lab environment.
 - Assess and evaluate DARPA fault tolerance and intrusion tolerance technologies.
- 3852 - Complete trade-off analysis of SUO/SAS wideband networking waveform technologies/components and develop system-on-a-chip/board design to reduce size, weight, and power for Objective Force Warrior networking digital radio.
 - Conduct breadboard implementation of SUO/SAS design optimization and size, weight, and power design changes.

Total 11525

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602783A - COMPUTER AND SOFTWARE TECHNOLOGY

PROJECT
Y10

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Y10 COMPUTER/INFO SCI TECH	4360	4113	4354	4406	4465	4114	4214

A. Mission Description and Budget Item Justification: The goal of this program element is two-fold: 1) To automate the collaboration for decision making (planning and execution) so that it is synchronized, parallel and real time, and 2) to develop collaboration tools to support both the staff and the Commander. Technical barriers to the accomplishment of this program include the non-existence of automated tools to support the flow and synchronization of data/information from humans to humans, from humans to computers, from computers to humans, as well as the fact that automation is currently too dependent on mouse and keyboard versus other modes of communication and understanding. This program element researches and applies information and communications technology to enhance understanding and speed the decision cycle for commanders operating in the mobile dispersed environment envisioned for the Objective Force. Efforts capitalize on computationally intensive approaches that exploit the rapidly evolving capabilities of emerging information and communication technology to create innovative military capabilities so as to yield a significant and real military advantage on the battlefield. Focus is on providing general solutions that can be applied to a wide variety of command and control (C2) problems. Work in this project is conducted by the U.S. Army Research Laboratory, and is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1361 - Enhanced performance of mobile ad hoc network algorithms and protocols integrated with self-configuring mobility protocols to support secure multicast streaming for mobile wireless nodes.
- Evaluated mobile ad hoc network algorithms and protocols integrated with self-configuring mobility protocols that support secure multicast streaming for mobile wireless nodes.
- Enhanced energy-efficient, self-configuring, ad hoc routing and medium access control algorithms integrated with localization algorithms that support unattended ground sensors.
- Enhanced automated vulnerability assessment tools with the capability to perform directed assessments of bandwidth-constrained wireless networks to confirm the existence of a set of known configuration errors and susceptibilities.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602783A - COMPUTER AND SOFTWARE
TECHNOLOGY**

PROJECT
Y10

FY 2001 Accomplishments: (Continued)

- 2999 - The following accomplishments were utilized by the Futures Battle Lab, Ft. Leavenworth KS and Command General Staff College for 3 Prairie Warrior exercises focusing on combat scenarios to establish future C2 requirements in the FCS environment. The exercises provided the necessary verification & validation of the technology and allowed for the collection of data necessary to conduct FY02 experiments with maturing collaborative technology.
 - Installed initial Collaborative Technology operating capability utilized second-generation technology and conducted initial experiments with Futures Battle Lab for design and usability feedback. Converted displays to mapping software, integrated speech / voice capabilities and text summarization tools into test bed.
 - Conducted experiment to empirically measure processing overhead due to intranet routing protocols and compared data to simulation results in order to identify most efficient protocol structures. Measured and evaluated performance improvement of information management algorithms responding to network delay feedback.
 - Integrated agent technologies into the battlespace decision environment to reduce the commander's workload in a command on the move scenario.

Total 4360

FY 2002 Planned Program

- 2766 - Evaluate and refine collaborative planning tools in support of evolving Objective Force command and control process, conduct and document the usability through experiments at TRADOC Futures Battle Lab and Agile Commander ATD.
 - Assess technologies for a low power, miniature radio that can be integrated in a miniature sensor to create a secure network to support forward-deployed unattended munitions, sensors and robotic prototype radio with integrated network protocols.
 - Define the requirements for a common network architecture for unattended sensor arrays, assess candidate protocols for very short duty cycle networks that use low power radios to control and transmit data from sensors, smart munitions and robots.
 - Provide mobile code for protecting tactical wireless networks, allowing Commanders to operate in a dynamically configurable environment.
 - Explore encryption algorithms and protection techniques for microsensors to reduce the vulnerability of unattended sensors arrays on the tactical battlefield.
 - Research various techniques that merge real time battlespace data to simulate proposed courses of action providing advantage and disadvantage insight of alternatives.
- 1347 - Communications and Networks Collaborative Technology Alliance will perform applied research on next generation automated intrusion detection techniques that accommodate wireless, self-configuring, mobile ad hoc networks and adapt to varying resource constraints.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602783A - COMPUTER AND SOFTWARE
TECHNOLOGY**PROJECT
Y10**FY 2002 Planned Program (Continued)**

- Communications and Networks Collaborative Technology Alliance will develop denial-of-service mitigation techniques for wireless networks with mobile network routers.

Total 4113

FY 2003 Planned Program

- 4354 - Provide tools for near term execution-centric decision making, improve capabilities for concurrent multi-echelon mission planning and immediate plan dissemination; preserve and make guidance available at all levels, provide framework for warfighter to provide feedback to technology.
- Evaluate low-power miniature radios with integrated energy efficient network protocols to provide enhanced communications capabilities for unattended sensor arrays, smart munitions, and robotics platforms.
- Optimize mobile code for protecting tactical wireless networks, allowing commanders to operate in a dynamically configurable environment.
- Provide encryption algorithms and protection techniques for microsensors to reduce the vulnerability of unattended microsensor arrays on the tactical battlefield.
- Integrate COA test-bed techniques that allow acceptance of battlespace data and provide real-time recommendations to the Objective Force commander as a battle progresses.

Total 4354

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602783A - COMPUTER AND SOFTWARE
 TECHNOLOGY**

PROJECT
Y10

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	3950	6154	4268
Appropriated Value	3987	4154	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-41	0
b. SBIR / STTR	-89	0	0
c. Omnibus or Other Above Threshold Reprogramming	0	0	0
d. Below Threshold Reprogramming	499	0	0
e. Rescissions	-37	0	0
Adjustments to Budget Years Since FY2001 PB	0	0	86
Current Budget Submit (FY 2003 PB)	4360	4113	4354

Change Summary Explanation:

FY02 funding to Project Y10 reduced by \$2100 by Congressional action.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602784A - MILITARY ENGINEERING TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	54366	59354	51124	53676	56325	57735	59796
855 TOP,IMAGE INTEL&SPACE	9394	9707	10938	11575	12728	13045	13442
EM2 FT GEORGE MEADE FUEL CELL DEMONSTRATION	0	2500	0	0	0	0	0
H71 ATMOSPHERIC INVESTIG	6238	7432	7145	8198	8651	8898	9106
T40 MOB/WPNS EFF TECH	15257	15638	19544	19884	20123	20962	22021
T41 MIL FACILITIES ENG TEC	4131	4458	5303	5544	5870	5580	5751
T42 COLD REGIONS ENGR TECH	5058	4889	4746	4856	5125	5240	5367
T45 ENERGY TEC APL MIL FAC	2752	2821	3448	3619	3828	4010	4109
T49 UNIVERSITY PARTNERING FOR OPERATIONAL SUPPORT	3845	3374	0	0	0	0	0
T52 DOD FUEL CELL TEST AND EVALUATION CENTER	4807	8535	0	0	0	0	0
T53 THERMOELECTRIC POWER GENERATION FOR MILITARY APPS	2884	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to provide technologies in direct support of critical warfighter functions of mobility, countermobility, survivability, sustainment engineering, and topography needed to transform the force. Research is conducted that supports special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. Key operational science and technology is provided to Army units under PE 0603734A (Military Engineering Advanced Technology). Results are tailored to support the materiel development, test, and operations communities in evaluating the impacts of weather, terrain, and atmospheric obscuration on military operations. Research provides and exploits a wide range of innovative technologies and applies them to Defense unique planning, acquisition, revitalization, and sustainment processes. This research will improve the efficiency and cost effectiveness as it relates to supporting the training/readiness/force projection missions in garrison and force sustainment missions in theaters of operation. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center and the U.S. Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	55332	42850	45508
Appropriated Value	55844	59850	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-496	0
b. SBIR / STTR	-754	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-210	0	0
e. Rescissions	-514	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	5616
Current Budget Submit (FY 2003 PB)	54366	59354	51124

Change Summary Explanation:

FY02 (+\$16504) Project 855 (-\$88), Project H71 (-\$65), Project T40 (-\$143), Project T41 (-\$40), Project T42 (-\$43), Project T45 (-\$26), Project T49 (-\$26), and Project T52 (-\$65) received general reductions in funding.

Congressional adds were made for Ft. George G. Meade Fuel Cell Demonstration, Project EM2 (+\$2500); Center for Geosciences, Project H71 (+\$1500); Cold Regions Military Engineering, Project T42 (+\$1000); University Partnership for Operational Support, Project T49 (+\$3400); Climate Change Fuel Cell Program, Project T52 (+\$3500); and DoD Fuel Cell Test and Evaluation Center, Project T52 (+\$5100).

FY03 (+\$5616) Project 855 (+227), Project H71 (+\$526), Project T40 (+\$3144), Project T41 (+\$621), Project T42 (+\$645), and Project T45 (+\$453) funding was increased in order to implement legislative change directing each agency to pay the full Government share of the accruing retirement costs of current Civil Service Retirement System (CSRS) employees and the accruing health care costs of all future Federal retirees.

Projects with no R-2As include:

- (\$2500) Ft. George G. Meade Fuel Cell Demonstration, Project EM2: The objective of this one year Congressional add is to demonstrate the

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commercial use of 1 Megawatt Solid Oxide Fuel Cells for military and civil stationary power applications. No additional funding is required to complete this project.

- (\$3400) University Partnership for Operational Support, Project T49: The objective of this one year Congressional add is to continue research that enhance operational, fine-scale forecast models of basic meteorological variables. No additional funding is required to complete this project.
- (\$3500) Climate Change Fuel Cell Program, Project T52: The objective of this one year Congressional add is to support the development and commercialization of domestic stationary fuel cell systems. No additional funding is required to complete this project.
- (\$5100) DoD Fuel Cell Test and Evaluation Center, Project T52: The objective of this one year Congressional add is to demonstrate and validate fuel cell technology for military and commercial applications. No additional funding is required to complete this project.

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February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
855

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
855 TOP,IMAGE INTEL&SPACE	9394	9707	10938	11575	12728	13045	13442

A. Mission Description and Budget Item Justification: The objective of this project is to provide warfighters with superior knowledge of the terrain and environment by adapting technologies to enable the Objective Force to move, shoot, and communicate on the battlefield more efficiently. Information dominance is a critical technology enabler for the Objective Force. Continuing evolution of these research efforts is imperative for the commander's ability to locate enemy forces, position troops in day/night all-weather conditions, provide crucial terrain data for command and control systems (C2) as well as effectively utilize modeling and simulation systems. Work in this project significantly enhances the Army's geospatial data management and dissemination capabilities by providing advanced technologies for storing, transforming, updating and disseminating extremely large volumes of terrain data at, or near, real-time. Weather/atmospheric effects data is provided for this project by the U.S. Army Research Laboratory project H71 in this program element. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 9394 - Created a capability for automated feature attribution using knowledge-based rules to provide better knowledge of the battlefield for FCS and the Objective Force.
- Extended advanced geospatial data management technology to support rapid update of terrain information using best available sources.
- Integrated a model derived from infrared and millimeter wave sensor performance overlays into 3D visualization for enhanced visualization of theater characteristics.
- Completed implementation of spectral/spatial algorithms for detection and identification of terrain features and conditions.
- Improved the spatial analysis tool to support course of action analysis for ground order of battle.
- Provided enhanced analytical terrain-reasoning tools to Army Battle Command System's All-Source Analysis System (ASAS) and Combat Terrain Information System (CTIS).

Total 9394

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**PROJECT
855**FY 2002 Planned Program**

- 9707 - Create initial terrain reasoning capability to provide time-sensitive course-of-action information for Objective Force applications.
 - Generate improved geospatial data access and distribution tools for more efficient dissemination of digital data.
 - Create semi-automated methods to produce modeling data sets for the Digital Topographic Support System (DTSS) and weather data sets from the Integrated Meteorological System (IMETS) for use with both infrared and millimeter wave scene visualization technologies.
 - Integrate new multi-sensor exploitation software into the digital stereo photogrammetric workstation for quicker and more efficient digital database construction.
 - Create a prototype for common environment database repository resulting in one integrated database for mission planning and rehearsal, modeling and simulation and common operating picture of the battlefield.
 - Complete spatial analysis software to support course of action analysis for ground order of battle.
 - Prototype rapid distributed data insertion software to tactical units for increased situational awareness to improve capability to provide time-sensitive course-of-action information.
 - Provide data exploitation software for new data sources to improve analysis of time-sensitive geospatial information.
 - Explore spatial and spectral information fusion techniques.
 - Establish interoperable web solutions for geospatial information.
 - Develop prototype of a low cost wheeled tactical navigator for improved battlefield vehicle POS/NAV.

Total 9707

FY 2003 Planned Program

- 10938 - Transition Tactical Decision Aid software into the Joint Precision Strike Demonstration program.
 - Provide a Web Mapping capability and integrate current state of the art technology to provide the ability for rapid, as-needed, in-field, and seamless use of map and geospatial information from servers world-wide; combining information from numerous enterprise systems into integrated visual and alphanumeric displays for the warfighter.
 - Generate enhanced data exploitation software sets for improved data analysis for Objective Force tactical decision aids.
 - Establish advanced tactical decision aids based on improved geospatial information.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
855

FY 2003 Planned Program (Continued)

- Formulate geospatial data fusion techniques to permit more intuitive presentation and more rapid comprehension of complex information sets.

- Create and integrate knowledge based editing software into the digital stereo photogrammetric workstation to reduce time required to develop a digital database.
- Integrate, test and evaluate the next generation national systems for developing geospatial information.
- Create software to incorporate secondary input sources (non-sensor sources) into current spectral sensor algorithms.

Total 10938

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
H71

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H71 ATMOSPHERIC INVESTIG	6238	7432	7145	8198	8651	8898	9106

A. Mission Description and Budget Item Justification: The objective of this project is to perform the applied research for tactical weather and atmospheric effects algorithms, and for the integration of battlefield atmospheric environments simulations. The Army's transformation plan to the Objective Force will require capabilities for battlefield commanders to make decisions based on tactical weather technology and impacts. This weather intelligence data will have to be not only accurate and timely, but distributed down to the lowest levels of command, which may include the individual soldier. This project accomplishes this mission by transitioning technology to the Project Director Integrated Meteorological System (PD-IMETS), through support to the Program Manager for Night Vision/Reconnaissance Surveillance and Target Acquisition (PM-NV/RSTA) for field artillery systems, and to the Department of Defense (DoD) modeling community. It provides the weather data from forecast/nowcast models, the distributed 4D weather database, and the weather decision aids that use this data for the digital battlefield commander by applying advanced computer techniques; incorporating new technology in meteorological sensor and system designs; researching data fusion techniques to horizontally integrate data from advanced weather sensors and non-weather sensors into decision aids for enhanced combat power on the battlefield and enhanced effectiveness of field artillery and deep attack assets. This project supports the Army's transformation to the Objective Force through future applications and platforms that support echelons at Brigade and below, down to the individual soldier, and Defense Technology Objectives, Weather/Atmospheric Impacts on Sensor Systems, and On-Scene Weather Sensing and Prediction Capability. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 6238 - Integrated joint weather impacts into decision aids for the Army's First Digitized Division weather capability.
- Upgraded the Weather Impact Decision Aid models with the characteristics and the impacts of weather on threat platforms, weapons, sensors and operations to enable the forecast of the deltas between threat and friendly systems.
- Completed a 3D atmospheric propagation and simulation model that included the effects of absorption, scattering, and radiative transfer, turbulence, clouds, aerosols, and smoke for improved simulations, virtual testing and analysis.
- Expanded the Electro Optics Systems Atmospheric Effects Library (EOSAEL) model suite with an acoustics model with documentation, for improved military analysis studies and wargames.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**PROJECT
H71**FY 2001 Accomplishments: (Continued)**

- Incorporated turbulent scattering into scanning acoustic wave propagation models for enhanced acoustic target acquisition.
- Coupled Acoustic Battlefield Aid (ABFA) with an Acoustic Target Recognition database and quantified the impacts on prediction of sensor performance.

- Conducted evaluation of neural network methods for retrieval of wind profiles from met satellite sounder data and integrated combined temperature retrieval methods to proof-of-concept Mobile Meteorological System Profiler (MMS-Profiler) processors to achieve better temperature sounding capability for improved artillery accuracy.
- Conducted verification and validation of Battlescale Forecast Model (BFM) modules for critical target area forecast parameters such as temperature, wind speed and wind direction, that will lead to more effective use of smart munitions and sub-munitions in the target areas.

Total 6238

FY 2002 Planned Program

- 5932
 - Incorporate full complex terrain/turbulent scattering acoustic propagation model into next generation weather decision aid systems.
 - Evaluate polarimetric imaging techniques for incorporation into sensor platforms for the Future Combat Systems (FCS).
 - Modify the BFM to accept weather data from local and RSTA sensors for improved meteorological information collection and utilization.

 - Evaluate techniques for effectively compressing meteorological data for distribution over low bandwidth networks.
 - Investigate methods for delivering meteorological information to FCS in compressed form to conserve limited bandwidth.
 - Investigate weather effects software to provide accurate artillery-tailored weather effects decision aids for trajectory analysis, targeting, and go/no-go forecasts to the fire control databases.
 - Evaluate non-hydrostatic mesoscale forecast model for more accurate battlefield moisture forecasts.
 - Verify the new Cumulus Parameterization Scheme for estimating convective precipitation for transition into IMETS and field artillery meteorological models.
 - Assess utility of prototype fluorescent particle sensor as part of a sensor suite for hazard detection and identification.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
H71

FY 2002 Planned Program (Continued)

- Research and test interim weather nowcast capability that can integrate ground-truth weather observations from non-conventional meteorological sensors such as Unmanned Aerial Vehicles (UAV), surface observations, and robotic sensors, with the current long-term forecasts generated at higher echelons to provide full spectrum weather support to the Army's Objective Force.

- Prepare distributed weather client applications for push/pull of forecasts and weather impact decision aids to lower echelons of the Objective Force, including Brigade Combat Weather Teams and soldier level interactive displays.

- 1500 - This one year Congressional add (Project H71) supports collaborative chemical and biological defense research. No additional funding is required to complete this project.

Total 7432

FY 2003 Planned Program

- 7145 - Integrate hyperspectral imaging with polarimetric imaging to aid in target signature analysis and target acquisition.
 - Integrate the effects of a forested canopy on acoustic propagation into a battlefield decision aid.
 - Implement advanced forecasting techniques for predicting critical target area meteorological (TAM) messages for test and evaluation.
 - Implement a research version of the BFM that has software for ingesting data from meteorological satellites, UAV, and distributed ground based sensors.
- Research and test the capability to host the BFM on battlefield gun platforms, initialized with data from the non-hydrostatic model hosted on the MMS-Profiler to allow for fully autonomous artillery meteorological message generation during battle.
- Verify a new high resolution, short-range forecasting capability based on integrating new battlefield meteorological data sources into model initialization. Improved data initialization will directly impact nowcast accuracy's, especially over the target area, and provide much higher resolutions over the theater of operations.
- Integrate distributed weather client applications and database connectivity with the ABCS or other joint C4I systems identified for Future Combat Systems Command and Control "on the move".
- Incorporate a new generation of physics-based weather impact decision aids into Army tactical weather workstations, to include a forecast of optical turbulence effects on RSTA, signature management and improved forecasts of nighttime light pollution on detection using low light level devices.

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2 - Applied ResearchPE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**PROJECT
H71**FY 2003 Planned Program (Continued)**

- Incorporate sets of weather algorithms that can be integrated into existing soldier and system embedded processors and that can use distributed processing to compute and replicate basic information for the individual soldier on current terrain and weather conditions, weather forecasts, weather warnings, heat stress, canteen use, and meteorological satellite imagery.
- Implement data assimilation techniques for incorporating data from chemical and biological sensors into nowcasting and hazard prediction models.

Total 7145

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February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
T40

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T40 MOB/WPNS EFF TECH	15257	15638	19544	19884	20123	20962	22021

A. Mission Description and Budget Item Justification: The objective of this project is to mature technology for rapid upgrading, construction, and repair of in-theater airfields; rapid establishment and repair of lines of communications (roads and bridges); expedient protection for the warfighter during contingency operations; and rapid port enhancement. This research supports development of the Future Combat Systems (FCS) and Objective Force by providing physics-based representation of mobility, obstacle and barrier creation, survivability, and weapons effects in urban terrain in modeling and simulation. Additionally, the project will mature technologies that will increase the survivability of critical assets from conventional and terrorist weapons, and sustainability of deployed forces, while reducing their logistical footprint. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 14257 - Matured analytical prediction methodology for forced-entry design criteria; evaluated protective concepts for base clusters and forward logistic nodes.
 - Selected analytic methodologies to provide lighter, more survivable protection by predicting down-axis ground shock from detonation partially in and below burster slab; completed dynamic experiments and analyses for enhanced survivability using square concrete structural components with intermediate span to thickness ratios; provided methods for retrofitting walls to resist terrorist mortars from asymmetric threats.
 - Completed Coastal Integrated Throughput Model Version II to include effects of nearshore bars, sea state, tidal changes, and validated improved, robust basin delineation computer sub-routines in a tactical planning exercise. Supported military exercise and real world evaluations of potential Joint Logistics Over The Shore (JLOTS) throughput and JLOTS sites.
 - Derived operational unit level movement algorithms for rapid, accurate and reliable representation of future force maneuver in Army models and simulations.
 - Advanced rapid construction, maintenance, and repair techniques and materials for roads and bridges to enable rapid force projection.

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
T40

FY 2001 Accomplishments: (Continued)

- Incorporated realistic performance/damage concepts into the advanced pavement analysis model to ensure accurate and reliable damage assessments on airfields during rapid force projection.
- Tested and evaluated Computer Aided Earthmoving System for initial assessment of rapid airfield construction capability.
- Implemented military bridging (ribbon bridge) representation, smart munitions (Hornet) with basic acoustic signals and weather effects, basic object models for rapid building generation, and physics-based airblast damage algorithms for modeling and simulation (OneSAF Testbed Baseline).

- 1000 - Added capability to the vulnerability assessment software to predict damage from an asymmetric terrorist attack against earth and rockfill dams.

Total 15257

FY 2002 Planned Program

- 14647 - Provide ballistic and low-signature protection for base camps, increasing their survivability from weapons threats; provide software structure and building wizard for regional-specific material properties and construction practices suitable for vulnerability assessments.
- Provide validated techniques for lighter, more survivable protection by predicting ground shock and structure-media interaction; derive analytic methodology to predict ground shock range to effect from detonation in limestone; provide experimentally validated techniques to predict effectiveness of barrier walls in reducing airblast loads on structures from terrorist weapons; evaluate effectiveness of high-strength/high-density overlays in defeating attack by high-velocity kinetic energy rods; create procedures to assess the vulnerability of structures used by deployed forces and methods to reduce blast stand-off distances from terrorist weapons.
- Determine mobility performance requirements for advanced vehicle platforms such as FCS.
- Evaluate hydrology model for effect/assessment on maneuver/counter maneuver during rapid force projection in worldwide scenarios.
- Complete coastal throughput assessment for rapid force projection and sustainment operations for a particular theater of operations to include assessment of capabilities to meet force projection demands associated with the Army Transformation.
- Provide methods for evaluating the effects of weather on engineer effort in rapid repair/construction of roadways during future force projection and sustainment operation scenarios.
- Expand pavement design and analysis model for rapid, accurate and reliable prediction of airfield performance using current and future aircraft.

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
T40

FY 2002 Planned Program (Continued)

- Assess materials and methods for rapid airfield construction that emphasize speed of construction and reliability of performance with a reduction in logistical tail during construction and maintenance of airfields.
- Create rapid airfield assessment technologies for determination of airfield capacity and performance predictions.
- Incorporate cross-beach Coastal Integrated Throughput Model into improved mobility models for accurate assessment of maneuver and throughput during rapid force projection and sustainment operations.
- Provide algorithms for rapid building generation, advanced vehicle platforms performance, and improve the representation of smart munitions effects in modeling and simulation.
- 991 - Incorporate damage prediction algorithms for remaining infrastructure components in vulnerability assessment software for protection of the selected critical infrastructure from asymmetric terrorist attacks.

Total 15638

FY 2003 Planned Program

- 19544 - Mature protective concepts for future theater missile defense systems used in transforming the force. Initiate evaluations of conceptual designs for survivability positions for dismounted forces in contingency environments.
- Draft input to the Tri-Service hardened design manual for increasing structure survivability by improved procedures for predicting ground shock due to detonations in or below burster slabs; gather experimental data defining ground shock, structure-media interaction, and structural damage for non ideal explosive detonations adjacent to reinforced-concrete walls.
- Create a basic 3D-modeling/viewing module for rapid bridge modeling system for improved situational awareness.
- Provide mobility risk analysis decision aids for FCS.
- Create hydrologic decision analysis capability for rapid in-theater maneuver assessment for the warfighter.
- Determine rapid force projection and sustainment requirements for future cross-beach operational scenarios.
- Provide digital reconnaissance applications to allow rapid remote main supply route assessments via TeleEngineering.
- Quantify maneuverability within urban environments on the future battlefield.
- Incorporate final Coastal Integrated Throughput Model into existing Military Hydrologic Models.
- Provide rapid in-theater performance model prediction capability for accurate and reliable assessment of airfields to enable rapid force projection.

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
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TECHNOLOGY**

PROJECT
T40

FY 2003 Planned Program (Continued)

- Create rapid stabilization and surfacing techniques to enable rapid airfield construction and rapid force projection operations in all weather conditions.

- Provide a capability for rapid building generation with correlation of structural properties and a baseline representation of vehicle maneuverability within urban environments for modeling and simulation.

Total 19544

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2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
T41

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T41 MIL FACILITIES ENG TEC	4131	4458	5303	5544	5870	5580	5751

A. Mission Description and Budget Item Justification: The objective of this project is to perform applied research necessary to deliver sustainable, cost efficient and effective facilities; and installation operations required to support the Objective Force. The project focuses on advanced technologies for the spectrum of facilities and operations directly supporting training, readiness, power projection, and forward basing. In addition, planned facility enhancements will achieve critically needed cost reduction in the Army facility life cycle process (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal), and the supporting installation operations. The improved facility quality resulting from this work will improve soldier quality of life and thereby enhance soldier retention. Technologies evolving from this work include composite rehabilitation materials, multi-hazard mitigation, electromagnetic shielding, concurrent engineering processes, collaborative decision support, and knowledge processing. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4131 - Completed development of an integrated corrosion control selection engineering process for determining use of corrosion control materials and technologies, and to minimize corrosion related Operations and Maintenance costs.
- Formulated predictive service life tests and criteria for roofing membrane materials to minimize roofing maintenance and reroofing.
- Created computable building model framework to support collaborative engineering planning and design to ensure integration of multiple and conflicting building requirement.

Total 4131

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
T41

FY 2002 Planned Program

- 4458 - Complete seismic vulnerability evaluation guidance for building floor and roof elements in Army facilities for assessing compliance with current seismic criteria.
 - Formulate a prototype model for reliability based maintenance of Army infrastructure for maintenance planning and cost reduction.
 - Generate requirements driven military construction (MCA) facility models to ensure facilities meet Army Installation Transformation cost effectiveness goals.
 - Formulate mission/site specific algorithm for rapidly generating base camp facilities requirements and plans.

Total 4458

FY 2003 Planned Program

- 5303 - Generate analytical models and design guidance for seismic rehabilitation of reinforced concrete frames with masonry infill to comply with current seismic criteria.
 - Develop performance envelope for composite structural repair and upgrade materials for predicting long-term usage in maintaining and improving infrastructure.
 - Complete a unified data integration process that supports design and construction analyses to ensure mission responsive facilities.
 - Analyze lightweight, alternative construction materials for base camp logistics reduction.
 - Improve analysis of installation force projection performance for compliance with transformation criteria.
 - Provide improved guidance and procedures to increase the reliability of shielded construction designed to protect critical command, control, communications, computer, intelligence, surveillance and reconnaissance (C4ISR) facilities against disruption or damage by electromagnetic (EM) threats.

Total 5303

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
T42

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T42 COLD REGIONS ENGR TECH	5058	4889	4746	4856	5125	5240	5367

A. Mission Description and Budget Item Justification: This project is the only Department of Defense (DoD) applied research effort focused on the knowledge base and engineering principles for achieving Objective Force capabilities across seasonal conditions and in cold regions of the world. The Objective Force and Future Combat Systems (FCS) must have expert knowledge of the battlespace environment to obtain desired lethality, survivability and mobility. Advances in sensing and target acquisition capabilities critical to FCS require greater fidelity and more accurate forecasts of state of the terrain. Research provides the basis for extending the operability of the Objective Force in all seasons through application of physics-based models for predicting state of the terrain, and the effects of the environment on target and target background signatures. To achieve superior mobility and enable required strategic, operational, and tactical maneuver in all seasons, the Objective Force requires non-materiel advances in military engineering capabilities. Research provides for advances in planning and assessment tools, innovative construction materials, and techniques and procedures to reduce dependence on ports and airfields. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. The work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 5058 - Characterized the geophysical properties at Yuma Proving Grounds Smart Weapons Test Range with geophysical testing techniques and ran corresponding computer simulations to verify accuracy of simulated seismic signal levels for non-moving impulsive loads.
- Measured significant improvements to target detection and battle position selection by providing synthetic infrared scenes for warfighter preview.
- Advanced thawed soil stabilization and winter concrete construction techniques for base camps and expedient roadways in austere/remote theaters.
- Incorporated freeze-thaw theory into the 3D finite element pavement model in order to predict pavement performance during freeze-thaw periods.
- Applied high fidelity vehicle dynamics modeling capability for development of seismic source signatures.

Total 5058

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
T42

FY 2002 Planned Program

- 3889 - Use DoD high performance computing resources to perform a seismic simulation sensitivity study of ground vibrations propagating from armored vehicles moving over a variety of terrains and geologic settings. Use results of the study to verify accuracy of seismic simulations in comparison to field test results of moving tracked vehicles.
 - Establish feasibility of generating 3D dynamic multi-spectral synthetic scenes for mission planning, training, and weapon selection through the Digital Topographic Support System.
 - Establish feasibility of using Dynamic Terrain State models in a tactical setting, with tactical computing assets to support sensor performance and mobility predictions. This forms one set of tools for combat decision support using terrain reasoning.
 - Complete mechanistic model for pavement design and evaluation to prevent/alleviate frost heave and thaw weakening, thermal cracking, and cracking induced by structural loading during thaw periods.
 - Develop high fidelity model for prototype wheeled vehicle performance evaluation on a dynamic surface (alterable friction coefficients representing snow and ice conditions).
- 1000 - This one year Congressional add (Project T42) demonstrates and completes effort to improve base camp winter construction techniques and procedures. No additional funding is required to complete this project.

Total 4889

FY 2003 Planned Program

- 4746 - Develop a geophysical model of Yuma Proving Grounds Smart Weapons Test Range for use in simulation-based system prototype development and advanced target location and tracking capabilities for Raptor-like seismic sensing arrays.
 - Formulate preliminary model that includes parameters of seasonal high amplitude background noise in a range of urban conditions as a baseline for acoustic detection algorithm development applicable to Objective Force unattended ground sensor requirements.
 - Fuse weather forecast and terrain reasoning products with thermal sensor performance modeling capability for enhanced battlefield terrain reasoning and awareness.
 - Complete ground and support assessments for strengthening indigenous soils during thaw periods for rapid all-season construction of theater airfields.
- Develop high fidelity, high resolution, deformable all-season terrain database for input to concept vehicle dynamics simulations.

Total 4746

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**

PROJECT
T45

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T45 ENERGY TEC APL MIL FAC	2752	2821	3448	3619	3828	4010	4109

A. Mission Description and Budget Item Justification: The objective of this project is to provide technology necessary to provide cost effective, energy efficient, sustainable military installations, emphasizing a secure and reliable energy supply for Army Installations supporting transformation. Advanced energy technologies and processes are also applied to the Army's industrial base to maintain its cost-effective readiness for munitions production. Advanced technologies include integrated, distributed and renewable energy supply, hybrid cooling, and microturbines for Army application at all installations, to include theater of operations. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2752 - Completed technology maintenance process for improving energy system performance and efficiency.
- Created a template and design practice for optimizing the selection of hybrid cooling systems.
- Provided process energy and pollution reduction (PEPR) program with expert system capability to ensure enhanced life-cycle performance.

Total 2752

FY 2002 Planned Program

- 2821 - Determine the number and types of verification processes necessary to validate the full range of Army energy projects.
- Generate prototype 'open system' direct digital control implementation concept for Heating Ventilation and Air Conditioning (HVAC) control systems to ensure common operating maintenance practices on all Army installations.

Total 2821

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
**0602784A - MILITARY ENGINEERING
TECHNOLOGY**PROJECT
T45**FY 2003 Planned Program**

- 3448 - Establish air pressure leak management techniques for modernizing Army compressed air systems.
- Investigate effective renewable and distributed energy technologies and compile recommendations for integration into a strategic energy plan that provides for a more diverse portfolio of energy supply options at Army installations.

Total 3448

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602785A - Manpower/Personnel/Training Technology	PROJECT 790					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
790 PERSONNEL PERFORMANCE & TRAINING TECHNOLOGY	11658	15175	14335	14591	14879	15148	15434

A. Mission Description and Budget Item Justification: The objective of this program element (PE) is to provide the scientific and technical basis for personnel selection, leader development, and training for Future Combat Systems and the Objective Force. This applied research program will provide advanced tools to improve the selection and classification procedures to ensure the right person is placed in the right job, determine leader skills and requirements, and provide the behavioral technologies required for the development of effective individual and collective (unit) training strategies. Research topics include training strategies for the digitized battlefield, training strategies in simulated environments, optimum designs and utilization of simulators and training devices to achieve maximum learning at minimum cost, and modernization of the selection and classification systems to maintain warfighting capabilities for future forces. Research in this PE is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance and supports the Human Systems - Personnel Performance and Training - Defense Technology Area. This Program Element is managed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 11658 - Identified potential training issues emerging from the Initial Brigade Combat Team (IBCT) that are relevant to the Future Combat Systems (FCS).
 - Developed, demonstrated, and evaluated extended instructional modules for versatile thinking skills required by division staff.
 - Evaluated the use of virtual environments for night operations training.
 - Prepared guidelines on the training, transfer, and adaptability of digital skills as a function of training method.
 - Incorporated prototype system for computer recognition of human gestures into Virtual Environments for dismounted soldier training and mission rehearsal.
 - Determined the relationships between 21st century NCO attributes and mission performance measures to identify the best predictors of success.
 - Assessed effectiveness of Dismounted Leader After Action Review System.
 - Recommended procedures to enhance transfer of performance across upgrades of digital systems.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602785A - Manpower/Personnel/Training
Technology**

PROJECT
790

FY 2001 Accomplishments: (Continued)

- Described changes in unit behavior associated with digitization.
- Developed and evaluated simulator instructional support features for Initial Entry Rotary Wing phases of flight training.
- Completed upgrades to Simulator Training Research Advanced Test bed for Aviation (STRATA).
- Identified and developed preliminary new screening tools for recruiters.

Total 11658

FY 2002 Planned Program

- 15175
 - Develop simulation-based program of instruction for OH-58D aircraft qualification using advanced methodologies adapted from Intelligent Flight Trainer (IFT).
 - Identify simulation collective task training requirements for current and future aircraft and for joint operations.
 - Implement and evaluate VE-based training system enhancements such as improved locomotion and visual systems, and voice and gesture control of simulated subordinates.
 - Identify variables that could influence performance in network-collaborative environments.
 - Develop graded measures of digital proficiency.
 - Identify common demands for future Army initial entry jobs.
 - Identify or develop measures and initiate validation of new screening tools for recruiters and recruiting station commanders.
 - Determine the best indicators of future NCO performance.
 - Pilot test new approaches to leader development within the Command and General Staff Officer's Course; initiate follow-up assessment of the impact on leader performance in the field.
 - Identify and select critical FCS C4ISR skills for commanders and staffs.
 - Refine existing Think Like a Commander leader development tool to support multi-echelon vignettes; implement pilot versions of the new system and initiate field trials.
 - Develop prototype computer-based situational awareness skills training for small unit leaders.
 - Implement experimental leader development program at Command and General Staff College (CGSC).
 - Field test small unit leader situational awareness measurement instruments.
 - Identify or develop candidate interventions to reduce first term attrition.

Total 15175

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602785A - Manpower/Personnel/Training
Technology**

PROJECT
790

FY 2003 Planned Program

- 14335 - Develop simulator and in-flight performance measurement technologies for determining training outcomes in the school and in field unit collective and joint training.
- Conduct experiments in virtual simulation to assess alternative methods/techniques for future C4ISR tasks.
- Develop prototype training for efficient digital-skill acquisition, retention and transfer within selected digital environments.
- Develop general principles of training and transfer for TRADOC use in digital skill acquisition programs.
- Evaluate the effectiveness of alternative aviator skill sustainment approaches for collective task training in field units, including in-flight training.

- Develop model for predicting first-term enlisted attrition and validate attrition interventions.
- Complete predictive validation of new screening tools for Army recruiters and station commanders.
- Identify candidate attributes for successful future job performance in the Objective Force.
- Develop prototype enlisted promotion measures geared to the needs of the 21st Century.
- Establish requirements for PC-based prototype system with VE-based simulation capability for training dismounted soldiers and units.
- Begin implementing materials on the worldwide web to support officer self-development of conceptual skills.

Total 14335

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
**0602785A - Manpower/Personnel/Training
 Technology**

PROJECT
790

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	11759	16315	13530
Appropriated Value	11869	15315	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-140	0
b. SBIR / STTR	-250	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	148	0	0
e. Rescissions	-109	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	805
Current Budget Submit (FY 2003 PB)	11658	15175	14335

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	26529	33474	25502	23655	23141	23736	24304
283 AIRDROP ADV TECH	3614	6534	3112	1860	2462	2540	2599
C60 AC60	873	1454	0	0	0	0	0
H98 CLOTHING & EQUIPM TECH	15623	16803	16667	16329	14954	15577	15917
H99 JOINT SERVICE COMBAT FEEDING TECHNOLOGY	6419	7683	5723	5466	5725	5619	5788
WA1 CENTER FOR RELIABLE WIRELESS COMM TECH	0	1000	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) improves soldier survivability and performance by researching and investigating technologies for: combat clothing and personal equipment; combat rations and combat feeding equipment; and the air delivery of personnel and cargo. This program element supports the Army Transformation in the areas of improved dismounted soldier capabilities (project H98), logistics footprint reduction (project H99), and rapid deployment (project 283). The Clothing and Equipment Technology project (H98) funds cutting edge research and technologies for clothing, equipment, and high-pressure airbeam supported shelters. Technologies will enhance warfighter survivability from both combat threats (e.g., ballistics, flame, directed energy) and the field environment; enhance signature management and integration; provide alternative self-sufficient power; and significantly lighten the soldier's load. Human science is incorporated into modeling and analysis tools that will enable technologists and military users to trade-off potential warrior system capabilities and develop a human-centered warrior system design. The Joint Services Combat Feeding Technology program (H99) supports all Military Services, the Special Operations Command, and the Defense Logistics Agency with research and development of high impact/high payoff technologies for performance enhancing combat rations, packaging, and combat feeding equipment/systems. Research will enhance nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; minimize physical, chemical and nutritional degradation of combat rations during storage; meet the needs of individual soldiers in highly mobile battlefield situations; and provide equipment and energy technologies to reduce the logistics footprint of field feeding while improving the quality of food service. Similarly, the Airdrop Advanced Technology project (283) supports all Services' requirements for air dropping larger combat and logistics loads while improving delivery accuracy, minimizing vulnerability of aircraft, and reducing life cycle costs. Investigation of technologies for safer, more combat efficient personnel parachutes addresses a critical capability for rapid deployment force projection, particularly into hostile environments. Contractors performing the work for this PE include: Alliant Technology, Inc., MN; General Dynamics, MI; South West Research Institute, TX; Ceradyne, Inc. CA; University of Virginia, VA; University of Rhode Island, RI; H.P. White Laboratory, MD; Irvin Aerospace, Inc., CA; Vertigo, Inc., CA; Simulation Technologies, Inc., OH; University of Massachusetts/Lowell, MA; Rensselaer Polytechnic Institute, NY; UMASS, Amherst, MA; and CERCOM, Inc., CA. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. It adheres to Tri-Service Reliance agreements on clothing, textiles, and operational rations and field food service

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

equipment, with oversight and coordination provided by the Human Systems Reliance Panel, the Warrior Systems Technology Base Executive Steering Committee, and the Department of Defense (DoD) Food & Nutrition Research & Engineering Board. The program element contains no duplication with any effort within the Military Departments. Efforts are coordinated with those in PE 0603001A (Warfighter Advanced Technology). Work is performed by the Natick Soldier Center, Natick, MA.

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	27901	27061	23260
Appropriated Value	28159	33761	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-287	0
b. SBIR / STTR	-516	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-857	0	0
e. Rescissions	-257	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	2242
Current Budget Submit (FY 2003 PB)	26529	33474	25502

Change Summary Explanation:

FY01 - Congressional adds were made for Combat Feeding, Project H99 (\$1500); Affordable Guided Airdrop System, Project 283 (\$1000); and Blisterguard Socks, Project H98 (\$1000).

FY02 - Congressional adds were made for Airbeam Manufacturing Process, Project H98 (\$1000); Center for Reliable Wireless Communications Technology for Digital Battlefield, Project WA1 (\$1000); Combat Feeding, Project H99 (\$1700); Standoff Precision Aerial Delivery System, Project 283 (\$2000); and Army Nutrition Program, Project H99 (\$1000).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

-\$1000) Center for Reliable Wireless Communications Technology for Digital Battlefield, Project WA1: The objective of this one year Congressional add is to support research in a wireless testbed facility for potential application to digital communications. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A - LOGISTICS TECHNOLOGY	PROJECT 283					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
283 AIRDROP ADV TECH	3614	6534	3112	1860	2462	2540	2599

A. Mission Description and Budget Item Justification: This project researches technologies to enhance personnel and cargo airdrop capabilities. These are key Army Transformation rapid deployment capabilities for force projection, particularly into hostile areas. Areas of emphasis include parachute technology for improved performance, precision offset aerial delivery, soft landing system development, airdrop simulation, and low altitude/high speed airdrop systems technologies. Efforts will result in increased personnel safety, more survivable and more accurate cargo delivery and reduced personnel, aircraft, and cargo vulnerability. This project will enhance the military's capability for global precision delivery and rapid force projection and supports the rapid deployment goal of the Army Transformation. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1714 - Identified and analyzed candidate concepts for a low cost, precision airdrop resupply capability for humanitarian and other one-time-use operations.
- Conducted market analysis for state-of-the-art technologies for decreasing rate of descent and automatic activation capabilities for personnel parachutes.
- Conducted feasibility experiments with candidate low cost precision airdrop concepts and advanced cargo airdrop mechanisms.
- Fabricated and conducted preliminary tests on miniaturized airdrop instrumentation package.
- 900 - Incorporated additional advanced features into a second-generation three-dimensional high performance airdrop system model and validated with concurrent experimentation as part of a High Performance Computing (HPC) Grand Challenge program.
- Simulated airdrop systems of interest to DoD, incorporated results to enhance Guidance, Navigation, and Control (GN&C) logic, and packaged software into a user-friendly Graphical User Interface (GUI) environment for use as an "airdrop virtual proving ground".
- 1000 - FY 2001 Congressional plus-up furthered research for an Affordable Guided Airdrop System (AGAS) to include GN&C and improved pneumatic control systems.
- Performed an integrated flight test utilizing AGAS technologies.

Total 3614

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGYPROJECT
283**FY 2002 Planned Program**

- 1064 - Research additional components and technologies in support of the Precision Roll-on/Roll-off Air Delivery STO and transition to 6.3 STO programs.
- 700 - Design automatic opening capability system prototypes and conduct systems integration/human factors analysis.
- 799 - Utilize Airdrop System Modeling to simulate brassboards and prototypes in tech base and development programs (such as the Affordable Guided Airdrop System and the Advanced Tactical Parachute System) while validating the results with flight test data.
- 1971 - Research concepts for, and feasibility of, developing a 20-ton, high altitude (25,000 ft), high offset (30 km) precision airdrop system to provide greater deployability and sustainability for the Objective Force.
- 2000 - FY 2002 Congressional plus-up for Standoff Precision Aerial Delivery System. Funding will develop a computer based airdrop mission planner to improve the accuracy of ballistic and autonomous airdrop systems.

Total 6534

FY 2003 Planned Program

- 972 - Complete GUI front end for Airdrop System Modeling tools and complete the approved HPC Grand Challenge program objectives.
- Optimize the design of advanced low cost autonomous controllable airdrop systems utilizing HPC modeling tools.
- 1140 - Design and conduct scaled tests on smaller and less expensive autonomous GN&C systems for low and primarily high altitude airdrop applications.
- 1000 - Fabricate system component prototypes for automatic opening capability and conduct component-level field experiments.

Total 3112

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

PROJECT
H98

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H98 CLOTHING & EQUIPM TECH	15623	16803	16667	16329	14954	15577	15917

A. Mission Description and Budget Item Justification: This project supports the Army Transformation in the area of improved dismounted soldier capabilities by researching and investigating technologies to improve soldier survivability and performance. Areas of emphasis include: research to significantly lighten the soldier's load; lightweight materials for personal survivability (e.g., improved ballistic, flame, and directed energy protection, enhanced signature management); human science, modeling and analysis tools for optimizing soldier system clothing and equipment; three-dimensional textiles for achieving rapidly deployable wide-span airbeam supported shelters. These advanced technologies are being investigated to support the requirements of the Objective Force. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 5744 - Evaluated simulations for virtual prototyping tools to develop warrior system designs, with a focus on integrated load carriage, helmet design, and component/capability placement on the torso and head; developed virtual prototyping approaches to analyze biomechanic effects of soldier systems designs; demonstrated the feasibility of incorporating nano-scale materials in soldier system components to reduce weight and/or enhance performance; fabricated lab scale quantities of carbon nanotube materials for prototype ballistic testing.
- Determined required level of human system data points to enable quantitative measures of soldier system performance, validation of small unit combat analysis models, and development of soldier system virtual prototyping and design tools; collected required human system data to accomplish those tasks.

- 5600 - Extended the IUSS individual/small unit combat model to provide the initial ability to assess the effects of restricted terrain (e.g., rooms, hallways, trenches) on warrior system performance.
- Transitioned improved test methodology/assessment criteria for protective helmet systems to the acquisition community to enable the trade-off of protection, weight, and affordability; continued to mature novel concepts to increase protection and decrease the weight of personnel armor components.

- 2164 - Determined effects of varied topographic and terrain conditions on soldier performance through biomechanical evaluations; extended the passive dynamic gait model to encompass terrain data; augmented 3-D anthropometric scanning capabilities to include tools for applications supporting human-based modeling/simulation and novel uniform and equipment virtual prototyping and design concepts.

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February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

PROJECT
H98

FY 2001 Accomplishments: (Continued)

- Investigated and processed electronic and photonic materials using electrospinning and electrostatic layer-by-layer deposition techniques into novel, high surface area nano-structures; assessed energy density and conversion efficiency potential for future power generating devices for soldier use.

- 2115 - Showed a 30% cost decrease compared to the cost of existing flame-resistant combat clothing systems while maintaining multiple threat protection levels; demonstrated flame resistant knit fabrics with a cost savings from 10-30%.
- Modified the breadboard design of millimeter-lens arrays for laser eye protection devices to decrease the length of the optical assembly to make them more compatible with human factors criteria. This technology will support all soldiers, including mounted and infantry, in the Objective Force.

- Demonstrated the ability of an airbeam-supported structure to span a cross section exceeding 85 feet in width and developed a rapidly deployable large weapons platform maintenance shelter prototype 85' x 120' long.

Total 15623

FY 2002 Planned Program

- 7293 - Enhance the capabilities of virtual prototyping tools, focusing on the head and torso areas, to advance the state-of-the-art in designing body worn soldier clothing and equipment.
- Produce breadboard prototype panels or system components made with nanomaterials for performance testing to determine the potential for significant system weight reduction and/or enhanced performance.
- Collect additional required human system performance data to support soldier system design decisions.
- 6042 - Develop close combat/small arms algorithms to assess warrior survivability and lethality at distances less than 25 meters.
- Complete an improved personnel armor casualty assessment model that will permit evaluation of personnel armor systems against conventional and emerging ballistic threats.
- 2468 - Provide design guidance for load carrying equipment that enhances mobility performance across squad positions by 15%.
- Improve energy density and conversion efficiencies of photovoltaic nanostructures to promising levels for soldier system use through unique materials, modeling, processing and fabrication strategies.
- 1000 - FY 2002 Congressional plus-up for Airbeam Manufacturing Process. Funding will develop manufacturing technology to improve affordability and reliability of new inflatable textile based structures for deployable shelters.

Total 16803

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

PROJECT
H98

FY 2003 Planned Program

- 6300 - Collect/use human system data to enhance and verify virtual prototyping tools for soldier systems with human biomechanical and performance data.
 - Evaluate the performance of breadboard prototype panels or system components made with nanomaterials to determine technology readiness for transition to the planned Objective Force Warrior program (PE63001, Proj J50), and to determine the path for further nanotechnology refinement and manipulation.
- 6037 - Show a capability to represent human behavior using reactive intelligent agents in the close combat/MOUT environment. Modeling will significantly improve combat worth assessments of warrior systems.
 - Investigate an improved material system breadboard (over FY99 insertions) for 2nd generation multiple ballistic threat protection prototype with 25% decrease in weight (or an increase in protection or a combination, depending on user requirements). Display a protective (opaque) armor system with 30% reduced area density (over FY00 baseline) against fragment threat without incurring significant cost, bulk, or flexibility penalties.
- 2856 - Show that physical training programs improve locomotor performance by 15%. Provide physics-based model of locomotion to enable soldier system equipment developers to design more efficient system components.
 - Fabricate conformal solar cell devices with a minimum 30% reduction in weight (when compared to power devices of similar current devices) for use in soldier systems.
- 1474 - Research, identify and analyze multiple materials and design concepts for form fitting combat uniform that provides a 20% weight reduction over standard uniform.
 - Enlarge breadboard lens array design to the size required for eyewear and define the curvature requirements for using arrays in a goggle. This will lead to a goggle that provides agile laser eye protection, vs. the current fixed line approach, for all soldiers.
 - Evaluate the unique dynamics which an urban battlefield imposes on the soldier's total camouflage signature and explore effective signature management treatments for the urban warrior.

Total 16667

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602786A - LOGISTICS TECHNOLOGY					PROJECT H99	
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H99 JOINT SERVICE COMBAT FEEDING TECHNOLOGY	6419	7683	5723	5466	5725	5619	5788

A. Mission Description and Budget Item Justification: The Joint Services Combat Feeding Technology project researches and applies combat feeding and food system technologies to revolutionize the manner in which we sustain and support the Armed Forces, ensuring optimal nutritional intake. This project supports the Army Transformation in the areas of sustainability and reduced logistics footprint. Thrust areas include: applied research of combat rations, packaging, and combat feeding equipment/systems. Near-term goals include: enhancing nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; reducing ration weight/volume and food packaging waste to minimize the logistics footprint; tailoring rations to the combat situation and radically improving mobility; reducing replenishment demand by extending shelf-life, permitting more extensive prepositioning of stocks, while maintaining initial quality; and providing equipment and energy technologies to reduce the logistics footprint of field feeding while improving the quality of food service. The work in this project supports all military Services, the Army's Objective Force, Special Operations Command, and the Defense Logistics Agency. The Army has Executive Agency responsibility for this DoD program. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1702 - Completed prototype design, fabrication and testing of innovative scroll expander for Liquid-Injection Cogeneration that enables silent efficient and reliable heat and power production for field kitchens; transitioned to another task within this project (Field-feeding and Advanced Sustainment Technology (FAST Food Service)).
 - Completed research for three competing cogeneration concepts for current field kitchens based on Thermophotovoltaics, Stirling Cycle, and Liquid-injected cogeneration. Designed for a nominal output of 500 watts, the cogenerators will replace the current 2 kW engine driven generator used in current kitchens with less noise, fuel consumption, and maintenance requirements.
 - Conducted a design study for thermoacoustic refrigeration that uses environmentally friendly refrigerants and only has one moving part to enhance reliability.
 - Completed design and testing of a lightweight self-powered sanitation center based on one sink. Using a standard shelter heater and four 30-watt thermoelectric modules, the center provides a spray wash capability and uses 1/3 the water of conventional systems. Tested and evaluated non-stick coating and sanitizing solutions for future waterless sanitation system for use in field kitchens.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGYPROJECT
H99**FY 2001 Accomplishments: (Continued)**

- 565 - Completed research and prototype development of Soldier Pocket Stove technology to validate/demonstrate revolutionary non-powered combustion technology; transitioned to Soldier Enhancement Program (PE/Proj 654713/668). Stove technology provides effective capability for soldiers to heat water for beverages, rehydrated rations, and personal hygiene.
 - Researched technology for Remote Unit Self-Heating Meals (RUSHM) including integration of food and heaters, and heat transfer modeling and testing to ensure environmental compliance and optimum performance at lowest cost. RUSHM provides hot group meals for the Objective Force prior to arrival of Combat Support Augmentation Team.
- 2450 - Completed research and conducted initial testing of combat optimized ration components to include engineered carrier matrices for bioengineered proteins, encapsulation technology for smart food ration components, and new delivery systems (i.e., gels) to increase cognitive/physical performance. Transitioned mature technology/components to First Strike Ration (FSR) and Performance Enhancing Delivery Systems (PEDS).
 - Completed concept evaluation of products produced with advanced dehydration technologies which reduce ration weight, volume and total logistics costs; transitioned to System Demonstration and Development (SDD) phase (PE/Proj 643747/610 Food Advanced Development).
 - Evaluated commercial components for ration quality status indicators for potential use by military logistics personnel to ensure least fresh, first out; designed integrated sustainment supply/requisition/distribution concepts that support DoD/Department of Army logistic initiatives and minimize logistical impacts, theatre stockpiles and resupply requirements.
 - Conducted technical research and developed initial design of smart packaging system prototypes that: will respond to the environment and have potential to provide a reduced signature single packaging system for all rations; will prevent lipid oxidation and help prolong quality retention of shelf stable ration items; and will use intercomponent films for multi-component ration items to increase product quality and menu variety.
- 1702 - Researched technology and evaluated pressure effects on texture mediated by activation/release of native enzymes in fresh vegetables (pectin esterases) or meats (proteases) as a pretreatment to reduce dehydration or thermal processing requirements for ration components, while maintaining initial quality.
 - Conducted processing trials to determine feasibility of utilizing and/or modifying existing methods and techniques; optimized processing parameters to enhance orientation of nanocomposite fillers, such that gas diffusion will be minimized, extending barrier protection for combat rations.
 - Conducted research and initiated technical testing of mixed culture samples to evaluate the potential and time for detecting and differentiating specific volatile compounds from food pathogens for use in easy-to-use, lightweight, field biosensor.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

PROJECT
H99

FY 2001 Accomplishments: (Continued)

- Investigated innovative food preservation technologies (thermal and non-thermal); awarded contract to assess the feasibility of novel nutrient delivery systems; researched foundations for enhancing human performance in stressful situations through nutritional initiatives; researched and evaluated material sciences for advanced food packaging systems to maintain barrier properties while improving environmental compliance; identified food safety detection and intervention methodologies for countering both bioterrorism threats and natural microbial pathogens in military feeding operations.

Total 6419

FY 2002 Planned Program

- 1807 - Investigate technology and conduct validation testing of selected carriers for "smart" food ration components to sustain cognitive and physical performance. Transition to SDD phase (PE/Proj 643747/610 Food Advanced Development).
 - Complete data analysis from Combat Optimized Rations Concept demo, implement changes and transition to First Strike Ration to reduce combat ration weight and volume.
 - Identify pathogen specific Volatile Organic Compounds (VOCs) and initiate exploratory development of recognition elements for incorporation into a surface scanning biosensor for ration contamination assessment.
 - Research and evaluate sensors and other components of the computer-based externally monitored ration quality system.
 - Research and produce a prototype of a shelf stable meat and vegetable bar and a family of shelf stable breakfast concepts that will expand menu choice, enhance mobility and reduce weight and cube.
 - Investigate ration packaging technologies, including nanocomposites, ultra-high barrier polymers, barrier films, and films with chromatic pigments, to extend quality/shelf-life of combat rations, reduce their weight and signature and minimize environmental impact while meeting operational requirements.

- 1260 - Complete technology maturation of high pressure ration processing to dramatically improve nutrient retention and sensory quality; transition to Fielded Individual and Group Ration Improvement Programs.
 - Complete research of mixed culture samples and develop strategy for identification of bacterial volatile compounds with field biosensors for ration contamination assessment to improve sensitivity and reduce identification time.
 - Design and assess methodologies for indexing the satiety value of military rations to improve acceptance and reduce battlefield waste.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

PROJECT
H99

FY 2002 Planned Program (Continued)

- 1260 - Research novel delivery systems for performance enhancing nutrients. Based on contract results, determine feasibility of transdermal nutrient delivery systems and identify candidate nutrients based on bioactivity, physical/chemical properties, and cognitive, physical enhancement potential; determine relationship between gelled/emulsified/slurried ration components and consumer acceptability/ration stability.

- Fabricate and test three competing prototype cogenerators for field kitchens which demonstrate high reliability, quiet operation, and high efficiency; downselect and transition to SDD phase (PE/Proj 643747/610 Food Advanced Development).

- Research technology for thermoacoustic refrigeration and test concepts for tempering frozen meats in a field environment to improve food safety.

- Research technology, design and fabricate experimental filtration and distillation prototypes for water conservation and re-utilization program for field kitchens to significantly reduce water requirement and gray water produced by field kitchens.

- Develop heat transfer models, investigate materials, and develop designs for a lightweight insulated food container to reduce weight and cube by 50%.
- 656 - Complete assessment of the effects that new technology and proposed kitchen systems have on field feeding manpower requirements.

- Integrate second generation cogenerator with kitchen appliances in a 10-foot expandable ISO container for FAST Food Service, an integrated field feeding concept that reduces logistics by 75% (parts, weight, footprint, fuel and water) and reduces manpower requirements by 50%. Conduct preliminary test and evaluation of container concept to determine user requirements for an FY04 demonstration; transition to 6.3 FAST program.

- Complete research and testing of heating element and heat transfer mechanism for RUSHM and transition to SDD phase (PE/Proj 63001/C07 FAST Program).
- 1700 - FY 2002 Congressional plus-up to research food and field feeding technologies to improve food quality to the warfighter.
- 1000 - FY 2002 Congressional plus-up to support research in nutrition for the warfighter.
- Total 7683

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

PROJECT
H99

FY 2003 Planned Program

- 2007 - Downselect Surface Scanning technology and modify coupled biochemical recognition elements for ration contamination assessment; complete research to validate zero false positive and negatives; transition to SDD (6.4).
 - Research technology for shelf stable meat/vegetable bars and breakfast bars/components to optimize quality and weight/cube reduction; transition to SDD phase (PE/Proj 643747/610 Food Advanced Development).
 - Investigate the use of encapsulated proteins to improve protein profile of high carbohydrate/high fat ration items enhancing ration acceptability while reducing volume, as compared to traditional meals.
 - Evaluate prototype film technology produced using nanocomposites and combining microlayering techniques; assess the barrier properties of the non-foil films for ration packaging and evaluate effectiveness and shelf-life properties of polychromide pigments.
- 1481 - Research, design and fabricate concept Transdermal Nutrient Delivery System that lightens the soldier's load and provides targeted performance enhancement during high intensity, short duration missions. Identify candidate nutrients and develop protocols for limited human testing of selected nutrients to assess impact on performance.
 - Evaluate physical and sensory properties of gels, emulsions and slurries developed to optimize eat-on-the-move and performance enhancing capabilities of combat rations for the Objective Force.
 - Mature technology for a microelectronic analog of the petri dish to reduce detection times and improve sensitivity to identify pathogenic bacteria; transition to Surface Scanning Biosensor program.
- 741 - Mature technologies for individual FAST Food Service subsystems including appliance heat exchangers, steam generator, control system, heat driven refrigeration, and water recycling sanitation system.
- 1494 - Explore thermoelectric technology and model concept designs for a lightweight device to provide hot water to heat/rehydrate meals and to provide cold drinking water for crew sustainment in Future Combat Systems and Objective Force vehicles.
 - Complete initial technology demonstration of Non-Powered Tempering System to determine the feasibility of safely tempering frozen meat products in the field.
 - Continue evaluation of experimental filtration and distillation technologies for water conservation and re-utilization to significantly reduce the logistics impact of field feeding and sanitation systems.

Total 5723

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	108400	128798	67476	71682	75359	76221	77722
841 COMPUTER-ASST MINIMALLY INVASIVE SURGERY	13460	11306	0	0	0	0	0
845 BONE DISEASE RESEARCH PROGRAM	5768	2778	0	0	0	0	0
863 BTLFLD SURGICAL REPLAC	0	4664	0	0	0	0	0
869 T-MED/ADVANCED TECHNOLOGY	4295	4460	3311	3496	3555	3597	3705
870 DOD MED DEF AG INF DIS	23630	25452	30568	32195	34109	34545	35379
873 HIV EXPLORATORY RSCH	11142	10969	0	0	0	0	0
874 CBT CASUALTY CARE TECH	10004	9004	11461	12252	12849	13161	13457
878 HLTH HAZ MIL MATERIEL	10302	11306	12302	12733	13271	13268	13461
879 MED FACT ENH SOLD EFF	8210	8668	9834	11006	11575	11650	11720
964 INFORMATICS-BASED MED. EMERG DECIS TOOLS (IMED)	5768	0	0	0	0	0	0
967 DYE TARGETED LASER FUSION	3845	3374	0	0	0	0	0
96A EMERGENCY HYPOTHERMIA	2884	2580	0	0	0	0	0
96B REAL TIME HEART RATE VARIABILITY TECHNOLOGY	2404	0	0	0	0	0	0
977 EMERGING INFECTIOUS DISEASES	6688	6937	0	0	0	0	0
MA1 ARTHROPOD-BORNE INFECTIOUS DISEASE CONTROL	0	2500	0	0	0	0	0
MA2 DIABETES PROJECT	0	5100	0	0	0	0	0
MA3 MEDICAL AREA NETWORK FOR VIRTUAL TECHNOLOGY	0	8000	0	0	0	0	0
MA4 SPEECH CAPABLE PERSONAL DIGITAL ASSISTANT	0	1000	0	0	0	0	0
MA5 CENTER FOR INTERNATIONAL REHABILITATION	0	1400	0	0	0	0	0
MA6 DERMAL PHASE METER	0	600	0	0	0	0	0

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

MA7	VCT LUNG SCAN	0	3200	0	0	0	0	0
MA8	MONOCLONAL ANTIBODY BASED TECHNOLOGY	0	3000	0	0	0	0	0
MA9	OPERATING ROOM OF THE FUTURE	0	2500	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element supports focused research for healthy, medically protected soldiers, and funds research consistent with the "Medical," "Survivability," and "Future Warrior" technology areas of the Objective Force. The primary goal of medical research and development is to sustain medical technology superiority to improve the protection and survivability of U.S. forces on conventional battlefields as well as in potential areas of low intensity conflict and military operations short of war. This program element funds applied research in Department of Defense (DoD) medical protection against naturally occurring diseases of military importance and combat dentistry, as well as applied research for Department of Army care of combat casualties, health hazard assessment of military materiel, and medical factors enhancing soldier effectiveness. This program element is the core DoD technology base to develop methods and materials for infectious disease prevention and treatment including vaccines, prophylactic and therapeutic drugs, insect repellents, and methods of diagnosis and identification of naturally occurring infectious diseases; prevention and treatment of combat maxillofacial (face and neck) injuries, and essential dental treatment on the battlefield; combat casualty care of trauma and burns due to weapons, organ system survival, shock resulting from blood loss and infection, blood preservation, and potential blood substitutes for battlefield care; assessment of the health hazards of military materiel, and the sustainment or enhancement of soldier performance. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program is managed by the U.S. Army Medical Research and Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	111696	82494	74304
Appropriated Value	112729	129694	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-896	0
b. SBIR / STTR	-2796	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-500	0	0
e. Rescissions	-1033	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	-6828
Current Budget Submit (FY 2003 PB)	108400	128798	67476

Program Change Summary Explanation:

Significant Changes: FY02- Congressional Adds totalling \$47200K (as noted below) added to this PE.

FY02 - Congressional adds were made for the Anthropod-borne Infectious Disease Control, Project MA1 (\$2500); Diabetes Project (Pitt), Project MA2 (\$5100); Emerging Hypothermia for Advanced Combat Casualty and Delayed Resuscitation, Project 96A (\$2600); Medical Area Networks for Virtual Tech, Project MA3 (\$8000); Osteoporosis Research, Project 845 (\$2800); Speech Capable Personal Digital Assist, Project MA4 (\$1000); Center for International Rehabilitation, Project MA5 (\$1400); Dermal Phase Meter, Project MA6 (\$600); Minimal Invasive Surgery Simulator, Project 841 (\$1400); Minimally Invasive Therapy (CIMIT), Project 841 (\$5000); VCT Lung Scan, Project MA7 (\$3200); Tissue Engineering Research, Project 863 (\$4700); Monoclonal Anti-body Based Tech (Heteropolymer System), Project MA8 (\$3000); Dye Targeted Laser Fusion, Project 967 (\$3400); and Operating Room of the Future, Project MA9 (\$2500).

Projects with no R-2A not listed/defined due to space limitations.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
869

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
869 T-MED/ADVANCED TECHNOLOGY	4295	4460	3311	3496	3555	3597	3705

A. Mission Description and Budget Item Justification: This project supports focused research for the soldier contributing to casualty avoidance, casualty detection, and evacuation and treatment of casualties through application of physiological status monitoring technologies (biophysical and biochemical sensors and fusion) as outlined in the Medical and Future Warrior Objective Force Technology Areas. Research efforts focus on developing a wearable, integrated system to determine soldier physiological status. This includes developing the ability to quickly and accurately determine when a soldier is minimally impaired but still capable of functioning. Work will also focus on identification and initial development of parallel and supporting technologies and systems, including medical informatics, medical artificial intelligence, and data mining tools. Intramural research under this project is conducted at the following U.S. Army Medical Research and Materiel Command laboratories: the U.S. Army Aeromedical Research Laboratory, the U.S. Army Research Institute of Environmental Medicine, the U.S. Army Institute of Surgical Research, and the Walter Reed Army Institute of Research. Additional contributors include Los Angeles County and the University of Southern California Medical Centers. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1896 - Demonstrated physiological status monitoring to measure physiological strain and developed a government off the shelf time series database and data management capabilities to predict individual soldier status. Developed a passive acoustic method for detecting air in the chest.
- 2399 - Evaluated new methods for the diagnosis and treatment of severe blunt chest injury and hemorrhage. Diagnostic techniques included noninvasive detection of changes in autonomic function.
 - Conducted applied research to support the Warfighter Physiological Status Monitor (WPSM) for assessing and predicting individual warfighter status.
 - Established the sensitivity of telemetrically monitored physiological changes to differing workload levels under various levels of sleep deprivation. Field studies demonstrated that laboratory models accurately portray the tactical environment.

Total 4295

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGYPROJECT
869**FY 2002 Planned Program**

- 1938 - Conduct applied research to measure the physiologic state of soldiers by testing and refining a prototype microwave /acoustic device to detect pneumothorax, hemothorax, and subdural hematoma through clothing and mission-oriented protective posture (MOPP) gear. Construct a prototype device based on the principles of pulse plethysmography and pulse wave transmission for the measurement of blood pressures to facilitate automated triage and diagnosis.
- 2522 - Develop and test a prototype system to detect a wounding event using a projectile's acoustic signature.. Establish a database of human physiological responses collected immediately after severe trauma.
- Conduct applied research to assess warfighter health status. Develop knowledge management system to reduce information from WPSM and predictive and health risk models. Determine level of predictability of physiological markers for performance decrements or increments in the aviation environment.

- Utilize physiological status monitoring data acquisition and management capabilities to predict performance and health risk essential to commanders. This effort will be applied to the "Future Warrior" technology area seeking to optimize utilization of the individual soldier.

Total 4460

FY 2003 Planned Program

- 1299 - Conduct applied research to integrate a device based on principles of pulse plethysmography and pulse wave transmission in a far-forward casualty care platform to measure the physiologic state of soldiers.
- Continue the collection of human physiological responses immediately after severe trauma from multiple civilian urban trauma systems.
- 2012 - Conduct validation studies for concurrent collection of physiological data and performance data and evaluate emerging technology for physiological sensors and telemetry systems in the aviation environment.
- Create reliable, automated bioelectronic, embedded toxic hazard and imminent physiological threat sensors via enabling technologies, directly supporting the Objective Force "Future Warrior" technology area, improving soldier protection.

Total 3311

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
870

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
870 DOD MED DEF AG INF DIS	23630	25452	30568	32195	34109	34545	35379

A. Mission Description and Budget Item Justification: This project supports development of medical countermeasures to naturally occurring infectious diseases consistent with the "Medical" technology area of the Objective Force. Infectious diseases pose a significant threat to forces deployed outside the United States. Countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations. Intramural research under this project is conducted at the U.S. Army Medical Research and Materiel Command's Medical Research Institute of Infectious Diseases, the Walter Reed Army Institute of Research and its overseas laboratories, and the Naval Medical Research Center and its overseas laboratories. Major contractors are the Kenya Medical Research Institute, Kenya; Peptide Therapeutics, Cambridge UK; Nanogen, San Diego CA; ACAMBIS, Inc., Cambridge MA; and University of Alabama, Birmingham AL. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 8533 -Evaluated modified virus as carrier vehicle for administration of candidate malaria vaccines, increasing immune protection.
 -Evaluated strategies to enhance ability of DNA vaccines for malaria to stimulate the immune system and protect vaccinees from disease.
 -Determined human immune response factors that protect against malaria for use in modifying candidate vaccines to enhance immune response.
 -Discovered through genetic manipulation the function of specific malaria proteins to identify the best drug targets. Determined the three-dimensional structure of vital malaria proteins to identify drugs that can disrupt their function.
 -Performed "molecular re-engineering" to reduce toxicity of two antimalarial drug candidates.
- 7321 -Studied epidemiology of Campylobacter diarrhea to determine the most prevalent strains to guide vaccine development. Conducted a clinical study to determine if Campylobacter antigens are involved in the occurrence of Guillain-Barre Syndrome (GBS) in order to ensure a safe vaccine design.
 -Designed and tested in animal models vaccine candidates for diarrhea-causing Shigella and enterotoxigenic E. coli (ETEC), including a vaccine expressing proteins from both, and a Campylobacter vaccine given with and without an immune booster.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
870

FY 2001 Accomplishments: (Continued)

- 2040 -Investigated malaria, diarrhea, Hantavirus and dengue diagnostic tests to be applied to a common diagnostic device for biological defense and infectious disease threats.
-Characterized a genetically modified candidate Group B meningitis vaccine, verifying that it exhibits reduced toxicity and high immune response.
- 5736 -Investigated an improved DNA vaccine candidate to protect against dengue fever.
-Evaluated the protective efficacy of an orally-administered DNA vaccine against dengue strain 2 in mice.
-Produced a pilot lot of candidate DNA vaccine directed against hantaviruses that cause hemorrhagic fever with renal syndrome; and evaluated different vaccine delivery methods for the vaccine to determine which method was superior.
-Investigated an insect repellent to replace the current military repellent, DEET, to ensure that it meets Environmental Protection Agency safety requirements and that it repels chiggers. Conducted field trials on a component of an insect vector control system that consists of a rapid test to identify dengue virus in mosquitoes.

Total 23630

FY 2002 Planned Program

- 9655 -Validate a human malaria sporozoite challenge model for evaluating vaccines against vivax malaria.
-Further test efficacy of molecularly-modified antimalarial drugs, including assessment of ease of manufacture.
-Evaluate a candidate malaria DNA vaccine containing 9 components representing multiple phases of the parasite's life cycle in humans; produce the 9 components for boosting the DNA vaccine and complete pre-clinical testing.
-Produce a candidate protein vaccine against the liver stage of malaria and initiate pre-clinical testing in animals.
-Cultivate multiple strains of malaria parasites in mosquitoes that can be used to challenge candidate vaccine recipients to determine if the vaccine is protective.
-Evaluate a combination vaccination consisting of the protein RTS,S vaccine and a blood-stage malaria protein for safety and protection in monkeys.

-Evaluate the effectiveness on a new immune booster delivered with the protein RTS,S malaria vaccine.

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

February 2002

**BUDGET ACTIVITY
2 - Applied Research**

**PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY**

**PROJECT
870**

FY 2002 Planned Program (Continued)

- 6886 -Develop a single Shigella vaccine candidate that could protect against all three major types of Shigella (*S. flexneri*, *sonnei* and *dysenteriae*) and evaluate its ability to stimulate an immune response against these 3 organisms in an animal model. Modify the candidate *Shigella flexneri* vaccine in an attempt to reduce side effects and test safety in animal models. Construct a hybrid *Shigella* -*E*TEC vaccine and test for its ability to stimulate an immune response against both of these causes of diarrhea in an animal model.
- 3536 -Identify and characterize strains of Group B meningitis bacteria for a multi-component vaccine that could protect against many strains and genetically engineer two candidate Group B meningitis vaccine strains to reduce toxicity and optimize the ability to stimulate immunity.
 -Assess antibody-based tests for the identification of militarily important pathogens causing dengue fever and scrub typhus.
 -Design a rapid diagnostic test for scrub typhus to assist in evaluation of vaccine efficacy and develop DNA-based diagnostic tests to detect antibiotic resistance in intestinal bacteria, for use in epidemiological studies.
 -Modify scrub typhus vaccine candidates based on gene sequencing efforts to make it more broadly protective. Create a chigger-challenge model for the evaluation of candidate scrub typhus vaccines in mice.
- 5375 -Conduct pre-clinical evaluation of candidate insect repellent compounds to replace DEET.
 -Modify dengue candidate DNA vaccine to improve its immune response. Refine methods for rapid isolation and ability to measure levels of circulating proteins indicative of dengue fever immunity.
 -Develop a combined candidate vaccine to protect against Rift Valley fever and Crimean Congo hemorrhagic fever viruses and test in animals to demonstrate feasibility of multi-agent hemorrhagic fever DNA vaccines.
 -Determine the role of neutralizing antibodies stimulated by DNA vaccines in protecting against hemorrhagic fever with renal syndrome in order to assess the importance of antibodies in protection against this disease.
 -Complete preclinical testing of a candidate hantavirus DNA vaccine to protect against hemorrhagic fever with renal syndrome in compliance with FDA standards.

Total 25452

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
870

FY 2003 Planned Program

- 14125 -Conduct preclinical studies of new analogs of macrolide antibiotics and antifolate compounds as new malarial prevention drugs.
 -Develop new animal models that better predict human safety and efficacy of antimalarial drugs.
 -Evaluate a candidate malaria DNA vaccine with a virally-delivered booster, containing 9 components representing multiple phases of the parasite's life cycle in humans. Complete pre-clinical testing of a candidate protein vaccine against the liver stage of the malaria parasite.
 -Cultivate multiple strains of malaria parasites in mosquitoes that can be used to challenge candidate vaccine recipients to determine if the vaccine is protective.
- 8382 -Complete preclinical testing of a modified *S. flexneri* candidate vaccine that can protect while having fewer side effects than the current vaccine candidates. Conduct preclinical studies of oral and intranasal *Campylobacter* vaccines.
 -Complete the combined *Shigella*-enterotoxigenic *E. coli* vaccine preclinical animal studies and construct a *Shigella*-*Campylobacter* hybrid vaccine candidate to support development of a multiagent anti-diarrheal vaccine that can protect against multiple causes of diarrhea with a single vaccine.
 -Produce cGMP lots of vaccine candidates to protect warfighters against diarrhea caused by ETEC.
- 1834 -Complete the genetic engineering, characterization and evaluation of three Group B meningococcal vaccine strains for use in production of a broadly protective vaccine to protect against this cause of meningitis, an infectious, potentially fatal disease that can affect recruits in basic training camps.
- 6227 -Conduct pre-clinical evaluation of DNA vaccines to protect against all 4 serotypes of virus causing dengue fever including evaluation of safety and immune response in monkeys.
 -Develop an animal challenge model for testing scrub typhus vaccine. Perform safety testing of vaccine against scrub typhus, a vector borne disease found in several areas of potential military action.
 -Submit an investigational new drug application to the FDA for testing a DNA based Hanta virus vaccine, a virus that causes pulmonary and hemorrhagic disease.
 -Produce cGMP DNA dengue virus vaccine and prepare Investigational New Drug (IND) to submit to the FDA. Test novel approaches for delivering dengue DNA vaccines.
 -Synthesize and evaluate new insect repellent candidates to replace DEET, the current repellent used by the military.

Total 30568

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A - MEDICAL TECHNOLOGY	PROJECT 873
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
873 HIV EXPLORATORY RSCH	11142	10969	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project supports the "Medical" technology area of the Objective Force by conducting applied research of improved diagnostics, epidemiology, candidate immunogens, promising drugs and behavioral modification for prevention and treatment of human immunodeficiency virus (HIV). Main efforts include developing experimental models of disease, preparation of new vaccine candidates, improved diagnosis of disease, and risk assessment. Intramural research under this project is conducted at the U.S. Army Medical Research and Materiel Command's Walter Reed Army Institute of Research and its overseas laboratories, and the Naval Medical Research Center and its overseas laboratories. Major contractors are the Henry M. Jackson Foundation, Rockville MD and SRA Technologies, Falls Church VA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 11142 - Researched manufacturing processes, produced pilot lots of vaccine, and conducted clinical sample processing and storage activities in support of vaccine testing and development.
- Investigated HIV virus and human host cell interactions, including virus entry into human cells, targeting of HIV vaccines to human immune cells, binding of candidate vaccines to human immune cells, and studies of HIV virus and immune system factors that are associated with immunity to assist with design and development of an effective vaccine.
- Conducted studies of two candidate vaccines in animal models to determine safety and efficacy for producing an immune response, which are necessary before studies are begun in humans.

Total 11142

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGYPROJECT
873**FY 2002 Planned Program**

- 10969 - Define HIV virus and immune system factors associated with immunity that will aid in vaccine design.
- Develop HIV diagnostic testing algorithms applicable to battlefields and civil/military emergencies so that newly developed tests will be used efficiently and effectively in protecting health care providers and emergency response teams.
- Investigate manufacturing processes and produce pilot lots of 3 candidate HIV vaccines that are directed against 2 subtypes of virus found outside of the United States and test these vaccines in animals .
- Conduct epidemiological studies and evaluate suitability of potential study sites for HIV vaccine testing in Cambodia, Uganda, Kenya, South America and Tanzania.
- Conduct studies of HIV-infected DoD beneficiaries, to include collection of data on disease progression, drug resistance, and epidemiology to identify additional treatment and prevention strategies.

Total 10969

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
874

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
874 CBT CASUALTY CARE TECH	10004	9004	11461	12252	12849	13161	13457

A. Mission Description and Budget Item Justification: This project addresses investigation of the treatments for weapons-induced trauma and shock due to blood loss on the battlefield in order to provide healthy, medically protected soldiers as outlined in the "Medical" technology area of the Objective Force. 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. It also funds technologies for resuscitation fluid and methods to prolong the shelf life of blood products. Intramural research under this project is conducted at the U.S. Army Medical Research and Materiel Command's U.S. Army Institute of Surgical Research, and the Walter Reed Army Institute of Research. Major contractors include the University of Washington, Seattle, Washington ; the State University of New York at Buffalo and Monterey Biomedical, Inc., Scotts Valley California. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1202 - Conducted applied research on a freeze-drying process for plasma to reduce the logistical burden of blood products on the battlefield.

- 2311 - Conducted applied research on novel methods to stop bleeding and limit blood loss by continuing the assessment of Food and Drug Administration (FDA)-approved drugs to prevent battlefield hemorrhage-related deaths.
 -Performed studies of a drug; (recombinant clotting factor VIIa) that indicated its usefulness for controlling hemorrhage in casualties that become cold after wounding.
 - Continued construction of a prototype high frequency-focused ultrasound device to stop bleeding in organs.

- 2944 - Conducted applied research on new strategies of resuscitation that can improve survival after hemorrhage. Compared controlled versus uncontrolled hemorrhage to reduce late end-organ damage following resuscitation from hemorrhagic shock.
 - Advanced the design of a second-generation eye oximeter to measure if the brain is getting enough oxygen.
 - Demonstrated the use of a lower body negative pressure chamber to optimize monitoring and care of patients following trauma injury.

- 2105 - Conducted applied research on novel methods to minimize, repair, and prevent injuries to hard and soft tissues to evaluate repair methods using a large-animal model for contaminated bone defects of the extremities.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
874

FY 2001 Accomplishments: (Continued)

- Tested the effect of aerosolized indomethacin to reduce the effects of smoke inhalation. Advanced design of a delivery system for the nasal application of ketamine to manage trauma-related pain.
- 1442 -Contract award pending for this 1-year congressional add that will conduct research in methods to purify blood products right on the battlefield. It will fund Emergency Blood Purification for Combat Casualty Care.

Total 10004

FY 2002 Planned Program

- 1020 - Conduct applied research to reduce the logistical burden of blood products on the battlefield by refining plasma's freeze-drying process for field application. Complete design and testing of a prototype device to detect infectious diseases such as human immunodeficiency virus (HIV) in blood to make transfusions safer.
- 2707 - Conduct applied research on novel methods to stop bleeding and limit blood loss by selecting the most effective FDA-approved drugs following severe liver injury. Complete the examination of the safety and efficacy of recombinant factor VIIa in the treatment of traumatic brain injury and in generalized uncontrolled hemorrhage.
 - Refine the prototype high frequency-focused ultrasound device that will stop bleeding in organs.
 - Continue the evaluation of the lower body negative pressure as a surrogate model of hemorrhagic shock.
- 2601 - Conduct applied research on new methods of resuscitation of various resuscitation fluids and recommending the best commercial off-the-shelf fluid.
 - Examine methods to modify inflammatory processes in animals subjected to severe blood loss to reduce shock and improve survival.
 - Complete the construction of a second-generation eye oximeter to noninvasively measure that the brain is getting enough oxygen.
- 2676 - Conduct applied research on novel methods to minimize, repair, and prevent injuries to hard and soft tissues and complete the evaluation of repair methods on a large-animal model for contaminated bone defects of the extremities.
 - Test a device to measure absolute cerebrospinal fluid pressure after head trauma to reduce deaths due to increased cranial pressure.
 - Conduct animal trials of a molecular biology-based method to mitigate the effects of smoke inhalation and thereby lower the death rate.

Total 9004

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
874

FY 2003 Planned Program

- 1544 - Conduct applied research to reduce the logistical burden of blood products on the battlefield by animal testing of dried plasma for field application. Further refine drying procedures for red blood cells to replace refrigerated red cells on the battlefield.
- 3298 - Conduct applied research on novel methods to stop bleeding and limit blood loss by selecting the most effective FDA-approved drugs/devices that can be introduced either through veins or by spraying into body cavities through wounds.
 - Conduct animal tests and continue refinement of a prototype high frequency-focused ultrasound device that will stop bleeding in organs.
 - Conduct studies on promising drugs to restore blood clotting when the patient is cold and thereby reduce blood loss.
- 3655 - Conduct applied research in new methods of resuscitation by studying ways to maximize the delay achievable with low volume resuscitation.
 - Make recommendations on new drugs and biologics with the intent of developing an improved resuscitation solution.
- 1630 - Conduct applied research on novel methods to minimize, repair, and prevent injuries to hard and soft tissues by exploring novel methods of treating the victims of land mines and flechette (shrapnel) weapons.
- 1334 - Conduct applied research on new stroke drugs to find a method of reducing the severe complications of head trauma.

Total 11461

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
878

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
878 HLTH HAZ MIL MATERIEL	10302	11306	12302	12733	13271	13268	13461

A. Mission Description and Budget Item Justification: This supports "Medical" and "Survivability" Objective Force Technology Areas with focused research for the soldier on protection from health hazards associated with materiel and operational environments. Emphasis is on identification of health hazards inherent to the engineering design and operational use of equipment, systems, and material used in Army combat operations and training. Specific hazards include repeated impact/jolt in combat vehicles and aircraft; blast overpressure and impulse noise generated by weapons systems; toxic chemical hazards associated with deployment into environments contaminated with industrial and agricultural chemicals; non ionizing radiation directed energy sources (laser); and environmental stressors (e.g. heat, cold, and terrestrial altitude). Specific research tasks include characterizing the extent of exposure to potential hazards; delineating exposure thresholds for illness or injury; identifying exposure thresholds for performance degradation; establishing biomedical databases to support protection criteria; and developing and validating models for hazard assessment, injury prediction, and health and performance protection. Intramural research is conducted at the U.S. Army Aeromedical Research Laboratory, the U.S. Army Research Institute of Environmental Medicine, and the Walter Reed Army Institute of Research. Major contracts are with Universal Energy Systems and JAYCOR. Additionally, numerous Cooperative Research and Development Agreements (CRDAs) are held with universities and independent laboratories. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1500 - Characterized the effect of head and eye movement on heat dispersion through the retina to improve thermal retinal injury models and improve standards for protection. Improved accessibility of the Laser Accident and Incident registry with a CD ROM version to assist in the awareness and assessment of laser eye injuries.
- 1666 - Determined risk of arm and eye injury to Army aircrew in helicopters equipped with cockpit airbag systems, which led to design modification guidelines to maximize aviator safety during mishaps.
- 1978 - Selected critical parameters for food and water contamination detection analysis from emerging technologies to enhance and facilitate assessment capabilities for deployed personnel.
- 1982 - Completed epidemiological studies of neck injury in operational aviation environments.
- 1299 - Determined the role of rotational head injury in helmet design to develop effective strategies to reduce injury rates. Determined the risk of injury to aviators from helmet-mounted displays worn during helicopter crashes and evaluated potential countermeasures.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
878

FY 2001 Accomplishments: (Continued)

- 1877 - Validated predictive models of blunt trauma, incorporating impact measurement, response model, and injury correlates to develop and assess the predictors of blunt trauma injury.

Total 10302

FY 2002 Planned Program

- 1310 - Identify, through microgene array techniques, promising candidate pharmaceuticals to mitigate loss of healthy photoreceptors to enhance protective strategies for soldiers.
- 1428 - Establish and test standard methodologies for evaluating restraint technologies for tactical vehicles and aircraft. Deliver model of aircrew airbag interaction in rotary-wing crash environment.
- 1495 - Establish visual performance criteria for the integration of flat panel displays into helmet-mounted displays. The results of this research will be to develop enhanced imaging and display technologies to optimize soldier performance in degraded battlefield environments.
- 1490 - Extend the combined gas injury incapacitation predictive models to include particles in aerosols to develop protective measures in smoke-filled buildings and in tactical vehicles.
- 1290 - Propose standards for head-supported mass for injury risk. This research will enhance soldier performance while reducing acute and chronic injuries due to increased load-bearing requirements placed on the warfighter.
- 1285 - Analyze rotational head injury in helmet design findings to develop effective strategies to reduce injury rates. Propose and assess new impact protection concepts for airborne troop helmets.
- 1528 - Research indicators of reproductive effects using genomic and proteomic technologies with *C. elegans*, to provide faster and comprehensive toxicological hazards assessment.
- 1480 - Conduct field studies for repeated jolt during ground troop training exercises, which will validate proposed Health Hazard Assessment methods and the American National Standards Institute standards.

Total 11306

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGYPROJECT
878**FY 2003 Planned Program**

- 1771 - Evaluate and determine efficacy of neuroprotectants and/or steroid combinations targeted to minimize secondary neuronal injury from battlefield lasers and refine operational exposure limits to ensure the ocular health of deployed elements of the Objective Force.
- 1523 - Define injury thresholds for dynamic responses in restraint systems for Army ground and air vehicles. This research will provide enhanced protection while in tactical vehicles and aircraft for the elements of the Objective Force.
- 1686 - Extend the combined gas injury incapacitation models to include physical exertion. The results of this research will be to investigate protective measures for the warfighter against toxic substances potentially inhaled while in smoke-filled buildings and in tactical vehicles penetrated by enemy weapons.
- 1378 - Extend aviation head-supported mass standards to dismounted soldiers and validate head-supported mass neck injury thresholds and performance criteria. This research will enhance soldier performance while causing a reduction in acute and chronic injuries due to the increased equipment requirements placed on the warfighter.
- 1334 - Determine new standards for minimum impact performance for Army aircrew/dismounted/airborne helmets. This research will support advanced protective technologies for aircrew and airborne elements of the Objective Force.
- 1367 - Mathematically model the effects of blunt trauma forces to soft tissue protected by body armor. The results of this study will be to increase survivability of the warfighter through body armor technology.
- 1497 - Provide validated repeated jolt guidelines and proposed standards for safe operations of tactical ground vehicles for use in the MANPRINT program.
- 1746 - Investigate a field deployable neurobehavioral toxicity assay in support of ongoing monitoring programs for water borne contaminants.

Total 12302

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602787A - MEDICAL TECHNOLOGY	PROJECT 879
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
879 MED FACT ENH SOLD EFF	8210	8668	9834	11006	11575	11650	11720

A. Mission Description and Budget Item Justification: This supports "Medical" and "Survivability" technology areas of the Objective Force with research for the soldier focused on preventing health and performance degradation in the military environment. Emphasis is on identification of baseline physiological performance and assessment of degradations produced by operational stressors. This database and collection of rules and algorithms for performance degradation in multistressor environments form the basis for the development of behavioral, training, pharmacological, and nutritional ("skin-in") interventions to prevent decrements and sustain soldier performance. Key stressors include psychological stress from isolation, new operational roles, and frequent deployments; inadequate restorative sleep; prolonged physical effort and inadequate hydration in extreme environments; desynchronization of biological rhythms during deployments across multiple time zones and night operations; and thermal and altitude stress. Research under this project is conducted at the U.S. Army Aeromedical Research Laboratory, the U.S. Army Research Institute of Environmental Medicine, and the Walter Reed Army Institute of Research and its overseas laboratories. Major contract is with JAYCOR. Additionally, numerous Cooperative Research and Development Agreements (CRDAs) are held with universities and independent laboratories. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1955 - Simulated thermoregulatory and cardiovascular parameters and body fluid shifts to better predict initial stages of heat injury and to model effects of dehydration, which will positively impact soldier readiness through early identification of heat stress injury.
- 931 - Examined the potential of amphetamines to mitigate sleep inertia and optimize vigilance in aviators leading to the development of fatigue countermeasures for aviators during sustained operations. Determined the efficacy and impact on flight performance of temazepam for induction of sleep for resynchronization after shift change.
- 1479 - Created statistical techniques to pattern behavioral changes between soldiers, to predict stress responses in deployed soldiers and optimize soldier performance.
- 850 - Demonstrated that sea level ventilatory responses are not predictive of Acute Mountain Sickness (AMS) and determined the feasibility of ambulatory monitoring to manage AMS. This will enhance ability to manage forces at moderate and high altitude elevations.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGYPROJECT
879**FY 2001 Accomplishments: (Continued)**

- 1104 - Demonstrated that body heat debt and not cutaneous heat flux provides the stimulus for human insulative cold acclimation, suggesting science-based approaches to better protect soldiers against cold, and field validated fluid replacement guidelines for hot weather training and evaluated the role of sodium loss and water over-consumption on the development of hyponatremia.
- 884 - Transitioned a Spatial Disorientation in-flight pilot demonstration into the Initial Entry Rotary Wing training program. This demonstration will provide pilots insight into the effects of in-flight disorientation and corrective measures for its prevention.
- 1007 - Used biomechanical research techniques to establish medical criteria to optimize efficiency and ensure safety of new individual soldier equipment for use by equipment developers.

Total 8210

FY 2002 Planned Program

- 1177 - Transition cold strain model to Java for compatibility with Army models. Study melatonin effects on cognitive ability, temperature regulation, and performance with integration into the SCENARIO model. Begin neural network model and sensitivity analysis of dehydration module and validate terrain coefficients in the model.
- 1301 - Test Food and Drug Administration (FDA) approved drugs that induce sleep without suppressing slow-wave sleep. Demonstrate efficacy of resynchronizing drugs for accelerating performance restoration following large eastward and westward deployments.
- 825 - Determine effectiveness of intermittent low barometric pressure, low oxygen exposures for inducing altitude acclimatization and demonstrate if moderate to high altitude residence ameliorates low blood oxygen levels and sustains cognitive performance without supplemental oxygen at between 3,000 and 4,300 meters.
- 1090 - Begin longitudinal studies of deployment stress in Reserve and National Guard units deploying to engage in Security and Support Operations (SASO) efforts. This research will identify stressors associated with peacekeeping and humanitarian mission deployments.
- 1190 - Determine the impact of deployment operational tempo on the health of the military family.
- 1110 - Determine the effects of fatigue on susceptibility to in-flight disorientation, motion sickness, and high-level cognitive function in Army aviators.
- 980 - Delineate relationships between skin temperatures/wettedness, thermal discomfort, and cognitive performance.
- 498 - Develop methods for assessing effects on performance of gray level perception in head-mounted devices. Determine compatibility trade-offs of image intensification devices with color multifunction displays.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602787A - MEDICAL TECHNOLOGY

PROJECT
879

FY 2002 Planned Program (Continued)

- 497 - Evaluate sound localization by Army warfighters in realistic noise environments under hearing protection.

Total 8668

FY 2003 Planned Program

- 1070 - Model the effects of deployment stress on soldier and unit readiness. This research will identify stressors associated with peacekeeping and humanitarian mission deployments.
- 1230 - Determine if acetazolamide, the Acute Mountain Sickness (AMS) medication, has detrimental effects on physical exercise performance.
- 1130 - Define countermeasures for fatigue-induced increases in oculomotor and spatial orientation disturbances that will enhance warfighter performance capabilities.
- 1280 - Establish visual performance criteria for the integration of flat panel displays into helmet-mounted displays.
- 980 - Identify potential molecular markers of heat adaptation/maladaptation. Determine the role of the central nervous system drive for dehydration-mediated reductions in exercise performance. Determine effectiveness of regional intermittent microclimate cooling.
- 1170 - Develop and complete testing of cold stress module and transition both the neural network and the high terrestrial coefficients into the model. Incorporate the biomedical model to optimize warfighter predictability.
- 1177 - Determine the effectiveness of modafinil for sustaining aviator performance in the in-flight environment using the UH-60 aircraft. Provide data on efficacy of modafinil compared to amphetamine and high dose caffeine. Provide comparative field evaluations of available countermeasures.
- 1240 - Develop animal hypothermia model that employs telemetry to monitor body temperature and cardiovascular responses.
- 557 - Characterize effects of hearing loss of free-field and virtual auditory localization. This research will help designers and leaders predict soldier performance.

Total 9834

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602805A - Dual Use Science and Technology

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	7593	13454	0	0	0	0	0
105 DUAL USE APPLICATIONS PROGRAM	7593	9954	0	0	0	0	0
NA2 MANUFACTURING RDE CENTER FOR NANOTECHNOLOGIES	0	3500	0	0	0	0	0

A. Mission Description and Budget Item Justification: The goal of this program element (PE) is to apply the Dual Use Science and Technology (DUST) Program process throughout Army agencies to leverage Army S&T development funds by partnering with the private sector in the development of technologies having both military and commercial applications and to mature and demonstrate processes for the bulk production of nanoscale materials. This PE contains two projects: Project 105 is the Dual Use Applications Program, and Project NA2 is the Manufacturing RDE Center for Nanotechnologies added by Congress for FY 2002. The objective of project 105, the DUST Program was primarily shorter-term military and commercial applications. Army funding for project 105 terminates after FY 2002, as Army S&T resources are focused on higher priority, accelerated Future Combat Systems and Objective Force transformation. Project NA2 to mature and demonstrate nanoscale manufacturing processes supports the Army transformation to the Objective Force. Work in this PE is consistent with the Army S&T Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. Program policy is established by the Office of the Secretary of Defense (OSD), office of the Director, Defense Research and Engineering, and is managed within the Army by the Office of the Deputy Assistant Secretary of the Army for Research and Technology. The PE contains no duplication with any effort within the Military Departments.

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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602805A - Dual Use Science and Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
President's Previous Budget (FY 2002 PB)	10061	10045	10604
Appropriated Value	10154	13545	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-91	0
b. SBIR / STTR	-299	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-2169	0	0
e. Rescissions	-93	0	0
Adjustments to Budget Years Since (FY 2002 PB)	0	0	-10604
Current Budget Submit (FY 2003 PB)	7593	13454	0

Change Summary Explanation:

Significant Changes:

FY01 (-2561) - Project 105 (-2561) funds realigned to higher priority requirements.

FY03 (-10889) - Project 105 (-10889) funds terminated.

FY02 - A Congressional Add was made for Manufacturing RDE Center for Nanotechnologies, Project NA2 (\$3500).

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

February 2002

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602805A - Dual Use Science and Technology	PROJECT 105					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
105 DUAL USE APPLICATIONS PROGRAM	7593	9954	0	0	0	0	0

A. Mission Description and Budget Item Justification: The goal of this project is to apply the Dual Use Science and Technology (DUST) Program process throughout Army agencies to leverage Army S&T development funds by partnering with the private sector in the development of technologies having both military and commercial applications. The objective of the DUST Program was primarily shorter-term military and commercial applications. Army funding for this project terminates after FY 2002, as Army S&T resources are focused on higher priority, accelerated Future Combat Systems and Objective Force transformation. Work in this program element is consistent with the Army S&T Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. Program policy is established by the Office of the Secretary of Defense (OSD), office of the Director, Defense Research and Engineering, and is managed within the Army by the Office of the Deputy Assistant Secretary of the Army for Research and Technology. The project contains no duplication with any effort within the Military Departments.

FY 2001 Accomplishments:

- 7593 Provided up to 25% of funding proposed by industry to support FY01 dual use technology development. The FY01 solicitation yielded 60 proposals, from which 19 proposals were selected in the following Focus areas:

 Weapons Sustainment - Log Command and Control (C2) Platform Telediagnosics; Manually Cranked Battery Charger; Affordable All-weather Rotocraft-Icing Protection System; Affordable Rotorcraft Structures; Advanced Materials And Manufacturing - Chemical/Biological (CB) Protective Clothing Based on Novel Membranes; Nanofibers for Chemical Protective Clothing Systems; Information And Communications - Embedded Short Range Wireless Networked Interconnect for Soldier Communications System; Information Processing (IP) Quality of Service-Mechanisms for Dynamic Mobile Heterogeneous Wireless Environment; Universal Personal Communication System/Mobile Satellite Services (PCS/MSS)Handset; Modulation Independent Turbo Codec; Advanced Propulsion, Power, And Fuel - Allison Hybrid Light Armored Vehicle and Civilian Heavy Hybrid Application; Simulation-based Design and Demonstration of Next Generation, Advanced Diesel Technology; Development of Advanced NiMH Battery for Heavy Duty Hybrid Electric Vehicles (HEV)Applications; High Efficiency Alternator & Climate Control System; Medical And Bioengineering - The Application of Electrode Arrays for the Development of a Rapid, Multiplexed Detection System for Biological Warfare and Infectious Disease; Development of a Subunit Vaccine for the Prevention of Campylobacter Disease; Dev. of a Dengue Virus Tetravalent DNA Vaccine Using Lysosome Associated Membrane Protein (LAMP)and Controlled Release Technologies; Development of a Live Attenuated Vaccine for the Prevention of Enterotoxigenic (ETEC) Diarrhea; and Microwave Sterilization.
- Total 7593

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**BUDGET ACTIVITY
2 - Applied ResearchPE NUMBER AND TITLE
0602805A - Dual Use Science and TechnologyPROJECT
105**FY 2002 Planned Program**

- 9954 - Provides up to 25% of funding for dual-use technology projects proposed by industry. Focus areas for Army topics in FY02 are anticipated to be: Affordable Sensors; Weapons System Sustainment; Advanced Propulsion, Power & Fuel Efficiency; Information & Communications Systems; Medical & Bioengineering Technologies; Distributed Mission Training; Advanced Materials & Manufacturing; and Environmental Technologies.
- Total 9954

FY 2003 Planned Program

The Department terminated the Dual Use S&T Program for FY2003 and beyond

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603001A - Warfighter Advanced Technology

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	21200	62089	50262	85024	69911	75447	71935
242 AIRDROP EQUIPMENT	2252	3895	3614	8352	4031	4169	4254
393 MIL OPS IN URBAN TERRAIN (MOUT)	3725	13753	0	0	0	0	0
543 AMMUNITION LOGISTICS	759	797	812	967	1594	1543	1476
545 FORCE PROJECTION LOGISTICS	0	48	7457	10372	10365	2060	2120
557 BIOSYSTEMS TECHNOLOGY	4807	4268	0	0	0	0	0
594 METROLOGY & CALIB	1442	993	0	0	0	0	0
C07 JOINT SERVICE COMBAT FEEDING TECH DEMO	2116	1700	2466	2468	2592	2696	2772
J50 FUTURE WARRIOR TECHNOLOGY INTEGRATION	6099	36635	35913	62865	51329	64979	61313

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates technologies to enhance dismounted soldier system capabilities by reducing the logistics burden on the battlefield; decreasing operation and sustainment (O&S) costs; and improving ammunition logistics system performance. This PE contains several projects. The Future Warrior Technology Integration project (J50) has been accelerated to better align with Objective Force needs. The resulting realigned program, Objective Force Warrior (OFW), is a leap-ahead integrated soldier system providing the next generation of capabilities beyond Land Warrior, and is projected to be fielded in the FY10-12 timeframe. OFW focuses on systems engineered, innovative approaches to achieve revolutionary capabilities. A competitive multiple contractor strategy will foster innovation and reduce risk to bring enhanced capabilities to the warfighter. OFW will provide an ultra-lightweight, stealthy armored suit, integrated with multi-functional sensors, weapons and proactive medical capabilities. The OFW will have connectivity to other dismounted personnel, and robotic air/ground platforms for improved situational understanding and effects. The intent of OFW is to provide the dismounted soldier with combat overmatch capabilities for the full spectrum of Objective Force missions. The Military Operations in Urban Terrain (MOUT) project (393) consists of an Advanced Concept Technology Demonstration (ACTD) executing from FY98 to FY02, and a second effort initiated in FY02 in partnership with DARPA to develop a robotic Micro Air Vehicle (MAV) for urban and complex environments. The MAV will supply a close-in, real-time surveillance capability for small units, thereby reducing the operational and tactical risks associated with small unit operations. The Joint Service Combat Feeding Technology project (C07) demonstrates technologies for military combat feeding systems and combat rations to include processing, preservation, packaging and equipment and energy technologies to reduce the logistics footprint while enhancing warrior mental and physical agility. The Ammunition Logistics project (543) demonstrates technology that optimizes weapon system rearm, ammunition packaging/palletization, explosives safety, material handling equipment, and ammunition throughput/management for improved munitions availability and survivability.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603001A - Warfighter Advanced Technology

The Force Projection Logistics project (545) will demonstrate embedded training simulations to support vehicle crews. The project also matures logistics simulations that relate combat performance to logistics requirements to demonstrate the effect of strategic policy and decisions on the size, cost, and effectiveness of the deployed force. The Airdrop Equipment project (242) provides enhancements to rapid deployment and force projection capability by maturing and demonstrating technology required for dropping cargo to precise locations from higher altitudes, greater offset distances and higher speeds. The objective is increased survivability of aircraft and crews, and increased probability that materials delivered will land in a usable condition. This PE supports the Army Transformation in the areas of improved dismounted soldier capabilities (projects J50 and 393), logistics footprint reduction (projects C07, 543 and 545) and rapid deployment (project 242). Contractors performing the work for this PE include: Aerovironment, CA; Battelle, OH; Innolog, MA; General Technical Services, NJ; Motorola, AZ; MRJ, FL; Rafael, Israel; Veridian, Canada; Exponent, CA; Arthur D. Little, MA; Irvin Aerospace Inc., CA; Vertigo, Inc., CA; Tecogen, MA; United Technologies, FL; Giordano Automation, NJ; InterVision, VT; STI, Inc., OH; Harris Corp, FL; and Time Domain, AL. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program adheres to Tri-Service Reliance Agreements on clothing, textiles, food, and explosive ordnance disposal with oversight and coordination provided by the Joint Directors of Laboratories through the Warrior Systems Technology Base Executive Steering Committee. The program also follows guidelines of the Department of Defense (DoD) Human Systems Technology Area Review and Assessment (TARA) Review process. Work in this PE is related to and fully coordinated with efforts in PE 0602786A, and Defense Advanced Research Projects Agency (DARPA) Small Unit Operations (SUO)/Situational Awareness Systems (SAS) projects. Project 543 is related to PE 0602624A and PE 0603004A. This PE contains no duplication with any effort within the military departments. It supports the transition path to the Objective Force described by the Transformation Campaign Plan (TCP). Work is performed by the Natick Soldier Center, the Aviation and Missile Command, and the Simulation, Training and Instrumentation Command.

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

February 2002

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603001A - Warfighter Advanced Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	21768	60332	47280
Appropriated Value	21969	62632	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-543	0
b. SBIR / STTR	-567	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-202	0	0
f. OSD Re-alignment	0	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	2982
Current Budget Submit (FY 2003 PB)	21200	62089	50262

Change Summary Explanation:

FY02 - Congressional adds were made for Metrology, Project 594 (\$1000); Pneumatic Muscle Soft Landing Technology, Project 242 (\$1000); Portable Cooling System Development, Project J50 (\$1000); Personal Warfighter Navigation, Project J50 (\$2500); and Biosystems Technology, Project 557 (\$4300).

Projects with no R-2A:

Project 393

- (FY02 Funding = \$13753) Mil Ops in Urban Terrain (MOUT): Completes MOUT ACTD and initiates joint development w/DARPA of a robotic Micro Air Vehicle (MAV) for urban and complex environments in support of MAV ACTD.

Project 543

- (FY02 Funding = \$797) Ammunition Logistics: Demonstrates technology to reduce the logistics burden of weapon system rearm, ammunition packaging/palletization, explosives safety, material handling equipment, and ammunition throughput/management for improved munitions availability and survivability.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603001A - Warfighter Advanced Technology

Project 557

- (FY02 Funding = \$4300) Biosystems Technology. The objective of this one year Congressional add is to demonstrate biosystems technologies with potential for military applications. No additional funding is required to complete this project.

Project 594

- (FY02 Funding = \$1000) Metrology. The objective of this one year Congressional add is to demonstrate and analyze standards for aerosol particles, microwave, and radiation calibration systems. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603001A - Warfighter Advanced Technology	PROJECT 242
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
242 AIRDROP EQUIPMENT	2252	3895	3614	8352	4031	4169	4254

A. Mission Description and Budget Item Justification: This project focuses on the maturation and demonstration of equipment and innovative techniques for aerial delivery of cargo and personnel. This is a key capability for rapid force projection and global precision delivery, particularly into hostile areas as envisioned in the Army Vision for the Objective Force. Precision airdrop can provide a long-range, autonomous airdrop capability, with the option to deliver separate and distinctive payloads to multiple locations. Capitalizing on advances in decelerator, guidance and sensing (e.g., Global Positioning System (GPS)), and wind sensing technologies, precision airdrop systems have the ability to be deployed from high altitudes (up to 25,000 ft) and to deliver payloads with better accuracy, i.e. a 100 meter Circular-Error-Probable (CEP). Capabilities envisioned are delivery of up to 20,000 lbs. from 20-40 km offset and extended range delivery of 500-2000 lbs. from 100 km offset (using powered glide augmentation), both with 100 meter CEP accuracy. Delivery from high altitudes and large offset distances improves cargo/personnel and aircraft survivability. The efforts in this project support the Army Transformation in the area of rapid deployment. This project is managed by the US Army Natick Soldier Center, Natick, MA. This program supports the transition path to the Objective Force in the TCP.

FY 2001 Accomplishments:

- 2252 - Designed full-size prototype pneumatic/airbag system to provide a roll-on/roll-off quick airdrop capability for a 10,000 lb. payload.
- Demonstrated prototype 10,000-12,000 lb. pneumatic and airbag systems and finalize design of 20,000 lb. system.
- Fabricated components and conducted scale model testing for the 20,000 lb. payload roll-on/roll-off system.

Total 2252

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603001A - Warfighter Advanced Technology

PROJECT

242**FY 2002 Planned Program**

- 2895 - Demonstrate the technology for a roll-on/roll-off capability for 15,000-20,000 lb. payload providing a 60% decrease in labor intensive rigging; transition technology to PM-Soldier Support for System Development and Demonstration.
- Design and evaluate (radio controlled) a 1/4-scaled prototype high altitude parachute control system.
 - 1000 - FY 2002 Congressional plus-up to demonstrate pneumatic muscle soft landing technology for heavy equipment airdrop systems.
- Total 3895

FY 2003 Planned Program

- 3614 -Design full-size prototype and test (autonomous controlled) a 1/4 scaled prototype high altitude parachute control system.
-Design and plan test of 10,000 lb . long-range autonomous "just-in-time" resupply airdrop system prototype.

Total 3614

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603001A - Warfighter Advanced Technology	PROJECT 393
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
393 MIL OPS IN URBAN TERRAIN (MOUT)	3725	13753	0	0	0	0	0

A. Mission Description and Budget Item Justification: The Military Operations in Urban Terrain (MOUT) project is comprised of two efforts, the MOUT ACTD (completing in FY02) and the Micro Air Vehicle (MAV) ACTD initiated in FY02. The project supports the Army Transformation by focusing on timely development of solutions for conducting military operations in complex and urban environments. These operating environments are recognized as the most likely battlefields of the 21st century, and the environments for which our military forces are least prepared and have the least advantage. The MOUT ACTD completed an assessment of the military utility of Commercial Off-the-Shelf and Government Off-the-Shelf technologies and products, and integrated selected technologies into a "System of Systems" concept for dismounted warriors operating in urban environments. Program emphasis was technologies based on validated warfighter needs in the areas of Command, Control, Communications, Computers and Information; Lethality; Engagement; and Force Protection. The program developed and evaluated operational concepts and Tactics, Techniques and Procedures (TTPs) enabled by these technologies to provide a comprehensive package for operational employment. A complete package of successful technologies and TTPs were turned over to operational units and supported for two years (FY01 and FY02), providing an enhanced interim operational capability. The MOUT ACTD was a joint Army/Marine Corps program. The MAV ACTD (initiated FY02 in partnership with DARPA) will demonstrate a lightweight, small, unmanned aerial vehicle (UAV) that can be carried in the backpack of a dismounted soldier. MAV will provide real time situational awareness in urban and complex terrain that allows the soldier to see first and understand first. The goal is a 6-inch diameter ducted fan UAV with hover and vertical take-off capabilities that is soldier supervised in autonomous flight. The MAV ACTD is being sponsored by the US Pacific Command and will be evaluated by the 25th Infantry Division (Light). The Army is supporting the funding of the ACTD in FY02, with DARPA and OSD supporting funding in FY03-06. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP) and is managed by the U.S. Army Natick Soldier Center, Natick, MA.

FY 2001 Accomplishments:

- 1959 - Refurbished MOUT ACTD residual hardware and transitioned to Army and USMC Experimental Force.
 - Conducted extended military utility and technical analyses and assessments of residual hardware.
 - Collected data on refinement of MOUT TTPs and capability requirements.
 - Provided technical/engineering support operations for residual hardware during extended user evaluation (EUE) phase (FY01-FY02).
- 1766 - Extended experimentation phase of program to focus on evaluation of solutions to unfulfilled and partially fulfilled MOUT ACTD requirements. Undertook other key MOUT activities as directed by OSD.

Total 3725

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603001A - Warfighter Advanced Technology

PROJECT

393**FY 2002 Planned Program**

- 3753 - Complete military utility and technical analyses/assessments of residual hardware; complete data collection on refinement of MOUT TTPs and capability requirements; provide required technical/engineering support for residual hardware during EUE phase which ends in 4Q FY02.
- Complete transitions of successful MOUT ACTD technologies to Army acquisition programs, thereby completing the MOUT ACTD.
- 10000 - Conduct initial MAV baseline build and establish Ground Control Station interface.
- Contract for first order of MAVs for evaluation.
- Conduct training for evaluation unit and schedule first ACTD field evaluation.

Total 13753

FY 2003 Planned Program

- Project not funded in FY03. FY03 funding for the MAV ACTD is supported by DARPA and OSD. MOUT ACTD completes in 4Q FY02.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603001A - Warfighter Advanced Technology	PROJECT 545					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
545 FORCE PROJECTION LOGISTICS	0	48	7457	10372	10365	2060	2120

A. Mission Description and Budget Item Justification: This project matures and demonstrates simulation technology to support highly deployable forces, including the full spectrum of simulation capabilities from wargaming systems to stand-alone training devices to embedded training. The products will have application for Army training, concept development, and mission rehearsal. It will provide information for material decisions and training capabilities to support future combat missions of the Objective Force. The simulation technologies will support evaluation of the effects of emerging capabilities on materiel system performance, Tactics, Techniques and Procedures (TTPs), and combat effectiveness. This project is managed by the U.S. Army Simulation, Training, and Instrumentation Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

Program not funded in FY 2001.

FY 2002 Planned Program

- 48 Program not funded in FY02. Funding is being realigned to other projects for execution within this PE.

Total 48

FY 2003 Planned Program

- 2833 - Mature a hierarchical logistics simulation and demonstrate narrow band proof of concept.
- 4624 - Develop Unit Cell/Unit of Action simulation architecture with hybrid Distributed Interactive Simulation/High Level Architecture functionality. This Modeling and Simulation effort supports analysis of Future Combat System of Systems.

Total 7457

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development		PE NUMBER AND TITLE 0603001A - Warfighter Advanced Technology				PROJECT C07		
COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
C07	JOINT SERVICE COMBAT FEEDING TECH DEMO	2116	1700	2466	2468	2592	2696	2772

A. Mission Description and Budget Item Justification: The Joint Service Combat Feeding Technology Demonstration project matures and demonstrates nutritionally advanced rations; biosensor technologies for ration contamination/wholesomeness assessment; and logistically streamlined combat feeding systems with enhanced fuel efficiencies to decrease the combat feeding logistics tail. The project focuses on demonstrations of advances in combat rations technology, materials, energy utilization, and heating technologies to provide efficient and effective field feeding without resupply. It exploits advances in ration formulation and quality, packaging, preservation, and nutritional content to improve morale, extend endurance, and sharpen mental acuity. This project supports the Army Transformation in reducing the logistics footprint. This project is a DoD program for which the Army has Executive Agent responsibility and is managed by the U.S. Army Natick Soldier Center, Natick, MA. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 661 - Integrated Superheated Liquid Injected Cogeneration technology in an experimental field kitchen; demonstrated the quiet and reliable power and mix of high and low temperature heat at 1/3 the fuel consumption of conventional field kitchens. Transitioned to the Field Feeding and Advanced Sustainment Technology (FAST) Food Service program.
 - Conducted focus groups on utility and sizing of Remote Unit Self Heating Meal; planned technical demonstrations.
- 1455 - Demonstrated a portable combat ration biosensor system prototype for validating the wholesomeness and safety of combat rations; transitioning to Veterinary Command is in progress.
 - Identified and conducted technical demonstration of prototype delivery systems that extend the shelf-life of fresh fruit and vegetables for military feeding systems and reduce demand for resupply.
 - Extended the Dynamic Nutrition Model to track an individual's "level of fatigue" based on "available energy" minus energy expenditures (task performance) to optimize combat performance.
 - Developed prototypes and initiated acceptability and shelf-life testing for improved United States Air Force tube food prototypes for high altitude reconnaissance to maintain high levels of pilot cognitive skills.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603001A - Warfighter Advanced Technology

PROJECT

C07**FY 2001 Accomplishments: (Continued)**

- Completed successful field demonstration of FDA approved irradiated foods. Products provide enhanced safety, extend shelf-life, and increased variety.
- Successfully demonstrated with soldiers, an improved pouch bread and transitioned to System Development and Demonstration (SDD).

Total 2116

FY 2002 Planned Program

- 537 - Optimize and demonstrate novel preservation and stabilization technologies to include non-foil packaging system prototypes for microwave/radio frequency sterilized ration components, compressed entree prototypes, and passive and non-passive shelf life extension technologies for fresh fruits and vegetables. Technologies will increase ration quality and variety while reducing the logistics footprint.
- 587 - Demonstrate technologies for novel nutrient delivery systems including a First Strike Ration system, enhanced prototypes for extended reconnaissance flight feeding and performance enhancing gels. Systems will enhance warfighter performance within mission constraints.
- 284 - Apply modeling and simulation technologies to demonstrate the influence of nutritional initiatives on force-on-force encounters and to demonstrate Class I supply/requisition/distribution concepts.
- 292 - Integrate optimized packaging, heater, and food for the Remote Unit Self Heating Meal prototype and complete final demonstrations, showing logistical reductions and new capability to sustain the warfighter in remote locations (90% reduction in manpower, weight and cost). Transition to SDD.

Total 1700

FY 2003 Planned Program

- 792 - Mature novel preservation and stabilization capabilities to include an expanded variety of microwave/radio frequency sterilized and compressed ration products and a brassboard storage/delivery system for fresh fruits and vegetables and transition to SDD.
- 700 - Optimize novel nutrient delivery and packaging systems for specialized rations (First Strike, Reconnaissance Flight Feeding, and Meal Cold Weather/Long Range Patrol) to improve consumption and reduce weight/volume; transition mature technologies to SDD.
- 276 - Conduct limited field demonstration for cost effective, easy-to-use external quality status monitoring system (temperature, relative humidity) for Class I; transition to SDD.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603001A - Warfighter Advanced Technology

PROJECT

C07**FY 2003 Planned Program (Continued)**

- 698 - Mature and integrate equipment and energy technologies into current and future field feeding platforms to reduce fuel usage, maintenance man-hours, noise, weight, and Operation and Sustainment costs.

Total 2466

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603001A - Warfighter Advanced Technology	PROJECT J50					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
J50 FUTURE WARRIOR TECHNOLOGY INTEGRATION	6099	36635	35913	62865	51329	64979	61313

A. Mission Description and Budget Item Justification: This project matures and demonstrates leap-ahead technologies and systems for the Objective Force Warrior (OFW), with emphasis on integrated multi-functionality. This effort provides the dismounted soldier the same combat-overmatch, skip-a-generation capability that the Future Combat Systems (FCS) bring to the Maneuver portion of the Objective Force. OFW will employ open system architectures and high-risk/high payoff technologies to yield an ultra-lightweight, stealthy armored suit, integrated with multi-function sensors, weapons and medical monitoring capabilities. The goal is to achieve a leap-ahead advance over Land Warrior Version 1.0 in the areas of survivability, soldier lethality, and agility - to operate for extended periods under arduous conditions, with minimal loss in physical capabilities from fatigue, stress, and hardship. This soldier system-of-systems will have connectivity to other dismounted personnel, Objective Force platforms including Future Combat System of Systems, and micro-robotic air/ground vehicles to form adaptive, distributed sensor networks for better situational understanding of local environments and threats. The program will have industry and government teams perform the system integration of the revolutionary technologies for the demonstrator soldier system. Concurrent maturation of technologies and their manufacturing processes will be performed to ensure system-of-system affordability, with reduced sustainment costs. To achieve this goal, current future warrior projects have been redirected, and funding brought forward, to achieve the desired capability within the decade. Funding has been increased in FY 2002 and FY 2003 for a competitive concept exploration phase and to begin the design phase. The completion of the design phase and the build and demonstrate phase (FY 2004-2006) will provide an integrated system-of-systems soldier demonstrator. The competitive strategy brings greater innovation and reduced risk in the soldier system demonstrator, an improved system Technical Readiness Level, and greater capabilities to the Warfighter. This project also will mature and demonstrate alternative advanced technology solutions to complex systems integration problems such as multifunctional integrated combat uniforms and integrated headgear suites during FY2000-2003. The project also demonstrates the integration of advanced technology upgrades for Land Warrior Systems, such as Integrated Navigation, Combat ID, embedded training simulation, and innovative weapon interfaces. The project will participate in DARPA SUO/SAS evaluations to measure SUO/SAS technologies performance within an integrated soldier system. The US Army Natick Soldier Center, Natick, MA manages this project. This program supports the Objective Force transition path of the TCP.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603001A - Warfighter Advanced Technology

PROJECT

J50

FY 2001 Accomplishments:

- 5199 - Evaluated DARPA SUO/SAS efforts to assess the viability of integrating selected technologies from these programs into future warrior systems.

- Matured augmented navigation (miniaturized dead reckoning blended with GPS via a Kalman Filter), embedded tactical engagement simulation (MILES 2000) and combat identification (laser query with encoded RF reply) technologies. Integrated those technologies with prototype Land Warrior systems and conducted user evaluations and field demonstrations. Transitioned those technologies to the Land Warrior SDD (6.4) program.

- Advanced the integration of key technology upgrades (e.g., Javelin thermal sensor and fire control, medical physiological status sensors, and system voice control) for Land Warrior. Results will be provided to PMs and the OFW program for potential transition.
- 900 - Conducted a comprehensive analysis and assessment of more than 200 government/industry/academia technology development efforts for their potential application to the emerging OFW project. Developed a robust technology investment plan and program strategy to enable revolutionary OFW system of systems capabilities.

- Conducted systems analyses and developed preliminary system of systems concepts for OFW to be included in the OFW solicitation package.

Total 6099

FY 2002 Planned Program

- 7108 - Mature various combat uniform design concepts and mock-up prototype alternatives (with limited functionality) for a fully integrated, multifunctional, combat uniform and for integrated headgear systems. Explore and determine feasibility of various combat uniform and headgear integration concepts, multi-functional combinations, and required technologies.

- Conduct user juries, laboratory and limited field evaluations of integrated, multifunctional, combat uniform and integrated headgear mock-up prototypes. Iterate design concepts based on user feedback, lab/field experiments, and emerging technology availability. Provide concepts, knowledge and critical information to the OFW system contractor teams.

- Investigate connector interfaces for textile based data/power buses, sensors, and/or miniaturized electronics for integration into a personal body local area network for future soldier systems.
- 26027 - Solicit and select up to two competitive industry lead system integrator teams to initiate Phase I, Concept Development, of the OFW project. Competitive approach is intended to foster revolutionary innovation and reduce program risk. The scope of OFW includes: development of an integrated lightweight helmet/suit ensemble with advanced protection, stealth and sustainment features; integrated, network-centric communications/sensor/power suite; integrated lightweight sensor/weapons capability with advanced accuracy and lethality in complex terrains and urban environments; integrated aerial and ground based robots to augment the warrior teams' load carrying, intelligence gathering and lethality.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603001A - Warfighter Advanced Technology

PROJECT

J50

FY 2002 Planned Program (Continued)

- Define stakeholder needs and system level requirements; set technical parameters and system cost objectives. Develop functional architectures and allocate requirements. Assess DoD and commercial technology alternatives and formulate risk management strategy.

- Define and construct models and simulations of OFW concepts and warriors to optimize system and operational design.

- 2500 - FY 2002 Congressional plus-up to develop Micro Electrical Mechanical System/Inertial Navigation System/ Global Positioning System with application to ground troops.
- 1000 - FY 2002 Congressional plus-up to develop and demonstrate a portable apparel cooling system.

Total 36635

FY 2003 Planned Program

- 7772 - Mature and iterate design concepts for integrated, multifunctional combat suit and integrated headgear systems based on results and analysis of the FY02 lab/field experiments. Conduct technology demonstration with troops in an operational environment. Fully transition technologies, concepts, knowledge and critical information to the OFW contractor teams.
- 25141 - Continuing Phase I, each contractor team will: identify government and commercial technology alternatives to leverage and integrate; develop preliminary system hardware and software architectures; and design and produce two mock-up system prototypes.
 - Update OFW program exit criteria (weight, power, cost and performance).
 - Complete Phase I, Concept Development, of OFW; down-select to one lead system integrator to continue into Phase II.
 - Initiate Phase II, Design Development, of the OFW program. Update system level requirements and allocate to subsystems and components.
 - Begin design synthesis and early component breadboard prototyping of smaller components and conduct lab/field experiments.
 - Develop integration strategy with other military and civilian programs and continue close coordination with FCS and other Objective Force initiatives.
- 3000 - Demonstrate manportable power technologies for the warfighter including battery/battery hybrid systems and recharging systems with improved efficiency.

Total 35913

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603002A - MEDICAL ADVANCED TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	216951	174042	16590	19925	21583	22128	23336
800 TELEMEDICINE TESTBED	4188	1650	1988	2920	3393	3986	4474
804 PROSTATE CANCER RSCH	3845	0	0	0	0	0	0
810 IND BASE ID VACC&DRUG	7823	8588	9637	10125	10615	11157	11691
814 NEUROFIBROMATOSIS	16343	20845	0	0	0	0	0
815 NATIONAL MEDICAL TESTBED	14420	7643	0	0	0	0	0
818 ADVANCED CANCER DETECTION CTR	3364	0	0	0	0	0	0
819 FLD MED PROT/HUM PERF	1626	551	572	1475	1644	1687	1718
840 COMBAT INJURY MGMT	6174	5116	4393	5405	5931	5298	5453
893 TISSUE REPLACEMENT	961	0	0	0	0	0	0
934 VOLUME ANGIOCAT	5768	0	0	0	0	0	0
937 NERVOUS SYSTEMS STUDIES	5768	0	0	0	0	0	0
938 TISSUE ENGINEERING	2211	0	0	0	0	0	0
940 EPIDERMOLYSIS BULLOSA	2884	0	0	0	0	0	0
941 DIABETES RESEARCH	13460	9132	0	0	0	0	0
945 BREAST CANCER STAMP	2381	0	0	0	0	0	0
969 ALCOHOLISM RESEARCH	8172	5559	0	0	0	0	0
971 HIV RESEARCH	9613	0	0	0	0	0	0
972 LASER VISION CORRECTION	5287	2978	0	0	0	0	0
973 RECOMBINANT VACCINE RESEARCH	5768	0	0	0	0	0	0
974 SMART AORTIC RESEARCH	0	992	0	0	0	0	0
975 PROTECTION AGAINST EMERGING INFECTIOUS DISEASES	3821	3965	0	0	0	0	0
97A BIOSENSOR RESEARCH	2404	2481	0	0	0	0	0
97B BLOOD SAFETY	6729	6750	0	0	0	0	0
97C CANCER CENTER OF EXCELLENCE	961	2085	0	0	0	0	0
97D CENTER FOR AGING EYE	1923	0	0	0	0	0	0
97E CENTER FOR PROSTATE DISEASE RESEARCH AT WRAMC	7210	6353	0	0	0	0	0

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

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE							
3 - Advanced technology development	0603002A - MEDICAL ADVANCED TECHNOLOGY							
97F CHRONIC DISEASE MANAGEMENT	4326	0	0	0	0	0	0	0
97G CHRONIC FATIGUE	1442	0	0	0	0	0	0	0
97H CLINICAL ASSESSMENT RECORDING ENVIRONMENT	961	0	0	0	0	0	0	0
97I DREAMS	9132	7941	0	0	0	0	0	0
97J ECHOCARDIOGRAM	1923	0	0	0	0	0	0	0
97K FUNCTIONAL MAGNETIC RESONANCE IMAGING	480	0	0	0	0	0	0	0
97L INTEGRATIVE MEDICINE DISTANCE LEARNING PROGRAM	769	0	0	0	0	0	0	0
97M LIGAMENT HEALING	1442	0	0	0	0	0	0	0
97N LUNG CANCER DETECTION	2884	0	0	0	0	0	0	0
97O LUNG CANCER RESEARCH	4326	3474	0	0	0	0	0	0
97P REMOTE ACOUSTIC HEMOSTASSIS	3845	0	0	0	0	0	0	0
97Q MICRO POSITRON EMISSION TOMOGRAPHY AT UAB	961	0	0	0	0	0	0	0
97R MOLECULAR AND CELLULAR BIOENGINEERING RESEARCH	577	0	0	0	0	0	0	0
97S MOLECULAR GENETICS AND MUSCULOSKELETAL RESEARCH	7692	8933	0	0	0	0	0	0
97T NEUROTOXIN EXPOSURE TREATMENT	14420	16875	0	0	0	0	0	0
97U OCULAR FATIGUE MEASUREMENT	403	0	0	0	0	0	0	0
97V POLYNITROXILATED HEMOGLOBIN	961	993	0	0	0	0	0	0
97W SEATREAT CANCER TECHNOLOGY	1442	1687	0	0	0	0	0	0
97X SYNCHROTRON-BASED SCANNING RESEARCH	6729	8438	0	0	0	0	0	0
97Y VIRTUAL RETINAL DISPLAY TECHNOLOGY	3845	1488	0	0	0	0	0	0
97Z TAFENOQUINE ANTIMALARIAL AGENT	1923	0	0	0	0	0	0	0
98A ARTIFICIAL HIP VOLUMETRICALLY CONTROLLED MFG	3364	3475	0	0	0	0	0	0
MB1 ADV DIAGNOSTICS & THERAPEUTIC DIG TECH	0	1300	0	0	0	0	0	0

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

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE							
3 - Advanced technology development	0603002A - MEDICAL ADVANCED TECHNOLOGY							
MB2 BRAIN, BIOLOGY, AND MACHINE	0	1800	0	0	0	0	0	0
MB3 CENTER FOR INTEGRATION OF MEDICINE & INNOV TECH	0	8500	0	0	0	0	0	0
MB4 CENTER FOR UNTETHERED HEALTHCARE	0	1000	0	0	0	0	0	0
MB5 CONTINUOUS EXPERT CARE NETWORK TELEMEDICINE	0	1500	0	0	0	0	0	0
MB6 FRAGILE X SYNDROME	0	1000	0	0	0	0	0	0
MB7 HEMOGLOBIN BASED OXYGEN CARRIER	0	1000	0	0	0	0	0	0
MB8 HEPATITIS C	0	3400	0	0	0	0	0	0
MB9 JOINT US NORWEGIAN TELEMEDICINE	0	1400	0	0	0	0	0	0
MC1 MEMORIAL HERMANN TELEMED NETWORK	0	1000	0	0	0	0	0	0
MC2 MONOCLONAL ANTIBODIES, MASS BIO LAB	0	1000	0	0	0	0	0	0
MC3 SACCADIC FATIGUE MEASUREMENT	0	1000	0	0	0	0	0	0
MC4 SECURE TELEMEDICINE TECH PROGRAM	0	2000	0	0	0	0	0	0
MC5 SPINE RESEARCH AT WRAMC	0	2100	0	0	0	0	0	0
MC6 TRAUMA RESEARCH CENTER	0	2100	0	0	0	0	0	0
MC7 NATIONAL TISSUE ENGINEERING CENTER	0	2000	0	0	0	0	0	0
MC9 MEDICAL SIMULATION TRAINING INITIATIVE	0	750	0	0	0	0	0	0
MD1 EMERGENCY TELEMED RESPONSE & ADV TECH	0	1500	0	0	0	0	0	0
MD2 VETERANS COLLABORATIVE CARE MODEL PROGRAM	0	1700	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element supports focused research for healthy, medically protected soldiers, and funds research consistent with the "Medical" and "Survivability" technology areas of the Objective Force. 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. This program element funds advanced technology development for the Department of Defense (DoD) core Vaccine and

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603002A - MEDICAL ADVANCED TECHNOLOGY

Drug Program, field medical protective devices, and combat injury management. The DoD core Vaccine and Drug Program provides, in accordance with Food and Drug Administration (FDA) regulations, drugs and vaccines for development that are effective protectants, treatments, and antidotes against military disease threats. Pilot and standard lots of candidate pharmaceutical-grade drugs, antidotes, and vaccines are produced. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program element is managed by the U.S. Army Medical Research and Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	221085	17541	16046
Appropriated Value	223132	175091	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-1049	0
b. SBIR / STTR	-6509	0	0
c. Omnibus or Other Above Threshold Adjustments	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	0	0	0
Adjustments to Budget Years Since FY2002 PB	328	0	544
Current Budget Submit (FY 2003 PB)	216951	174042	16590

Program Change Summary Explanation

Significant Changes: FY02- Congressional Adds totalling \$157550K (as noted below) added to this PE.

FY02 – Congressional adds were made for the Adv Diagnostics and Therapeutic Digital Technologies, MB1, (\$1300); Artificial Hip (Volumetrically Controlled Manufacturing), 98A, (\$3500); Biology, Education, Screening, Chemoprevention and Treatment (BESCT) Lung Cancer Research Program, 97O, (\$3500); Biosensor Research, 97A, (\$2500); Blood Safety (continuation of current program), 97B, (\$6800); Brain Biology and Machine, MB2, (\$1800); Cancer

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Center of Excellence (Notre Dame), 97C, (\$2100); Center for Integration of Medicine and Innovative Tech- Computer Assisted Minimally Invasive Surgery, MB3, (\$8500); Center for Prostate Disease Research at WRAMC, 97E, (\$6400); Center for Untethered Healthcare at Worcester Poly Inst, MB4, (\$1000); Continuous Expert Care Network Telemedicine Program , MB5, (\$1500); Disaster Relief and Emergency Medical Services (DREAMS), 97I, (\$8000); Fragile X, MB6,(\$1000); Hemoglobin Based Oxygen Carrier, MB7, (\$1000); Hepatitis C, MB8, (\$3400); Joint Diabetes Program, 941, (\$5000); Joint U.S. - Norwegian Telemedicine, MB9, (\$1400); Joslin Diabetes Research - eye care, 941, (\$4200); Laser Eye Correction (WRAMC), 972, \$3000; Life Support for Trauma and Transport (LSTAT), 840, (\$2500); Medical Simulation Training Initiative, MC9, (\$750); Memorial Hermann Telemedicine Network, MC1, (\$1000); Molecular Genetics and Musculoskeletal Research Program (only to continue current ARMY program), 97S, (\$9000); Monoclonal Antibodies, Mass Bio Lab, MC2, (\$1000); Emergency Telemedicine Response and Adv Tech Program, MD1, (\$1500); National Medical Tested--For ongoing programs, 815, (\$3700); National Medical Tested--Emergency/Trauma Care Adv Tech Programs, 815, (\$4000); Neurofibromatosis Research Program (NF), 814, (\$21000); Neurology Gallo Center - alcoholism research, 969, (\$5600); Neurotoxin Exposure Treatment Research Program (NETRP) Parkinson's, 97T, (\$17000); Polynitroxylated Hemoglobin, 97V, (\$1000); Retinal Scanning Display Technology, 97Y, (\$1500); Saccadic Fatigue Measurement, MC3, (\$1000); SEAtreat cervical cancer visualization and treatment, 97W, (\$1700); Secure Telemedicine Technology Program (only for C suite), MC4, (\$2000); Smart Aortic Arch Catheter, 974, (\$1000); Spine Research at WRAMC, MC5,(\$2100); Synchrotron Based Scanning Research (continue current ARMY Synchrotron-based scanning program to begin protocol testing), 97X, (\$8500); Trauma Research Center, MC6, (\$2100); Ve terans Collaborative Care Model Program, 2BA, (\$1700); National Tissue Engineering Center, MC7,(\$2000).

Projects with FY2002 Congressional Adds and no R-2A not listed/defined due to space limitations.

Core project without R-2A Exhibit that contains less than \$1M in FY 2003 is described below:

Project 819, 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 operational conditions. Specific support includes medical development of laser eye protection technologies and laser bioeffects treatment, environmental health-monitoring methods to link soldier physiological status with climatic and environmental conditions, methods to enhance sleep and alertness during continuous/sustained operational scenarios, nutritional strategies to enhance soldier mental and physiological performance, and medical protection from vibration and repeated shock hazards arising from the operation of combat vehicle and aircraft systems and rapid test kits for toxic industrial and agricultural chemicals.

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BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603002A - MEDICAL ADVANCED TECHNOLOGY	PROJECT 800					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
800 TELEMEDICINE TESTBED	4188	1650	1988	2920	3393	3986	4474

A. Mission Description and Budget Item Justification: This project supports the "Medical" technology area of the Objective Force by developing and demonstrating future medical concepts of operations, operational architectures, and operational requirements to support forward echelon telemedicine presence, medical command and control, and collaborative planning tools for mission planning and rehearsal. It funds development, evaluation, and demonstration of prototype advanced technology concepts and materiel for provision of enhanced Force Health Protection. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1697 - Evaluated modeling and simulation to provide commanders with capabilities to tailor deploying medical forces as part of Joint Medical Operations - Telemedicine Advanced Concept Technology Demonstration (ACTD).
- Demonstrated and selected the leave-behind capability package that will be evaluated by the U.S. Pacific Command during the transition phase of the ACTD and refine operational concepts.
- 2491 - This one year Congressional add demonstrates and completes a secure medical telecommunications capability. Proposal received and contract award pending.

Total 4188

FY 2002 Planned Program

- 1650 - Field a leave-behind capability and evaluate its robustness as a follow on of the Joint Medical Operations - Telemedicine ACTD. This will allow the users to further refine the operational and materiel concepts for employment of telemedicine in deployed joint military environments. Refine the logistical support concepts.

Total 1650

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PROJECT

800**FY 2003 Planned Program**

- 1988 - Complete evaluation of the leave-behind capability package and the assessment of robustness of the operational, materiel, and logistical support concepts in continuation of the Joint Medical Operations - Telemedicine ACTD. This will ensure that the optimum joint capability is retained.

- Complete the Military Utility Assessment and transition final operational, materiel, and logistical support recommendations to Commanders-in-Chief and Service Medical planners so that the lessons learned can be incorporated into joint battlefield medical operations.

Total 1988

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603002A - MEDICAL ADVANCED TECHNOLOGY	PROJECT 810					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
810 IND BASE ID VACC&DRUG	7823	8588	9637	10125	10615	11157	11691

A. Mission Description and Budget Item Justification: This project supports the "Medical" technology area of the Objective Force by developing medical countermeasures for naturally occurring diseases that are militarily significant due to their potential impact on military operations. Medical countermeasures will protect the force from infection and sustain operations by preventing hospitalization and evacuations from the theater of operations. Intramural research under this project is conducted at the U.S. Army Medical Research and Materiel Command's Medical Research Institute of Infectious Diseases, the Walter Reed Army Institute of Research and its overseas laboratories, and the Naval Medical Research Center and its overseas laboratories. Major contractors are Promed Trading, SA, Panama; the Research Triangle Institute, Research Triangle Park, NC; the University of California, San Francisco CA; and SRI International, Menlo Park, CA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3959 -Conducted human trials of a malaria DNA vaccine followed by a v iral delivered malaria vaccine boost designed to increase vaccine protection.

 -Conducted monkey trials on vaccines for both falciparum and vivax malaria species to determine safety and immune response.
 -Evaluated in clinical trials promising combination malaria vaccine candidates including a DNA vaccine that contains five genes representing multiple stages in the life-cycle of the malaria parasite to assess ability to provide a broader range of immunity.
 -Conducted pre-clinical efficacy, dosing, and toxicology evaluations as required by the Food and Drug Administration (FDA) for artelinic acid, the leading candidate drug to treat multi-drug resistant and severe and complicated malaria.
- 2217 -Completed Phase 1 inpatient trial of candidate vaccines against Shigella flexneri and conducted Phase 1 clinical trials of candidate vaccine to protect against enterotoxigenic E. coli (ETEC) to assess safety and immunogenicity of these vaccines to protect against debilitating diarrhea.

 -Designed and tested in animal models, antidiarrheal vaccine candidates for Shigella and ETEC, including a vaccine expressing proteins from both of these bacteria, and a Campylobacter vaccine administered with and without an immune booster.

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PROJECT

810**FY 2001 Accomplishments: (Continued)**

- 456 -Completed preparations and FDA coordination for a Phase 1 trial of a candidate Group B meningitis vaccine to identify the best vaccine design and formulation. Validated a rapid test for identifying Shigella in stool samples and a rapid field test to detect Plasmodium falciparum and P. vivax malaras in infected mosquitoes
- 1191 -Improved hantavirus DNA vaccines delivered by a “gene-gun” and tested in hamsters. Validated a rapid, high volume DNA-based test to measure effectiveness of dengue candidate vaccine. Conducted field evaluations of systems to kill dengue fever-transmitting mosquitoes, and to rapidly detect malaria-infected mosquitoes. Validated DNA-based tests for the identification of militarily important pathogens from Southeast Asia.

Total 7823

FY 2002 Planned Program

- 4560 -Conduct clinical Phase 1 testing of candidate vaccines to protect against vivax malaria and conduct animal studies to evaluate safety and immunogenicity of a candidate falciparum malaria vaccine. Select the best candidate drug for the treatment of severe and complicated malaria and conduct preclinical testing.
- 1680 -Complete preclinical testing of Shigella dysenteriae vaccine candidate; conduct animal safety and immunogenicity studies of enterotoxigenic E. coli (ETEC) and Campylobacter candidate antidiarrheal vaccines.
-Complete Phase I testing and begin Phase II testing of a candidate vaccine to protect against diarrhea caused by ETEC and Conduct Phase 2 testing in Israel of a vaccine to prevent diarrhea caused by Shigella sonnei. Transition S. sonnei vaccine to advanced development.
- 1065 -Conduct pre-clinical studies on the leading candidate Group B meningitis and plague vaccines to define the best vaccine designs.
- 1283 -Conduct non-human primate trials of candidate dengue vaccines against three of the four dengue serotypes and conduct Phase 1 human trial of a single serotype dengue candidate vaccines to determine the appropriate component for an effective and safety vaccine against dengue fever virus.

Total 8588

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BUDGET ACTIVITY

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PE NUMBER AND TITLE

0603002A - MEDICAL ADVANCED TECHNOLOGY

PROJECT

810

FY 2003 Planned Program

- 4264 -Complete clinical safety and immunogenicity studies of multivalent DNA and multivalent protein candidate vaccines for falciparum malaria.

-Complete safety and immunogenicity testing of a candidate vaccine to protect against vivax malaria.
-Complete pre-clinical testing of leading antimalarial drug artemisinin analog candidate for treatment of severe and complicated malaria caused by multidrug resistant parasites and to initiate preparation of an Investigational New Drug application to the FDA. Conduct initial preclinical testing of biguanides, tryptanthrins and antifolates in animals as new prophylactic compounds and downselect the best candidates for further trials.
- 1913 -Conduct a Phase 1 trial of Shigella dysenteriae vaccine.
-Complete Phase 2 clinical testing of candidate vaccines against E. coli diarrhea and Shigella sonnei
- 1243 -Prepare a clinical lot of vaccine from the first of three multivalent vaccine strains for use in a broadly protective multivalent group B meningitis vaccine and conduct Phase 1 clinical trials.
- 2217 -Complete Phase 1 clinical trials of the Dengue serotype (strain) 1 DNA vaccine and complete preclinical testing of DNA vaccines against Dengue serotypes 3 and 4 and candidate tetravalent vaccines in nonhuman primates.
-Complete manufacturing and begin phase 1 clinical trials of a hantavirus DNA vaccine to prevent hemorrhagic fever with renal syndrome and complete animal studies to determine the ability of antibodies to treat or protect against hemorrhagic fever caused by Lassa virus.

Total 9637

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BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603002A - MEDICAL ADVANCED TECHNOLOGY	PROJECT 840
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
840 COMBAT INJURY MGMT	6174	5116	4393	5405	5931	5298	5453

A. Mission Description and Budget Item Justification: This project addresses investigation of the treatments for weapons-induced trauma and shock due to blood loss on the battlefield as outlined in the Objective Force Medical Technology Area. The project funds prototypes of nonsystem-specific medical materiel items for far-forward medical management of shock and trauma and for casualty resuscitation including preclinical testing of candidate drug and biologic compounds and equipment to obtain data necessary for Food and Drug Administration (FDA) approval for human use. Intramural research under this project is conducted at the U.S. Army Medical Research and Materiel Command's Institute of Surgical Research, and the Walter Reed Army Institute of Research and its overseas laboratories. Major contractors include Integrated Medical Systems, Signal Hill, California and the American Red Cross. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1215 - Evaluated novel drugs for reducing blood loss and enhancing blood clotting in wounded warfighters under severe cold conditions and tested biologic agents to control massive internal bleeding. Examined methods to inactivate infectious agents in whole blood and red blood cells to enhance blood supply far forward.
- 973 - Completed the pre-clinical evaluation of an updated anesthesia device; performed field tests of a one-handed tourniquet.
- 3986 - FY 2001 congressional add to enhance and continue development of Life Support for Trauma and Transport (LSTAT).
- Conducted Milestone B and procured additional prototypes for continued user evaluation.

Total 6174

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

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3 - Advanced technology development

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**0603002A - MEDICAL ADVANCED
TECHNOLOGY**

PROJECT

840**FY 2002 Planned Program**

- 3459 - Conduct advanced technology development to complete evaluation of drugs for reducing blood loss in cold casualties and complete study of methods for the delivery of biologic agents to control massive internal bleeding. Continue investigations to support the development of methods to inactivate infectious agents in whole blood to enhance blood supplies far forward.
- 1657 - Complete clinical trials of an integrated anesthesia device and the preclinical evaluation of a self-contained, 20-pound intensive care life support system.

- Complete technical testing of a personal oxygen generation system that will eliminate the need for oxygen cylinders on the battlefield.

- Demonstrate lightweight dental equipment sterilizer in field environment.

Total 5116

FY 2003 Planned Program

- 1600 - Conduct advanced technology development to inactivate infectious agents in whole blood and red blood cells. Investigate intravenously applied biologics that will promote formation/strengthening of clots and test a hemostatic foam preparation in clinical trials to reduce battlefield deaths from loss of blood.
- 1760 - Perform clinical evaluation of a microwave or acoustic device to indicate the presence and magnitude of internal bleeding or air in chest/abdominal cavities after blunt trauma to guide casualty treatment. Obtain FDA approval of an integrated anesthesia device and a personal oxygen generator.
- 1033 - Transition to clinical trials anticaries and antiplaque peptide to prevent dental disease in the field.

Total 4393

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603003A - AVIATION ADVANCED TECHNOLOGY						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	26835	38496	45404	74754	83300	85758	86474
313 ADV ROTARYWING VEH TECH	12885	18129	30366	60429	52259	50506	50013
435 AIRCRAFT WEAPONS	2851	1778	2327	994	11541	10207	10758
436 ROTARYWING MEP INTEG	4462	9538	5857	6206	12064	16757	17019
447 ACFT DEMO ENGINES	6637	9051	6854	7125	7436	8288	8684

A. Mission Description and Budget Item Justification: The Aviation Advanced Technology Development program element (PE) matures and demonstrates manned and unmanned rotary wing vehicle (RWV) technologies in support of the Objective Force and Joint Vision 2020. Based on the Army transformation, this PE has been refocused to demonstrate technologies applicable to unmanned systems and selected opportunities for manned systems. Unmanned rotary wing vehicles bring unprecedented agility, maneuverability, and lethality to the Objective Force while providing reduced signature and logistics. Within this PE, aviation technologies will be matured and integrated into realistic and robust prototype system demonstrations that meet a Technology Readiness Level of 6 or better. Emphasis will be placed on maturing unmanned combat, reconnaissance, and communications relay capability. Technologies that enable the autonomous flight, higher aerodynamic airframe loads, and increased maneuverability possible with unmanned aerial vehicles will be demonstrated. This PE provides technical support and technology transition to Unmanned Aerial Vehicles (UAV) and RAH-66 Comanche. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance for which the Army is the lead service for the maturation of rotorcraft science and technology. Related applied research is conducted under PE 0602211A (Aviation Technology). Efforts under this PE transition to programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). The program element contains no duplication with any effort within the Military Departments. Work in this PE is performed by the Aviation and Missile Research, Development and Engineering Center, Redstone Arsenal, AL. This PE supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603003A - AVIATION ADVANCED TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	28545	44843	45028
Appropriated Value	28810	38843	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-347	0
b. SBIR / STTR	-796	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-915	0	0
e. Rescissions	-264	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	376
Current Budget Submit (FY 2003 PB)	26835	38496	45404

Change Summary Explanation:

Significant Change:

FY02 (-\$6000) Congressional reduction.

FY02 - Congressional adds:

(\$1500) Aviation Advanced Technology, Project 436 for Airborne Manned/Unmanned System Technology Radio Frequency network.

(\$3500) Aviation Advanced Technology, Project 447 for Unmanned Aerial Vehicle turboshaft engine.

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February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603003A - AVIATION ADVANCED TECHNOLOGY	PROJECT 313					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
313 ADV ROTARYWING VEH TECH	12885	18129	30366	60429	52259	50506	50013

A. Mission Description and Budget Item Justification: The Advanced Rotary Wing Vehicle (RWV) Technology project matures and demonstrates rotary wing unmanned and manned platform technologies for the Objective Force. It is envisioned that the Objective Force will need unmanned and manned rotorcraft systems that have significantly increased/improved lift, range and survivability with an overall reduction in logistics. Key to this effort is the demonstration of a vertical takeoff and landing (VTOL) UAVs for the Objective Force. The critical technologies to support these capabilities will be matured through Technology Demonstrations (TDs) of prototype UAVs, rotors, active controls, structures, drive train, and threat protection. The near term demonstration of unmanned, VTOL UAVs will focus on the A-160 Hummingbird UAV and the Organic Air Vehicle (OAV), to include the Micro Air Vehicle variant, for Reconnaissance, Surveillance and Target Acquisition (RSTA) capability. These demonstrations will focus on military operations and the application of military specification on these maturing systems. The Survivable, Affordable, Repairable Airframe Program (SARAP) and Full Spectrum Threat Protection (FSTP) TDs will reduce weight and increase the survivability for manned and unmanned systems. The Rotorcraft Drive Systems for the 21st Century (RDS21) TD will provide a 35% increase in power-to-weight ratio, 20% reduction in both production and operating and support costs and a 15 decibel (dB) reduction in noise for advanced drive-systems. The Helicopter Active Control Technology (HACT) TD will contribute to a 50-100% increase in payload, 100-200% increase in range and 50-65% improvement in maneuverability / agility when integrated with the RWV system. Work in this project is performed by contractors including: Boeing Company, Mesa, AZ and Philadelphia, PA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Lockheed Martin, Atlanta, GA; Sikorsky Aircraft Corporation, Stratford, CT; Raytheon Company, Arlington, VA; and United Technologies Research Center, Hartford, CT. This system supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 6991 - Conducted detailed design of active flight control system. Integrate hardware and software into test rotorcraft.
 - Conducted flight control subsystems flight tests.
 - Refined helicopter active flight controls engineering models and simulation.
- 5519 - Prepared detailed design and fabrication of tooling for exit criteria demonstration of test articles.
 - Conducted full-scale static testing of rotary wing structural fuselage sections affirming weight, cost and development cycle time reductions.
- 375 - Conducted RDS21 preliminary design for 35% increase in power-to-weight, -15dB noise reduction, 2X increase in durability and 25% reduction in production cost.

Total 12885

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BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603003A - AVIATION ADVANCED
TECHNOLOGY**

PROJECT

313

FY 2002 Planned Program

- 4717 - Establish Hardware in the Loop (HWIL) simulations for small UAVs: Micro Air Vehicle (MAV) and Organic Air Vehicle (OAV)
 - Refine Wind Tunnel parameters for UAV unique tests.
 - Conduct demonstration of RSTA VTOL UAV (A -160 Hummingbird) with DARPA.
 - Refine open source software for autonomous operation.
 - Conduct lethality evaluations on UAVs.
- 3361 - Conduct RDS21 detailed design.
 - Conduct analysis of RDS21 design parameters.
 - Perform rig testing of face gears for durability and strength
- 7000 - Perform helicopter active control system flight test.
 - Analyze test results using metrics developed to quantify system improvements.
 - Conduct HACT flight control system flight testing.
- 1951 - Identify and screen candidate technologies with potential to meet SARAP program goals of 25% weight and 40% manufacturing labor reductions compared to 1994 baseline.
 - Identify unique issues associated with large airframe affordability/survivability/reparability.
- 1000 - Conduct lab testing of candidate signature reduction hardware and active countermeasure devices for incorporation into the FSTP test platform.
- 100 - Personnel Recovery Extraction Survivability aided by Smart Sensors (PRESS) Advanced Concept Technology Demonstration (ACTD).

Total 18129

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BUDGET ACTIVITY

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PE NUMBER AND TITLE

0603003A - AVIATION ADVANCED TECHNOLOGY

PROJECT

313

FY 2003 Planned Program

- 16786 - Conduct HWIL UAV simulations for small UAVs (MAV and OAV) and medium sized UAV (A-160 Hummingbird and UCAR).
 - Conduct wind tunnel testing for small and medium UAVs
 - Conduct autonomous operations and evaluations.
 - Conduct small heavy fuel engine UAV demonstration.
 - Conduct Smart Structures UAV demonstration.
 - Conduct adaptive sensors UAV demonstration.
 - Conduct airspace management demonstration.
- 5280 - Complete RDS-21 preliminary design and analysis.
 - Complete laboratory validation of RDS21 components.
 - Begin fabrication of RDS21 demonstrator hardware.
- 3300 - Design, fabricate and test component level risk reduction specimens that supports SARAP program goals.
 - Conduct preliminary design phase for test articles in FY 2004.
- 5000 - Conduct validation laboratory test results and follow-on lab testing of candidate signature reduction hardware and active countermeasure devices for incorporation into the FSTP test platform.
 - Fabricate FSTP test aircraft.

Total 30366

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BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603003A - AVIATION ADVANCED TECHNOLOGY	PROJECT 435
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
435 AIRCRAFT WEAPONS	2851	1778	2327	994	11541	10207	10758

A. Mission Description and Budget Item Justification: The Aircraft Weapons project matures manned and unmanned rotorcraft sensor and weaponization technologies for air-to-ground and air-to-air application. This project supports the Objective Force and Joint Vision 2020 by providing mature technologies to focus combat power on multiple targets. The technologies will provide precision engagement capabilities to meet the demands of Military Operations in Urban Terrain (MOUT), force protection, and other asymmetrical threats. Integration of advanced missiles (Air-to-Air / Air-to-Ground), rockets, guns, fire control, advanced target acquisition and pilotage sensors, and directed energy weapons, including non-lethal capabilities, are evaluated and on rotorcraft platforms to assure compatibility of the weapon system with the rotorcraft system. Technology integration issues with on-board systems, vehicle flight characteristics and weapon system are matured and demonstrated. The project will mature Low Cost Precision Kill (LCPK) rocket system using a 2.75-inch rocket with a laser seeker sensor and the project will evaluate other technologies for providing rotorcraft combat enhancements. Work in this project is performed by contractors including: Boeing Company, Mesa, AZ and Philadelphia, PA; Lockheed Martin, Atlanta, GA; and Raytheon Company, Arlington, VA. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2851 - Finalized LCPK ATD AH-64D aircraft integration system analyses and design.
 - Built flight hardware for Apache Longbow to support airborne evaluation of the LCPK guided rocket
 - Investigated LCPK aircraft integration common areas with Army, Marine, and Special Operations Aviation (SOA) aircraft.
 - Conducted integration of LCPK with an unmanned aerial vehicle to address manned-unmanned aviation platform teaming issues and weapons/sensor integration issues.
- Total 2851

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3 - Advanced technology development

PE NUMBER AND TITLE

**0603003A - AVIATION ADVANCED
TECHNOLOGY**

PROJECT

435**FY 2002 Planned Program**

- 1778 - Conduct LCPK Advanced Technology Demonstration AH-64D aircraft. integration
- Perform airborne evaluation of the LCPK guided rocket.

Total 1778

FY 2003 Planned Program

- 1327 - Conduct AH-64D airborne evaluation of the LCPK guided rocket.
- 1000 - Provide technical support to Loitering Electronic Warfare Killer Advanced Concept Technology Demonstration.

Total 2327

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603003A - AVIATION ADVANCED TECHNOLOGY	PROJECT 436
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
436 ROTARYWING MEP INTEG	4462	9538	5857	6206	12064	16757	17019

A. Mission Description and Budget Item Justification: The Rotary Wing Mission Equipment Package Integration project matures and affirms man-machine integration and mission equipment technologies. This project improves the overall mission execution by demonstrating Unmanned/Manned System teaming, enhanced helicopter pilotage capability and improved crew workload distribution. This project supports the Objective Force and Joint Vision 2020 by providing mature technology to enhance near-real time situational awareness for unmanned and manned rotary wing vehicles. The Airborne Manned/Unmanned System Technology (AMUST) program integrates advanced technologies in sensors, displays, communication and controls necessary to team airborne manned and unmanned vehicles to maximize the teams' lethality, survivability, and operational tempo in support of the maneuver commander. The manned/unmanned team will be capable of performing scout and reconnaissance assignments and alerting manned rotorcraft of "just ahead" tactical situation awareness. State-of-the-art approaches in artificial intelligence, intelligent agents, sensors, avionics, communications, pilot vehicle interfaces, and autonomous assistants will result in an integrated team that enhances Army aviation battlefield effectiveness. This project provides Cognitive Decision Aiding (CDA) tools for crews by maturing knowledge-based information systems. Advanced integration technology in information management, sensors, displays, and controls will be matured to maximize combat helicopter mission effectiveness and survivability for day / night adverse weather operations. Virtual prototyping capability is used as the foundation for evaluating combined rotorcraft control and crew performance. Work in this project is performed by contractors including: Boeing Company, Mesa, AZ and Philadelphia, PA, Lockheed Martin, Atlanta, GA, and Raytheon Company, Arlington, VA. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4462 - Refined AMUST functional and interface specs to support critical operational functions.
- Performed initial integration of CDA and AMUST technologies as part of the Hunter Standoff Killer Team (HSKT) Advanced Concept Technology Demonstration.
- Conducted knowledge acquisition for Aviation scout / attack mission teams composed of manned and unmanned platoons.
- Provided Manned-Unmanned Teaming capability to 101st Airborne Division for Joint Readiness Training Center (JRTC) training rotation.
- Modified operational Longbow Apache. Line pilots from 101st controlled the Hunter Unmanned Aerial Vehicle and received video to increase situational awareness and survivability.
- Performed compatibility study with the Navy Tactical Control System (TCS).

Total 4462

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BUDGET ACTIVITY

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PE NUMBER AND TITLE

**0603003A - AVIATION ADVANCED
TECHNOLOGY**

PROJECT

436**FY 2002 Planned Program**

- 9538 - Integrate AMUST technology with the Navy Tactical Control System (TCS).
- Integrate AMUST technology with Warfighter's Decision Aid.
- Expand AMUST teaming technology to other tactical UAVs.
- Perform transition study of AMUST teaming technology to Comanche.
- Flight test AMUST teaming technology with Warfighter's Decision Aid equipped Longbow Apache and other tactical UAVs as part of Hunter Standoff Killer Team (HSKT) Advanced Concept Technology Demonstration.
- Develop interface control documents to integrate HSKT hardware in a System of Systems Construct, (i.e. Apache, Hunter Unmanned Aerial Vehicle (UAV), UH-60 with Army Airborne Command and Control System, and F/A 18).
- Mature, with user, tactics, techniques, and procedures for HSKT.
- Mature, with user, training concepts for HSKT System of Systems.
- Integrate alternative radio frequency wideband network.

Total 9538

FY 2003 Planned Program

- 5857 - Integrate AMUST technology into Army Airborne Command and Control System (A2C2S) and other manned platforms.
- Flight test AMUST technology in A2C2S and other manned platforms.

Total 5857

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603003A - AVIATION ADVANCED TECHNOLOGY	PROJECT 447
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
447 ACFT DEMO ENGINES	6637	9051	6854	7125	7436	8288	8684

A. Mission Description and Budget Item Justification: The Aircraft Demonstration Engines project matures power system technologies through competitively performed design, fabrication and test of advanced material technologies, engines and integrated components. This project supports the Objective Force and Joint Vision 2020 by providing mature technologies for lighter turbine engines that provide more power, can go farther, and are easier for the warfighter to maintain and sustain. This will improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. The Joint Turbine Advanced Gas Generator (JTAGG) efforts are all fully coordinated / aligned with the phases / goals of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) program and industry. IHPTET / JTAGG goals focus on reducing specific fuel consumption (SFC) and increasing the power-to-weight (P/W) ratio of turboshaft engines while decreasing production and maintenance costs. This provides significantly increased range and payload capabilities for future unmanned and manned rotorcraft and sustainment upgrades for current engines, with significant Operation and Support cost savings. Work in this PE is performed by contractors including: General Electric Aircraft Engines, Lynn, MA; Honeywell, Phoenix, AZ; Rolls - Royce/Allison, Indianapolis, IN; and Pratt & Whitney, Hartford, CT. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 6637 - Performed fabrication of the final core engine build components including the High Effectiveness Affordable Turbine (HEAT) blades in preparation for final demonstration of program goals.
- Fabricated initial JTAGG III gas generator hardware and conducted initial JTAGG III build component testing.

Total 6637

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603003A - AVIATION ADVANCED
TECHNOLOGY**

PROJECT

447

FY 2002 Planned Program

- 5551 - Conduct testing of JTAGG III initial gas generator build, which includes a forward swept rotor, a split-inducer impeller, a ceramic matrix composite combustor liner and un-cooled ceramic low pressure turbine blades.
 - Affirm in testing of the final core engine build the JTAGG II goals of 80% increase in shaft horsepower to weight ratio, 30% decrease in SFC and 20% reduction in production and maintenance costs.
 - Fabricate and test components in support of second JTAGG III gas generator build.
- 3500 - Design turboshaft engine for Unmanned Aerial Vehicles (UAV).
 - Conduct evaluation of UA V turboshaft engine.

Total 9051

FY 2003 Planned Program

- 6854 - Conduct testing of JTAGG III second gas generator build which introduces a ceramic nozzle in the high pressure turbine.
 - Affirm in testing the JTAGG III goals of 120% increase in shaft horsepower to weight ratio, 40% decrease in Specific Fuel Consumption (SFC), and 35% reduction in production and maintenance costs with the addition of magnetic bearings and component aerodynamic improvements.

Total 6854

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603004A - Weapons and Munitions Advanced Technology						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	56230	35381	66514	36959	62123	55440	58670
232 ADVANCED MUNITIONS DEM	20612	31907	66401	36821	61908	40154	42356
43A ADV WEAPONRY TECH DEMO	35618	3474	113	138	136	154	150
L94 ELECTRIC GUN SYS DEMO	0	0	0	0	79	15132	16164

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates affordable, smaller and/or lighter advanced weapons and munitions technologies to increase battlefield lethality and survivability for the Future Combat Systems (FCS) for the Objective Force. Specific efforts include: FCS Multi-Role Armament and Ammunition System ATD; Direct Fire Lethality (DFL) Program; Multi-Purpose Extended Range Munition (MP-ERM); Precision Guided Mortar Munition (PGMM); Area Denial Systems; and Responsive Accurate Mission Module (RAMM). The FCS Multi-Role Armament utilizes Electrothermal-Chemical (ETC) propulsion and provides single armament module configurations to support both maneuver and fire support missions. The corresponding FCS Multi-Role Ammunition, consisting of a three-cartridge suite, provides overwhelming lethality at ranges up to 50 km with greater precision and accuracy, and with reduced logistics footprint. The MP-ERM cartridge will provide combat overmatch against the full target spectrum by using advanced explosively formed penetrator (EFP) warheads that exploit energetics, liner materials and modeling/simulation technologies. The project demonstrates the increase in armor penetration for these new EFP warheads. 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). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey. This system supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603004A - Weapons and Munitions Advanced Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	55227	29684	33284
Appropriated Value	55738	35684	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-303	0
b. SBIR/STTR	-1597	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	2600	0	0
e. Rescissions	-511	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	33230
Current Budget Submit (FY 2003 PB)	56230	35381	66514

Change Summary Explanation:

Significant Changes:

FY03 - (+\$33230) - Project 232 (+\$33117) and Project 43A (+\$113) increased to FCS: perform projectile modeling and simulation; conduct validation and verification tests for models, develop MRM airframe (includes design, modeling and simulation, hardware fabrication and demonstration); develop guidance and control (G&C) seeker/sensor subsystems; design, fabricate test samples/fixtures and conduct high-G tests of the G&C subsystem; develop seeker/sensor models, simulations and algorithms.

FY02 - Congressional adds were made for Low Cost Course Correction Technology, Project 43A (+\$3500); and SMAW Shoulder- Launched Multipurpose Assault Weapon and Munitions Engineering Development, Project 232 (+\$2500).

Projects With No R-2A:

Project 43A (FY02 funding = \$3474) - This project will demonstrate and complete Low Cost Course Correction Technology. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603004A - Weapons and Munitions Advanced Technology	PROJECT 232					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
232 ADVANCED MUNITIONS DEM	20612	31907	66401	36821	61908	40154	42356

A. Mission Description and Budget Item Justification: This project matures and demonstrates munitions enhancement for the FCS Multi-Role Armament and Ammunition Systems (MRAAS) and matures emerging technologies in lightweight structures, smart materials and in-flight update architectures. The DFL program focuses on enhancing kinetic energy (KE) penetrator lethality against explosive reactive armor (ERA) appliqué arrays (now available on fielded threat systems), exploiting novel defeat mechanisms. The MP-ERM program evaluates warhead designs against various range targets. RAMM will be developed under this project. A Mid-Range Munition (MRM) and the MRAAS Cargo Round provide additional lethality options for FCS. A Congressionally funded effort to mature and demonstrate Shoulder-Launched Multipurpose Assault Weapon (SMAW) and associated munitions for use in confined spaces will be completed 4QFY02. In-house efforts are accomplished by ARDEC, Picatinny Arsenal, New Jersey and the Army Research Laboratory, Aberdeen Proving Ground, MD. Major contractors include: Alliant Tech Systems, Minneapolis, MN; Science Applications International Corp., McLean, VA; LTV Aerospace, Dallas, TX; Textron Defense Systems, Wilmington, MA; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; General Dynamics - Ordnance Tactical Systems, Red Lion, PA; Alliant Tech Systems -Allegheny Ballistics Laboratory, Rocket City, MD and Raytheon/TI Systems, Tucson, AZ. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 6500 - Demonstrated advanced KE munition novel penetrator defeat against ERA with an increase in penetration of at least 50% over the M829A2 at extended range; demonstrated feasibility of minimum 30% increase in system accuracy (probability of hit) with radial thruster technology on KE penetrators.
- 6705 - Completed TERM warhead design and analysis; conducted warhead testing versus range targets; performed ballistic test firings of the TERM propulsion system over the temperature ranges; updated tactical seeker design; transferred design and technology to MP-ERM for FCS.
- 7407 - This one year Congressional add funded a feasibility study adapting SMAW-CS to Bunker Defeat Munition; conducted modeling and simulation and limited test and evaluation of prototype hardware. No additional funding is required to complete this effort.

Total 20612

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603004A - Weapons and Munitions Advanced Technology	PROJECT 232
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FY 2002 Planned Program

- 5924 - Conduct airframe and lethality demonstrations of the MP-ERM.
- 1760 - Complete design and initiate fabrication of medium caliber air bursting projectile; conduct medium caliber novel kinetic energy penetrator testing against advanced armors.
- 17000 - Complete the following for the FCS Multi-Role Armament: fabricate and conduct functional test of lightweight, low impulse multi-role cannon for FCS; fabricate automated ammunition handling system and conduct load/unload function testing with multi-role cannon; demonstrate best technical approaches for ETC propellant with increased energy and lower sensitivity; complete fire control software development, hardware integration, and conduct preliminary System Integration Laboratory prove-out.
- 4723 - Complete Multi-Role Smart Cargo projectile design to include guidance and control; demonstrate best technical approaches for dynamic retargeting to locate and defeat time critical targets; use modeling and simulation to demonstrate maximized payload volume enabled by application of smart materials, structures and metal matrix composites for airframe.
- 2500 - This one year Congressional add (SMAW, Shoulder-Launched Multipurpose Assault Weapon and Munitions Engineering Development) matures and demonstrates (and completes) technology to launch SMAW in confined spaces. No additional funding is required to complete this project.

Total 31907

FY 2003 Planned Program

- 3052 - Fabricate preliminary subsystem hardware of the RAMM mortar module.
- 6932 - For the FCS Multi-Role Ammunition: demonstrate defeat of advanced threat armor at extended ranges with integrated novel penetrator and composite sabot; demonstrate critical Guidance and Control and high-G components for MP-ERM; complete airframe design for Smart Cargo round to achieve deliveries of lethal payloads to 50 km.
- 2500 - Demonstrate integrated medium caliber air bursting projectile lethality of four-fold increase in lethal area over traditional point-detonating warhead against personnel targets.
- 20917 - For the FCS Multi-Role Armament: demonstrate firing of multi-role cannon with integrated cartridge; demonstrate, at subscale, feasibility of achieving 25% increase in energy (while retaining equal sensitivity to current tank ammunition) using Generation II ETC propellant; demonstrate fire control software and hardware in a System Integration Laboratory; conduct secondary armament turreted system slew and firing demonstration; conduct testing of automated ammunition handling system load/unload sequence reliability; complete turret design; initiate fabrication of turret structure.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603004A - Weapons and Munitions Advanced
Technology**

PROJECT

232

FY 2003 Planned Program (Continued)

- 33000 - For the Mid Range Munition (MRM)for FCS: perform projectile modeling and simulation; conduct validation and verification tests for models, develop MRM airframe (includes design, modeling and simulation, hardware fabrication and demonstration); develop guidance and control (G&C)seeker/sensor subsystems; design, fabricate test samples/fixtures and conduct high-G tests of the G&C subsystem; develop seeker/sensor models, simulations and algorithms.

Total 66401

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603005A - Combat Vehicle and Automotive Advanced Technology						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	167679	225960	234978	218157	181468	105234	110314
221 COMBAT VEH SURVIVABLTY	27270	31879	49401	44327	27166	16136	17972
440 ADV CBT VEHICLE TECH	89017	22954	2774	10066	10896	54601	55094
441 COMBAT VEHICLE MOBILTY	7167	14603	39210	18184	14181	13910	16402
497 COMBAT VEHICLE ELECTRO	2916	5567	6334	5955	68	13267	13342
506 METAL MATRIX COMPOSITES	7692	2481	0	0	0	0	0
515 ROBOTIC GROUND SYSTEMS	1694	9219	8873	22514	14939	5092	5191
533 TECHNOLOGY TRANSFER CENTER	4807	0	0	0	0	0	0
539 MOBILE PARTS HOSPITAL	7692	5559	0	0	0	0	0
53B FUEL CELL AUX POWER UNITS FOR LINE HAUL TRUCKS	2884	0	0	0	0	0	0
53C NATIONAL AUTOMOTIVE CENTER - UNIV INNOVATIVE RSCH	2884	0	0	0	0	0	0
53D NATIONAL AUTOMOTIVE CENTER - ADV TECH	3845	4169	0	0	0	0	0
53E IMPACT TRUCK PROGRAM	4807	3474	0	0	0	0	0
53F NAC STANDARD EXCHANGE OF PRODUCT MODEL DATA	2884	2481	0	0	0	0	0
53G FUTURE COMBAT SYSTEMS (FCS)	0	110587	125147	116112	113194	0	0
540 IMPROVED HMMWV RESEARCH	0	2084	0	0	0	0	0
C66 DC66	2120	4703	3239	999	1024	2228	2313
CA2 TACOM HYBRID VEHICLE DEMO: LITHIUM ION TECH	0	1000	0	0	0	0	0
CA3 CORROSION PREVENTION AND CONTROL PROGRAM	0	1400	0	0	0	0	0
CA4 VEHICLE BODY ARMOR SUPPORT SYSTEM	0	3300	0	0	0	0	0
CA5 FUEL CATALYST RESEARCH EVALUATION	0	500	0	0	0	0	0

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603005A - Combat Vehicle and Automotive Advanced Technology

A. Mission Description and Budget Item Justification: The goal of this Program Element (PE) is to mature and demonstrate new and improved combat vehicle and automotive technologies to enable transformation of the Army to the Objective Force. Future Combat Systems (FCS), the Army's top priority S&T program, is the primary emphasis of work funded in this PE to support Army Transformation. A large portion of the funds in this PE supports the collaborative Army/Defense Advanced Research Projects Agency (DARPA) FCS program. A Memorandum of Agreement (MOA) between the Army and DARPA (signed February 2000) delineates the approach, funding and responsibilities for the FCS program. The Army vision demands a force that is deployable, agile, versatile, lethal, survivable and sustainable across the spectrum of operations. This PE supports the following enabling technology areas: survivability, mobility and intra-vehicular digital electronics. It also integrates diverse vehicle technologies developed by the Army, other DoD agencies and industry. These technologies are demonstrated in coordination with Army warfighter organizations through vehicle component and system level technology demonstrations. In addition, three Advanced Technology Demonstrations (ATDs) are funded: Future Scout and Cavalry System (FSCS), Crew Integration & Automation Testbed (CAT), and Robotic Follower. The FSCS ATD is a joint US/UK effort incorporating the state-of-the-art sensor, armor, and survivability technologies that could transfer to the FCS. The CAT ATD demonstrates multi-mission capable crew stations, required for the versatility of the Objective Force. The Robotic Follower ATD will demonstrate an unmanned ground system capability for FCS that will increase survivability and reduce logistics. This PE is managed by the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), a subordinate organization of the Tank-Automotive and Armaments Command (TACOM), located in Warren, MI. This program adheres to Tri-Service Reliance Agreements on advanced materials, fuels and lubricants, and ground vehicles with oversight and coordination provided by the Joint Directors of Laboratories. Work in this program element is related to, and fully coordinated with, PE 0602601A (Combat Vehicle and Automotive Technology). Furthermore, the project is coordinated with the Marine Corps office through the Naval Surface Warfare Center, the Naval Research Laboratory, Air Force Armaments Command, and other ground vehicle developers within the Departments of Energy, Commerce, Transportation and DARPA. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603005A - Combat Vehicle and Automotive Advanced Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	166571	193858	300150
Appropriated Value	168114	227858	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-1898	0
b. SBIR / STTR	-2287	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Above Threshold Reprogramming		0	0
e. Below Threshold Reprogramming	3394	0	0
f. Rescissions	-1542	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	-65172
Current Budget Submit (FY 2003 PB)	167679	225960	234978

Change Summary Explanation:

Significant Changes:

FY02 (+\$32102) - Increase due to Congressional Adds as noted below.

FY03 (-\$65172) - Decrease Project 53G due to FCS acceleration (i.e., Milestone B in FY03 vs. FY06); funds redirected to accelerate high priority FCS Army enabling technologies.

FY02 - Congressional adds were made for: Aluminum Reinforced Metal Matrix Composites for Track Shoes, Project 506 (\$2500); Combat Vehicle Research - Weight Reduction, Project 440 (\$6000); Electrochromatic Glass for Combat Vehicles, Project 53D (\$1700); Fuel Catalyst Research Evaluation, Project C51 (\$500); Mobile Parts Hospital Technology Program, Project 539 (\$5600); Movement Tracking System (MTS) for Family of Heavy Tactical Vehicles, Project 53D (\$2500); National Automotive Center Standardized Exchange of Product Data (N-STEP), Project 53F (\$2500); Up-armored HMMWV, Project 540 (\$2100); TACOM Hybrid Vehicle Demonstration: Lithium Ion Technology, Project CA2 (\$1000); Improved Materials & Powertrain Architecture for 21st Century Truck (IMPACT), Project 53E (\$3500); Composite Body Parts, Project 440, (\$1400); Corrosion Prevention and Control Program, Project CA3 (\$1400);

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603005A - Combat Vehicle and Automotive Advanced Technology

Vehicle Body Armor Support System, Project CA4 (\$3300)

Projects With No R-2A:

Project 506 (FY02 Funding = \$2481) Aluminum Reinforced Metal Matrix Composites for Track Shoes - Supports and completes verification of the performance of the XT172 Single Pin Metal Track through a 3,500 mile durability test in Yuma Proving Grounds (YPG) and explores the potential of adapting metal matrix composites technology to the other automotive components. No additional funds required to complete this effort. COMPLETE 4Q02

Project 539 (FY02 Funding = \$5559) Mobile Parts Hospital Technology Program - Supports and completes testing of a computerized module testing of a containerized module for the mobile Parts Hospital (MPH), due for delivery 1 APR 02; implementation of an agile manufacturing cell at Focus: HOPE; adding parts to the MPH database; testing sample parts on Army vehicles; and MPH demonstrations at various sites. No additional funds required to complete this effort. COMPLETE 4Q02

Project 53D (FY02 Funding = \$4169) National Automotive Center - Formulates and matures (and completes) advanced modeling and simulation strategies for the Army's vehicle fleet; models and experimentally validate advanced propulsion and mobility simulations for future fleet of vehicles. COMPLETE 4QFY02

Project 53D (FY02 Funding = \$1700) Electrochromatic Glass for Combat Vehicles - Demonstrates and completes evaluation of electrochromatic glass in Combat Vehicle applications. No additional funds required to complete this effort. COMPLETE 4Q02

Project 53D (FY02 = \$2500) Movement Tracking System (MTS) for family of Heavy Tactical Vehicles - Demonstrates and completes adaptation, installation and testing of commercially available situational awareness/logistics technology (currently used in the automotive industry and commercial log-haul trucking). No additional funds required to complete this effort. COMPLETE 4Q02

Project 53E (FY02 Funding = \$3474) Improved Materials and Power Train Architecture for 21st Century Truck (IMPACT) - Develops and completes the transfer and optimization of weight reduction and fuel technologies, developed and integrated into a commercial Model F150 into a demonstrator platform using a heavier commercial truck platform (Model F350). No additional funds required to complete this effort. COMPLETE 4Q02

Project 53F (FY02 Funding = \$2481) National Automotive Center Standardized Exchange of Product Data (N-STEP) - Develops and completes development of Standardized Exchange of Product Data (STEP) protocols for manufacturing and demonstrating STEP as a cost savings saving tool for manufacturing. No additional funds required to complete this effort. COMPLETE 4Q02

Project 540 (FY02 Funding = \$2084) Up-Armored HMMWV - Improves (and completes) the protection level of the HMMWV by developing, fabricating, and testing lightweight ceramic/composite materials for ballistic protection. No additional funds required to complete this effort. COMPLETE 4Q02

Project CA2 (FY02 Funding = \$1000) TACOM Hybrid Vehicle Demonstration: Lithium Ion Technology - Completes development and evaluation of Li-Ion

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive Advanced
Technology**

batteries to provide higher energy density and improved power output vs. current lead acid batteries. No additional funds required to complete this effort. COMPLETE 4Q02

Project CA3 (FY02 Funding = \$1400) Corrosion Prevention and Control - Completes the evaluation of specific corrosion prevention and control techniques for Army vehicles. No additional funds required to complete this effort. COMPLETE 4Q02

Project CA4 (FY02 Funding = \$3300) Vehicle Body Armor Support System - Develops, demonstrates an effort that protects crew in a tactical wheeled vehicle against small arms fire. No additional funds are required to complete this project. C

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603005A - Combat Vehicle and Automotive Advanced Technology	PROJECT 221
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
221 COMBAT VEH SURVIVABLT	27270	31879	49401	44327	27166	16136	17972

A. Mission Description and Budget Item Justification: This project demonstrates the advanced vehicle protection technologies needed for a force that is survivable across the full spectrum of operations. As combat systems become smaller and lighter to provide the necessary strategic deployability and tactical mobility, providing adequate protection without reliance on heavy armor is one of the greatest technological and operational challenges. The solution involves developing and integrating an optimal suite of protection approaches such as armor, active protection systems (APS), signature reduction, jammers, and decoys. This project matures, integrates, and demonstrates the advanced component APS technologies that will provide protection against threat munitions (e.g., guided and unguided anti-armor munitions) for FCS and Objective Force. Products will be made available to FCS contractors for incorporation into their systems designs. Initial APS efforts demonstrate the technologies needed for a system that is effective against Chemical Energy (CE) munitions (e.g., anti-tank guided missiles with Shape Charge warheads). The ultimate goal is a Full Spectrum Active Protection (FSAP) system that will provide hemispherical survivability against CE, large caliber tube launched Kinetic Energy (KE), and top attack threats. Survivability technologies, integrated and demonstrated in the laboratory and in the field under this project, include those technologies transitioned from the following program elements: 0601102A, 0602270A. Major contractors include: United Defense Limited Partnership, San Jose, CA; Sanders, a Lockheed Martin Company, Nashua, NH; TRW, Redondo Beach, CA; Hughes Danbury, Danbury, CN; General Dynamics Land Systems, Warren, MI; Chang Industries, Salt Lake City, UT & Laverne, CA; New Mexico Tech, Socorro, NM; IST, Goleta, CA, Aerojet, Azusa, CA. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 15147 - Conducted APS development and testing of advanced technologies under contract with UDLP; completed APS component integration.
- 1011 - Matured APS radar design and investigated advanced tracking radar technologies for FCS.
- Procured test munitions for system testing.
- 1462 Provided program management for APS technology maturation and advanced survivability technologies integration and other government agency/user/test support.
- 4825 - Identified design changes which will provide the extended range sensor capability to detect and track KE threats for FSAP system.
- 4825 - Evaluated emerging signature management technologies utilizing survivability optimization modeling to reduce combat vehicle detection probabilities; conducted an initial test evaluation of emerging signature management technologies to quantify performance.

Total 27270

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

221

FY 2002 Planned Program

- 12352 - Conduct full scale range testing to demonstrate defeat of Anti-Tank- Guided Missiles, Rocket Propelled Grenades and smart munitions with the survivability system integrated on a surrogate platform.
- Prepare and deliver final report and video summarizing all testing and accomplishments of the program; develop design guides for vehicle Program Manager (PM) use.
- 388 - Perform distributed interactive simulation for combat fidelity testing and user evaluation.
- 1564 - Provide program management for APS development and advanced survivability technologies integration and other government agency/user/test support.
- 897 - Conduct field testing to evaluate performance of integrated survivability system.
- 5512 - Test and demonstrate tracking radar sensor technology for FSAP KE detection and tracking.
- Conduct range tests of FSAP KE countermeasure warheads against multiple horizontal and overhead threats.
- Locate and obtain threats for coordinated test and evaluations.
- Integrate countermeasure and sensor subsystem models for FSAP performance simulations.
- 5000 - Conduct full scale breadboard testing to quantify field performance and validate signature modeling predictions.
- Develop virtual models of vehicle integration concepts to predict signature management performance.
- Mature advanced signature management to prepare for FY 2004-2005 full scale performance testing.
- 6166 - Design and develop control algorithms and platform stabilization hardware for APS on-the-move demonstration.
- Fabricate hardware for stabilization units and develop search radar.
- Conduct preliminary testing of stabilization hardware configuration.

Total 31879

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

221

FY 2003 Planned Program

- 9329 - Design and fabricate optimal extended range tracking radar sensor based on FY 2002 tests of APS.
- Complete FSAP integrated system design and fabricate into a full scale operational FSAP System.
- 5000 - Acquire threat munitions for range tests.
- Conduct laboratory FSAP system simulations to predict system performance.
- Add FSAP capability to Commander's Decision Aid.
- 4924 - Mature signature management technology for virtual component designs and performance predictions.
- Fabricate and integrate advanced hardware to prepare for full scale vehicle testing in FY 2004.
- Mature detailed virtual vehicle and prototypes in preparation for FY 2004 virtual hardware evaluations with user organizations.
- 9148 - Mature on-the-move simulation and algorithms.
- 8000 - Integrate and test search radar for on-the-move full scale range testing of on-the-move vehicle APS against threat munitions.
- Provide program management for APS development and other government agency/user/test support.
- 9000 - Conduct full scale range testing of tracking sensor and perform redesign based on range test results.
Fabricate and mature threat tracking radar.
Fabricate high acceleration, clean exhaust countermeasure rocket motor and range test.
Design and fabricate rotational countermeasure rocket guidance sensor.
- 4000 - Design and fabricate course correction into countermeasure rocket and range test.
Construct engineering level model of full spectrum active protection system.

Total 49401

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603005A - Combat Vehicle and Automotive Advanced Technology	PROJECT 440					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
440 ADV CBT VEHICLE TECH	89017	22954	2774	10066	10896	54601	55094

A. Mission Description and Budget Item Justification: This project demonstrates the operational potential, technical feasibility and maturity of advanced combat vehicle technologies through integrated demonstrations of subsystems, systems, and system of systems. In FY 2002 Army funds for the collaborative Army/DARPA FCS effort were transferred from this project to Project 53G to provide better visibility. (See project 53G for a description of the FCS program.) Work performed under this project (440) demonstrates innovative concepts, combat vehicle configurations, enabling technologies and integration techniques. All demonstrations include User and developer teaming in field and/or laboratory environments. Computer simulations and hardware demonstrations (subscale and full-scale) are conducted to accomplish a more rapid and seamless transition of advanced technologies into systems applications. The FSCS ATD integrates advanced sensors, survivability, mobility and communications technologies into a robust vehicle platform. Congress zeroed the Army's FY 2001 request for the FSCS ATD without prejudice. In September 2000, the Congress approved reprogramming of FY 2000 funds in the amount of \$65.894M for the FSCS Program. Two consortia, SIKA and Lancer, perform the work under firm fixed price contracts awarded by the United Kingdom. Each will deliver to the government robust integrated demonstrator assets, through which they will demonstrate the technical maturity and the ability to successfully integrate technologies. The demonstrators will undergo technical testing with a limited operational evaluation to assist the Training and Doctrine Command in developing warfighting tactics, techniques, and procedures. The FSCS ATD program completes in FY02. Technologies developed under this program and the lessons learned about integrating FSCS technologies on a C-130 transportable platform will be made available to the FCS LSI to reduce risk and, perhaps, accelerate FCS development. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 7197 - Provided Army's share of funds in support of Army/DARPA FCS concept development for four contractor teams (\$7752 in PE 0602601A, Project HH7, also supports this effort).
 - Developed metrics for evaluation of FCS performance; designed and demonstrated force-level simulation capability for FCS.
 - Conducted technical and operational experimentation in support of system design concepts ; demonstrated use of and completed architecture for Integrated Data Environment (IDE).
 - Conducted technology and operation trade-assessments to determine optimum design for each systems concept.

- 28272 - Provided Army's share of funds in support of Army/DARPA FCS enabling technologies as follows:
 - Netfires: produce system prototypes.

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced technology development

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

440

FY 2001 Accomplishments: (Continued)

- Autonomous Navigation (Preceptor): Award Section 845 agreement; produce robotic surrogates for testing in FY 2002.
- Unmanned Ground Vehicle Program: Award ten (10) Section 845 agreements to investigate/study concepts for unmanned ground vehicles.
- Laser Radar (LADAR) Through Canopy (Jigsaw): Award Section 845 agreement to develop technical approaches for producing a LADAR that can see through canopies.
- 3963 - Completed Congressional special interest program designing two advanced structural concepts; one pure monocoque and one hybrid spaceframe/stiffened skin/monocoque incorporating derivatives of CAV composites technology, aerospace aluminum-lithium alloys and friction-stir welding; structural and ballistic component tests confirmed structural and ballistic efficiencies.
- 49585 - Reduced technical and schedule risk for FCS program by increasing the competition for ideas by the Army/DARPA FCS contractors, increased funds for critical Army enabling technologies, and bolstered modeling and simulation to support the Army/DARPA FCS program as follows:
 - Augment Army/DARPA FCS contractor teams.
 - Performed government modeling and simulation to support FCS program.
 - Demonstrated additional, competing Netfires concept.
 - Completed Congressional special interest program to demonstrate turbo fuel cell engine
 - Conducted government C4ISR architecture study and analysis.
 - Initiated the Joint Virtual Battlespace (JVB) program, and executed the following*: - (1) Developed the Modeling & Simulation (M&S) framework and Federation of Models (FOM) architecture to support integration of Simulation & Modeling for Acquisition, Requirements and Training (SMART) tools for Future Combat System (FCS) and Objective Force (OF), - (2) Integrated functional capabilities including force behavior models, robotics, route planning, mobility, communications, etc., to support operational concept assessments; and - (3) Initiated Objective Force Survivability Study in support of TRADOC/TRAC for the analysis of key Objective Force operational concepts and organizational design issues.- *Note: JVB was initiated in FY01 with PE 0603005A funds but, beginning in FY02, funding for JVB is included in PE 0603238A.

Total 89017

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

440**FY 2002 Planned Program**

- 15554 - Complete software development and assemble hardware into FSCS ATD demonstrator vehicles.
- Conduct and complete combined US/UK user test of FSCS ATD demonstrator vehicles.
- Conduct and complete combined US/UK evaluation and analysis of FSCS ATD demonstrator vehicles and prepare final report.
- 1400 - This one year Congressional add (Composite Body Parts) supports and completes the adaption and evaluation of HMMWVs with composite construction. No additional funds are required to complete this initiative.
- 6000 - This one year Congressional add (component Vehicle Research - Weight Reduction) supports and completes development and evaluation of low-cost composites using intelligent Vacuum Assisted Resin Transfer Molding (VARTM) process control and low cost tooling technology for thin gage sheet metal panel replacement for trucks and other tactical vehicles. No additional funds are required to complete this initiative.
- Perform prototype and field exposure tests of multiple wheeled vehicle "composite-sheet-metal" components and assemblies.

Total 22954

FY 2003 Planned Program

- 2774 - Initiate development and demonstration of a system to recover water from vehicle exhaust gases for logistics burden reduction for FCS using technology being developed in PE 0602601 Project AH91.

Total 2774

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603005A - Combat Vehicle and Automotive Advanced Technology	PROJECT 441
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
441 COMBAT VEHICLE MOBILTY	7167	14603	39210	18184	14181	13910	16402

A. Mission Description and Budget Item Justification: This project matures and tests vehicle mobility technologies that that will provide lighter, agile, deployable, and more fuel efficient ground combat vehicles needed for FCS and the Army Transformation to the Objective Force. The principal elements of these mobility demonstrations are: higher power density engines, hybrid-electric drive, active and semi-active suspensions, and lightweight track. The Army matures high power density engines because commercial engines lack the necessary power density to meet power, space and weight constraints of FCS, and alternate power generation technologies (e.g., fuel cells) are not expected to be sufficiently mature for initial FCS fielding in this decade. Main programs funded by this project are Combat Hybrid Power Systems (CHPS) and FCS Engine. Hybrid-Electric drive offers unique capabilities, such as improved performance, silent operation and vehicle design flexibility; however, it presents new challenges, especially in power electronics thermal management. Army efforts in hybrid electric drive leverage two prior joint Army/DARPA programs, CHPS and the Electric Drive Vehicle Demonstration Program. CHPS successfully transitioned to the Army in FY 2000 with the objective of designing, maturing and testing a robust ground vehicle electrical power architecture in a Systems Integration Laboratory (SIL) that will support the FCS program. FCS Engine develops prime power for combat vehicles with a goal to double the power density (horsepower per cubic foot) of a comparable, state-of-the-art, commercial engine. Other efforts funded in this project focus on developing components to meet unique military requirements for mobility, including: need for a stable ride at high speeds (above 20 miles per hour) over cross country terrain for weapon targeting on the move; need to provide crew comfort and endurance for maneuver-dominant warfare, the need for compact and light vehicle systems to reduce vulnerability of detection, acquisition and attack by enemy weapons, enhanced deployability and reduced logistics burden (e.g., fuel); the need to protect vehicle subsystems under armor (e.g., complicates design of air intake and exhaust systems). Government partners include: Army Research Laboratory (ARL), Aberdeen Proving Ground, MD; Waterways Experiment Station, Vicksburg, MS; Army Research Laboratory, Adelphi, MD. Major contractors include: General Dynamics Land Systems Muskegon Operations, Muskegon, MI; Pentastar, Huntsville, AL; SAIC, San Diego, CA; United Defense Limited Partnership, San Jose, CA; Michigan Technological University, Houghton, MI; General Electric, Schenectady, NY; and Cadillac Gage Textron, New Orleans, LA; Northrop Grumman, Los Angeles, CA. This program supports the Objective Force transition path of the TCP.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

441

FY 2001 Accomplishments:

- 2706 - Installed compressible fluid strut suspension system on a wheeled vehicle to test for increased mobility and speed over cross country terrain.
 - Determined differential torque steer dynamic model from physical test and establish control requirements.
 - Completed design of advanced high efficiency mechanical transmission enabling reduced vehicular fuel consumption and increased transmission power density.
 - Modified combat vehicle band track for mine resistance.
- 2840 - Projected system level and component level power requirements for FCS within hybrid electric architecture.
 - Built and tested pulse forming networks for electro-thermal-chemical gun and electromagnetic armor for FCS.
 - Conducted repetitive ETC gun simulator.
- 1621 - Tested advanced components (e.g., flywheel, high temperature/fast response converters and advanced high energy density batteries) for performance assessment in CHPS Systems Integration Laboratory (SIL).

Total 7167

FY 2002 Planned Program

- 4732 - Test advanced components of CHPS hardware on a mobility test bed to demonstrate robustness and fuel efficiency for combat vehicles.
 - Incorporate new system level and component level vehicle power requirements based on results of CHPS SIL testing and FCS contractor concept designs.
 - Incorporate and evaluate advanced componentry design and integrate into SIL-based vehicular architecture reflecting potential FCS configuration.
 - Complete and issue initial version of hybrid electric design guide and virtual prototyping modeling tool.
- 9871 - Establish demonstration program of at least two competing high power density diesel engines to meet FCS power, size, and weight constraints with a goal of twice the horsepower at 1/2 the weight and volume.

Total 14603

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

441

FY 2003 Planned Program

- 6210 - Demonstrate state-of-the-art combat vehicle high power, control methodology, and hybrid-electric architecture that will be available for FCS.
 - Configure CHPS SIL with FCS contractor hybrid electric breadboard systems and test.
 - Develop and modify hybrid electric architecture to accommodate directed energy weapons.
 - Fabricate an advanced component level design for future testing in a vehicular architecture reflecting an FCS-like configuration.
 - FCS system level prototype componentry incorporation into architecture and prep for CHPS SIL reconfiguration.
- 7000 - Continue development of high power and high temperature components for hybrid electric propulsion for FCS.
- 11000 - Demonstrate performance benefits of hybrid electric propulsion with both real and simulated combat vehicles; identify and implement solutions to vehicle integration issues to assure availability of a compact propulsion system for FCS mobility platforms.
- 15000 - Demonstrate at least two competing high power density engines to meet FCS power, size, and weight constraints with a goal of twice the horsepower per cubic foot of total propulsion installation volume.

Total 39210

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603005A - Combat Vehicle and Automotive Advanced Technology	PROJECT 497
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
497 COMBAT VEHICLE ELECTRO	2916	5567	6334	5955	68	13267	13342

A. Mission Description and Budget Item Justification: This project provides key enabling technologies for transforming the Army to the rapidly deployable Objective Force. Work conducted matures intra-vehicle electronics hardware and software technologies that will yield increased crew efficiencies/performance or reduced crew size; demonstrates these technologies; and advances open system architectures for ground vehicle weapon systems. Current efforts leverage semi-autonomous robotics technologies (e.g., automated driving) for application to manned systems. A FY 2004 vehicle demonstration is planned to prove the ability of a UGV to perform crew functions associated with fighting, performing reconnaissance and carrying troops for a two-man crew vehicle. Goals include a 30% reduction in software cost, a 10 times increase in architecture throughput, and full mission rehearsal via embedded simulation that will be relevant to the FCS. Major contract efforts will include: DCS Corp, Alexandria, VA; Oasis, Troy, MI; and RST, Westminster, MD. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 2916 - Conducted field experiments of indirect vision technology, an enabling technology to reduce size and increase survivability in combat vehicles.
- Conducted vehicle test bed data reduction and analysis; identified lessons learned for application to reduced volume crew stations to meet FCS deployability requirements.
- Designed advanced architecture for reduced volume crew stations, incorporating semiautonomous driving and embedded simulation system.
- Demonstrated conceptual FCS multi-mission crew stations for User at Mounted Maneuver Test Facility (Fort Knox, KY).

Total 2916

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

497**FY 2002 Planned Program**

- 1250 - Define semi-autonomous driving interface for integration into mobile reduced crew testbed.
- 900 - Adapt cognitive decision aids for ground systems for integration into mobile reduced crew testbed.
- 700 - Mature route planning software for integration into mobile reduced crew testbed.
- 1822 - Design and integrate Systems Integration Laboratory (SIL) to enable early evaluation of advanced crew station, electronics architecture and embedded simulation technologies by FCS contractors in FY03.
- 895 - Implement testbed architecture in SIL.

Total 5567

FY 2003 Planned Program

- 1492 - Complete SIL and conduct early evaluation of advanced crew station, electronics architecture and embedded simulation technologies for FCS.
- 2087 - Complete cognitive decision aids and route planning software development for future integration into mobile reduced crew testbed.
- 2068 - Develop mobile test bed to allow soldier testing of advanced crew station, electronics architecture and embedded simulation technologies and for evaluation by FCS contractors.
- 687 - Develop technology to mix live and virtual imagery, enabling on-the-move embedded simulation and training.

Total 6334

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603005A - Combat Vehicle and Automotive Advanced Technology	PROJECT 515					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
515 ROBOTIC GROUND SYSTEMS	1694	9219	8873	22514	14939	5092	5191

A. Mission Description and Budget Item Justification: This project provides near-term unmanned ground system technologies to support the FCS program and the Objective Force. The project funds technological maturation and demonstration of unmanned follower vehicle technologies required for multiple tactical and logistics applications. Efforts demonstrate technologies required for unmanned ground vehicle (UGV) systems to move autonomously over terrain at militarily significant speeds, mature the technologies for transition to FCS, and conduct system-of-systems field experimentation to allow warfighters and FCS contractor(s) to evaluate these technologies. The main effort funded in this project is the Robotic Follower ATD. In addition the project funds development of advanced technologies needed to improve flexibility and utility of UGVs, decrease the frequency of human intervention/direct control, and implement a robotic leader initiative for potential future applications (e.g. scout/reconnaissance missions.) Technologies proven in robotic demonstrations are expected to be transferable to other unmanned platforms as well as manned platforms to reduce operator workload. This project was established by the Army in recognition of the increasing maturity of robotics technology, growing User interest in unmanned platforms, and an urgent need to make the force lighter, more agile strategically and tactically and more survivable. The Army's approach builds upon previous and ongoing investments, such as the Demo III program, conducted under the Joint Robotics Program Office. The work is primarily conducted by U.S. Army Research Laboratory (ARL), Aberdeen Proving Grounds, MD Major contractors include: GDLS, Sterling Heights, MI; DCS Corp, Alexandria, VA; and GDRS, Westminister, MD. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 1694 - Completed analysis of leader/follower robotics technologies and supporting operational concepts for initial unmanned system capabilities for FCS.
- Identified standard architecture for intelligent control of baseline unmanned system demonstrators.
- Identified existing and required modeling and simulation capabilities and requirements to support robotics technology development and testing.

Total 1694

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

515

FY 2002 Planned Program

- 529 - Model sensors, representative terrain and ARL autonomous mobility algorithms.
- 500 - Complete development of intelligent control architecture.
- 950 - Implement Demo III autonomous mobility algorithms as baseline.
- 900 - Design unmanned follower control interface for manned lead vehicle.
- 1421 - Perform system integration for field demonstration to prove Technology Readiness Level (TRL) 5.
- 419 - Model robotic follower capability for logistics and Net Fires.
- 1400 - Implement robust follower asset TRL 6 experiments.
- 2200 - Evaluate algorithms for line-of-sight (LOS), high speed, on-road convoying for logistics convoy to demonstrate TRL 6.
- 900 - Assess algorithms for low speed, all terrain, robotic mule with advanced autonomous perception for low-speed, off-road mounted or dismounted following to demonstrate TRL 6.

Total 9219

FY 2003 Planned Program

- 500 - Conduct chassis evaluation and select demonstration system with mobility characteristics that are relevant to FCS.
- 1250 - Perform field demonstration for FCS contractors to prove TRL 5.
- 2823 - Complete autonomous mobility design, purchase and integrate sensors.
- 900 - Implement intelligent control architecture in testbed vehicles.
- 1700 - Integrate ARL autonomous mobility algorithms.
- 500 - Demonstrate TRL 6 using modeling and simulation in conjunction with FCS contractor platforms.
- 1200 - Mature autonomous mobility software for transition to FCS contractors.

Total 8873

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603005A - Combat Vehicle and Automotive Advanced Technology	PROJECT 53G
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
53G FUTURE COMBAT SYSTEMS (FCS)	0	110587	125147	116112	113194	0	0

A. Mission Description and Budget Item Justification: This project funds the Army's share of the cost-shared Army/Defense Advanced Research Projects Agency (DARPA) collaborative Future Combat Systems (FCS) program and other FCS key component technologies. This project (53G) was established by means of a zero sum transfer of funds from project 440, starting in FY02, to provide better visibility of this high priority program. FCS is the centerpiece of the Army's strategy to achieve the Objective Force. It is a multi-functional, system of systems that will be capable across the full spectrum of operations. DARPA is the executive agent for the FCS Program; therefore the majority of the funds in this project are provided to and executed by DARPA, in accordance with the MOA (February 2000). Under terms of the MOA, the Army committed to provide the following funding for the Army/DARPA Collaborative FCS Program: \$107M (FY 2002), \$122M (FY 2003), \$114M (FY 2004) and \$111M (FY 2005). This constitutes the Army's share of funding for both the system Design/Demonstration and the DARPA enabling technologies including: Robotic Unmanned Ground Vehicle, Maneuver Command and Control Communications, Maneuver Beyond-line-of-sight (BLOS) Networked Fires Weapon, and BLOS Surveillance and Targeting Systems. This program responds to a draft Mission Needs Statement issued by the U.S. Army Training and Doctrine Command and the Army Vision. The FCS Program completes the concept design phase in FY02. In accordance with direction from Army Leadership in November, 2001, the FCS Program has been accelerated by three years, to enter System Development and Demonstration in 2003. To meet this change in schedule, the new strategy is to recompute for the next phase of the program. In February 2002, DARPA will issue one or more Section 845 agreement(s) for a Lead System Integrator. The final product will be a system of systems that will meet the Army's transformation goals to achieve First Unit Equipped in 2008, field an Initial Operational Capability in 2010 and to have a Force that is strategically and logistically superior in all aspects. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- Program funded in Project 440

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

53G

FY 2002 Planned Program

- 25000 - Army's share of Army/DARPA collaborative FCS core program for the FCS Design/Development efforts, in accordance with the MOA.
 - Perform FCS tradeoff and technology analyses; develop detailed cost, schedule, performance objectives;
 - Complete force level modeling and simulation efforts to support FCS concepts/Objective force employment and downselect decisions.
 - Complete evaluation of Army/DARPA FCS initial objective force concepts.
 - Select Army/DARPA FCS Lead Systems Integrator (LSI) to begin detailed design.
- 59000 - Army's share of the Army/DARPA FCS Enabling Technologies, in accordance with the MOA. The remainder of the Army's share for Enabling Technologies(\$20000) is funded in PE 0602601/HH7. Funding is applied to the following efforts:
 - Autonomous Navigation (Preceptor); develop detailed design of sensors and perception algorithms for autonomous vehicle designs.
 - Unmanned Ground Vehicle Program; downselect and begin detailed design of 600 Kg and 6000 Kg. unmanned ground combat vehicles.
 - Netfires; finalize missiles design and build hardware for flight test.
 - LADAR through the Canopy (Jigsaw); finalize LADAR design and begin hardware build.
- 3496 - Army Objective Force Task Force (TF); conduct analyses and program integration.
- 20091 - Perform technology integration efforts and accelerated development/ demonstration of FCS enabling technologies, for which the Army has responsibility under the MOA; matures selected lethality, survivability, mobility and communications technologies for potential transition to SDD in FY03.
- 3000 - Develop concepts and conduct Modeling and Simulation exercises in accordance with FCS MOA.

Total 110587

FY 2003 Planned Program

- 50000 - Supports Army/DARPA FCS Lead Systems Integrator detailed FCS design effort in accordance with FCS MOA.
- 72000 - Funds the Army's share of Army/DARPA FCS Enabling Technologies including:
 - Autonomous Navigation (Preceptor): Downselect to two(2) concepts and perform field tests.
 - Unmanned Ground Vehicle Program: Deliver robotic ground vehicles and perform field tests.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603005A - Combat Vehicle and Automotive
Advanced Technology**

PROJECT

53G

FY 2003 Planned Program (Continued)

- LADAR through Canopy (Jigsaw): Deliver LADAR system and perform field tests.
- 3147 - Provide Army Objective Force TF support for FCS analysis and program integration.

Total 125147

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603006A - Command, Control, Communications Advanced Technolo						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	27820	33176	4826	5236	5670	6279	6840
247 TAC C4 TECHNOLOGY INT	12313	13772	238	206	192	185	181
257 DIGITAL BATTLEFLD COMM	3703	11478	237	194	181	177	170
592 SPACE APPLICATION TECH	5075	7926	4351	4836	5297	5917	6489
59A INTELLIGENCE ANALYSIS ADVANCED TOOL SET	3845	0	0	0	0	0	0
59B BIG CROW PROGRAM OFFICE SUPPORT	2884	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced space technology applications for the Army's Objective Force. It provides Space Force Enhancement applications for intelligence, reconnaissance, surveillance, target acquisition, position/navigation, missile warning, and Space Control ground-to-space surveillance, negation and battle management capabilities. Advanced Space Force Enhancement technologies include electro-optical, infrared, multi/hyperspectral, synthetic aperture radar, ground-to-space radar, directed energy, and advanced data collection, processing and dissemination in real and near real time. Additionally, the project demonstrates, evaluates, and defines Army technical requirements for space platform/sensor systems, on orbit sensor data collection and processing, satellite tasking and direct downlink data dissemination to ground/air systems. The project develops algorithms that optimally process space sensor data in real and near real time for integration into battlefield operating systems. This project provides Space Control advanced technology risk reduction capability for ground-to-space surveillance and space object negation (disrupt, degrade, deny and destroy) systems development. Additionally, the project provides an advanced space technology base for the space and missile defense battlelab. This program supports the Objective Force transition path of the TCP. This program is designated as a DoD Space Program. Funding for non-space related programs was realigned to PE 0603008 starting in FY03.

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603006A - Command, Control, Communications Advanced Technolo

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	28243	31865	22988
Appropriated Value	28505	33465	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-289	0
b. SBIR / STTR	-754	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	331	0	0
e. Rescissions	-262	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	-18162
Current Budget Submit (FY 2003 PB)	27820	33176	4826

Change Summary Explanation:

Significant Changes:

FY03 (-\$18162) - Reduced due to realignment of non-space related projects to Program Element 0603008.

FY02 - Congressional adds were made for Battlefield Ordnance Awareness, Project 592 (\$2800); and Network Environment for C3 Mobile Services, Project 257 (\$2800).

Projects With No R-2A

Project 247 (FY02 Funding = \$13772) - The objective of this project is to mature network and communications technology options for the Objective Force. FY03-07 funding will realign into Program Element 0603008, Project TR1.

Project 257 (FY02 Funding = \$11478) - The objective of this project is to provide the Army's Objective Force with communications capability that supports dispersed wireless elements in diverse complex terrain. FY03-07 funding will realign into Program Element 0603008, Project TR2.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603006A - Command, Control, Communications Advanced Technolo	PROJECT 592
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
592 SPACE APPLICATION TECH	5075	7926	4351	4836	5297	5917	6489

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced space technology applications for the Army's Objective Force. It provides Space Force Enhancement applications for intelligence, reconnaissance, surveillance, target acquisition, position/navigation, missile warning, and Space Control ground-to-space surveillance, negation and battle management capabilities. Advanced Space Force Enhancement technologies include electro-optical, infrared, multi/hyperspectral, synthetic aperture radar, ground-to-space radar, directed energy, and advanced data collection, processing and dissemination in real and near real time. Additionally, the project demonstrates, evaluates, and defines Army technical requirements for space platform/sensor systems, on orbit sensor data collection and processing, satellite tasking and direct downlink data dissemination to ground/air systems. The project develops algorithms that optimally process space sensor data in real and near real time for integration into battlefield operating systems. This project provides Space Control advanced technology risk reduction capability for ground-to-space surveillance and space object negation (disrupt, degrade, deny and destroy) systems development. Additionally, the project provides an advanced space technology base for the space and missile defense battlelab. This program supports the Objective Force transition path of the TCP. This program is designated as a DoD Space Program.

FY 2001 Accomplishments:

- 986 - Demonstrated Overhead Sensor on board, near-real time, spectral/polarization data processing, and hyperspectral spatial and temporal signature processing with sensor in tower tests.
- 3032 - Completed Battlefield Ordnance Awareness infrared signature database development.
- Demonstrated algorithms for near real time processing of ordnance events in airborne tests.
- Developed initial set of Army technical ordnance reporting requirements for integration in intelligence, fire support and DoD space based infrared systems.
- 1057 - Completed Space Surveillance threat database development and evaluated potential image correlation process algorithms for technology demonstration.

Total 5075

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603006A - Command, Control, Communications
Advanced Technolo**

PROJECT

592**FY 2002 Planned Program**

- 1118 - Field test an integrated Overhead Sensor on an aerial platform and measure performance against camouflaged and concealed tactical targets.

- Assess performance of Long Wave Infrared/ Acoustic-Optical Turable Filter (LWIR /AOTF) and focal plane array; define LWIR hyperspectral sensor design for aerospace test platforms.
- 3771 - Complete Battlefield Ordnance Awareness (BOA) technical requirements definition and provide to DoD space based infrared system developers.

- Transition advanced infrared and data processing algorithms to intelligence and fire support systems developers with Proof of Principle Operational Field Test.
- 3037 - Mature formal Space Surveillance software coding of algorithms, user interface design and demonstrate threat assessment techniques on ground-to-space surveillance radar.

Total 7926

FY 2003 Planned Program

- 1465 - Integrate Overhead Sensor advanced LWIR hyperspectral technologies into an air platform for demonstration.
- 2886 - Complete Space Surveillance radar hardware/software integration and demonstrate near real time threat assessment in an integrated laboratory environment.

Total 4351

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603007A - Manpower, Personnel and Training Advanced Technolo						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	6844	3093	3527	8391	9698	4417	4632
792 PERSONNEL PERFORMANCE & TRAINING	4921	3093	3527	8391	9698	4417	4632
79A ARMY TRAINING SUPPORT CENTER	1923	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element (PE) is to develop and demonstrate advanced soldier-oriented technologies to enhance soldier and unit performance in the Army's transformation to the Objective Force. A key goal of this program is the reduction of training and other personnel costs through the development of effective training strategies that incorporate appropriate mixes of live, virtual, and constructive simulations. Research and development (R&D) efforts include designing new ways to efficiently develop collective training; developing and demonstrating prototype training methods and programs that improve mission performance; devising training strategies using distributed training technology to conduct multi-site training, assessment, and feedback; and evaluating the effectiveness of compressed gunnery training strategies for the Reserve Component. R&D will also design innovative methods and technologies to develop effective leaders for small team operations and for developing Battle Commanders for the digitized battlefield. Work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This PE is managed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603007A - Manpower, Personnel and Training Advanced Technolo

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	7008	3120	3153
Appropriated Value	7072	3120	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-27	0
b. SBIR / STTR	-163	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-65	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	374
Current Budget Submit (FY 2003 PB)	6844	3093	3527

Change Summary Explanation:

FY03 (+\$374) - This Program Element increased due to expanded participation in virtual simulation experiments to determine the feasibility of selected techniques and tools for training future forces in support of the Army Transformation to the Objective Force.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603007A - Manpower, Personnel and Training Advanced Technolo	PROJECT 792					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
792 PERSONNEL PERFORMANCE & TRAINING	4921	3093	3527	8391	9698	4417	4632

A. Mission Description and Budget Item Justification: The objective of this program element(PE) is to develop and demonstrate advanced soldier-oriented technologies to enhance soldier and unit performance in the Army's transformation to the Objective Force. A key goal of this program is the reduction of training and other personnel costs through the development of effective training strategies that incorporate appropriate mixes of live, virtual, and constructive simulations. Research and development (R&D) efforts include designing new ways to efficiently develop collective training; developing and demonstrating prototype training methods and programs that improve mission performance; devising training strategies using distributed training technology to conduct multi-site training, assessment, and feedback; and evaluating the effectiveness of compressed gunnery training strategies for the Reserve Component. R&D will also design innovative methods and technologies to develop effective leaders for small team operations and for developing Battle Commanders for the digitized battlefield. Work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This PE is managed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2992 - Developed and demonstrated new training and performance assessment technologies that prepare operators and commanders to take advantage of evolving digital systems.
 - Conducted annual assessment of Army command climate, identifying trends and new issues of concern to soldiers.
 - Provided guidelines for integrating a question-asking technique (to stimulate thinking) into distance learning courses.
 - Developed preliminary guidelines for use by the U.S. Army Intelligence School to train cognitive skills and declarative/factual knowledge using distributed learning technologies.
- 1929 - Continued the development and demonstration of an aircrew coordination training program.
 - Developed a Laser Marksmanship Training System for predicting USAR pistol marksmanship qualification, to help maximize training resource efficiency in the Reserve Component.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603007A - Manpower, Personnel and Training
Advanced Technolo**

PROJECT

792

FY 2001 Accomplishments: (Continued)

- Transferred methods and products developed with Special Forces soldiers (e.g., personal discipline and adaptability assessment tools) to conventional Army sites.

Total 4921

FY 2002 Planned Program

- 3093 - Plan the computer automation of certain instructor functions in collaborative learning environments.
- Evaluate the training of digital procedures for soldiers through distributed learning over the Internet.
- Conduct annual assessment of Army command climate and trends over time, and identify new issues of concern to soldiers.
- Determine key training requirements and determine the relevance of selected training techniques and tools for future forces.
- Identify the training/coaching strategies and mentoring processes effective leaders use to develop individuals in team contexts.
- Complete development and evaluation of new technologies for training Army Aircrew Coordination.
- Develop worldwide web interactive reference tool to help AC and RC unit leaders deal with operational and cultural differences in multi-component units.

- Design and develop a prototype web-based anonymous reporting system for aviation incidents.

Total 3093

FY 2003 Planned Program

- 3527 - Generate guidelines and techniques for the Army's training of cognitive and digital skills for soldier-centered training in collaborative environments.
- Participate in virtual simulation experiments to determine feasibility of selected techniques and tools for training future forces.
- Conduct annual assessment of Army command climate and trends over time, and identify new issues of concern to soldiers.
- Develop and pre-test scenarios and role plays designed to help leaders assess, train, and develop team members.
- Determine required frequency for device- and live-fire-based qualification firing to maximize small arms marksmanship proficiency.

Total 3527

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603008A - Electronic Warfare Advanced Technology

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	0	0	28254	21729	20689	22083	23156
TR1 TAC C4 TECHNOLOGY INT	0	0	14823	15288	14747	15077	15955
TR2 DIGITAL BATTLEFLD COMM	0	0	13431	6441	5942	7006	7201

A. Mission Description and Budget Item Justification: The goal of this program element (PE) is to provide the Army's Objective Force with distributed, mobile, secure, self organizing communications networks. It will demonstrate the capability to seamlessly integrate command, control, communications (C3) and, networking technologies across all layers, including unattended systems and sensor layers, maneuver layers and space layers. Commercial communication technologies will be investigated and leveraged, wherever possible. The Multifunctional On -the-Move (OTM) Secure Adaptive Integrated Communications (MOSAIC) Advanced Technology Demonstration (ATD) will provide the communications technology foundation that seamlessly and automatically supports secure, high volume, multimedia traffic in a dispersed OTM network. It provides protection technologies for tactical networked systems against modern network attacks. Smart sensor networking technologies will provide the ability to network and control unmanned systems anywhere on the battlefield, providing a timely sensor-decider-engagement linkage to defeat critical targets. Advanced antenna technologies will provide the Objective Force and Joint Tactical Radio System (JTRS) with greater communications mobility, range and throughput. This program also tests and evaluates networked radio, common user, advanced antenna concepts, and distributed communications equipment and automated network management aids, in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the other services. The cited work is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. Work in this program element is related to, and fully coordinated with, efforts in PE 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. The PE contains no duplication with any effort within the Military Departments. Work is performed by the US Army Communications-Electronics Command, Fort Monmouth, NJ. This program supports the Objective Force transition path of the Army Transformation Campaign Plan (TCP). THIS IS NOT A NEW START IN FY03. PLEASE REFERENCE PROGRAM ELEMENT 0603006 (Space Applications Technology) FOR INFORMATION REGARDING THIS EFFORT IN FY02. Per OSD direction, existing PE 0603006 was designated as a Space Related PE. All non-space related funding in that PE was realigned to this PE starting in FY03.

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603008A - Electronic Warfare Advanced Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
President's Previous Budget (FY 2002 PB)	0	0	0
Appropriated Value	0	0	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	0	0
b. SBIR / STTR	0	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	0	0	0
Adjustments to Budget Years Since (FY 2001/2002 PB)	0	0	0
BES Adjustments Since FY 2002 PB	0	0	28254
Current Budget Submit (FY 2003 PB)	0	0	28254

Change Summary Explanation:

FY03 (+\$28254) - Project TR1 (+\$14823) and Project TR2 (+\$13431) restructured from Program Element 0603006 (Projects 247 and 257). THIS IS NOT A NEW START IN FY03. PLEASE REFERENCE PROGRAM ELEMENT 0603006 (Space Applications Technology) FOR INFORMATION REGARDING THIS EFFORT IN FY02.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603008A - Electronic Warfare Advanced Technology	PROJECT TR1					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
TR1 TAC C4 TECHNOLOGY INT	0	0	14823	15288	14747	15077	15955

A. Mission Description and Budget Item Justification: This project matures communications and networking technology for the Objective Force. Commercial technologies will be leveraged where applicable to support mission planning and battlefield decision making, execution and targeting. This project includes the MOSAIC ATD, which seamlessly and automatically will support secure, high volume, multimedia traffic for OTM operations required for the Objective Force. The MOSAIC ATD will mature and demonstrate the core self-organizing, ad hoc, mobile network capability. It will use an open architecture approach, via application program interfaces, to enable integration of other capabilities and technologies. It also will demonstrate the integration of the basic maneuver layer to all other layers. In addition, this project includes protection technologies for tactical networks, C2 information systems, and components and data against modern network attacks. This project advances OTM satellite communications (SATCOM) technology, with the reachback communications capability required to reduce the number of personnel deployed into a theater of operations. Additionally, this project is maturing technologies that are required for the Objective Force and JTRS, to include open system design techniques for wideband networking. Finally, the project matures a family of highly efficient, cost effective antennas and subordinate products covering the 30 MHz to 44 GHz frequency range. This program supports the Objective Force transition path of the TCP.

FY 2003 Planned Program

- 2404 - Mature and demonstrate advanced tactical PKI, mobile code authentication, ad hoc network access controls and synchronized security management.
- 2348 - Complete development and testing of JTRS OTM multiband ground vehicle antenna and mature the JTRS OTM multiband airborne antenna prototype
 - Evolve coding protocols and modems for narrowband protected mode SATCOM OTM.
- 10071 - Enhance and modify MOSAIC communications and networking protocols (based on results of modeling and simulation and limited field test) to support increased mobility of horizontal and vertical hand-off for optimal network operations.
 - Enhance and modify MOSAIC communications and networking protocols to support increased mobility of internet protocol (IP) quality of service (QoS) and ad-hoc networking to support self-initialization, adaptive, mobile networks, bandwidth management, and security solutions.
 - Integrate enhanced mobile protocols.
 - Test and evaluate enhanced mobile protocols in a laboratory environment.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603008A - Electronic Warfare Advanced
Technology**

PROJECT

TR1

FY 2003 Planned Program (Continued)

- Integrate communication protocols with Agile Commander ATD applications to improve bandwidth utilization in preparation for a joint final demonstration in FY 2004.

Total 14823

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603008A - Electronic Warfare Advanced Technology	PROJECT TR2					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
TR2 DIGITAL BATTLEFLD COMM	0	0	13431	6441	5942	7006	7201

A. Mission Description and Budget Item Justification: This Project jointly funds, with project TR1, the MOSAIC ATD. The goal of the MOSAIC ATD is to provide the Army's Objective Force with a networked communications capability that supports dispersed wireless elements in diverse, complex terrain. Multiple wireless transmission facilities provide the user flexibility to traverse varied terrain over wide areas, improving system robustness and reducing vulnerability. The overall system will provide a scaleable capability offering the user the best wireless communications system available based on current operating conditions. To provide this highly reliable mobile infrastructure; the communications assets will seamlessly assign bandwidth as a function of range and network conditions. In addition, routing protocols will be automatically reconfigured without operator intervention. Airborne communications payloads will provide a networked, beyond-line-of-sight capability, which allows maneuver elements to be dispersed in excess of 15 km to support split-based, early entry operations associated with the Objective Force. The ability to seamlessly and automatically support OTM, multimedia traffic and sensor data over variable range and bandwidth transmission systems will also be demonstrated. The communications system will dynamically operate over several different transmission systems, including a wireless local area network (LAN), packet radio, wideband cellular radio, unmanned aerial vehicles (UAVs), and satellites. Protection technologies for tactical networks and C2 information systems will be matured and demonstrated. This project also includes the sensor communications networking portion of the Networked Sensors for the Objective Force (NSOF) ATD, providing the ability to task unmanned sensors and transport data and images to data fusion points. A variety of efforts will be leveraged, including the DARPA Small Unit Operations (SUO) and Sensor Information Technology (SensIT) programs as well as technologies developed by the Army Research Laboratory (ARL). This program supports the Objective Force transition path of the TCP.

FY 2003 Planned Program

- 4704 - Apply security architecture approach to link and network layer technologies.
 - Complete modeling and simulation evaluation for scalability of network protocols to larger networks.
 - Integrate low overhead network management tools to provide dynamic network control.
 - Integrate OTM satellite communications and sensor networking technologies.
 - Coordinate with DARPA Future Combat Systems (FCS) Communications program to ensure compatible, integrable communication technologies.

- 8000 - Mature and demonstrate advanced C2 OTM capability.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603008A - Electronic Warfare Advanced
Technology**

PROJECT

TR2

FY 2003 Planned Program (Continued)

- 727 - Refine protocols to optimize network performance.
- Extend unattended sensor communications requirements analysis to munitions and robotics.

Total 13431

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603105A - MILITARY HIV RESEARCH					PROJECT H29		
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	
H29 MED PROTECT AGNST HIV	5661	5885	0	0	0	0	0	

A. Mission Description and Budget Item Justification: This project supports the medical technology area of the Objective Force by conducting concept exploration of candidate vaccines to include safety and efficacy in model systems to prepare and conduct clinical studies. It funds Acquired Immune Deficiency Syndrome (AIDS) research to control the infection in military environments, protect the military blood supply, and protect military personnel from risks associated with infection. AIDS research is focused on the following areas: diagnosis, natural history, epidemiology, and vaccine development. Preclinical trials and phase 1, 2, and 3 clinical trials are performed as required for drug and vaccine licensure with US Food and Drug Administration. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Major contractor is the Henry M. Jackson Foundation, Rockville MD. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 5661 - Conducted clinical studies of HIV drug resistance for the management of HIV infection in military service members and other military health-care beneficiaries.
- Conducted phase 1 and 2 clinical trials of candidate vaccines and novel vaccine delivery systems to test their safety and their ability to produce an immune response.
- Prepared for phase 1 study of a live virally-delivered candidate HIV vaccine in Uganda.

Total 5661

FY 2002 Planned Program

- 5885 - Define HIV virus and immune system factors that are associated with immunity.
- Produce clinical-grade quantities of a candidate DNA vaccine against HIV serotype D and virally-vectored vaccines against HIV serotypes D and E, which are found outside the United States and therefore important in deployed military infections.
- Conduct pre-clinical studies of candidate HIV vaccines in animal models to determine safety and efficacy for producing an immune response before studies are begun in humans.
- Develop HIV vaccine cohorts for future field trials in Kenya and Tanzania.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603105A - MILITARY HIV RESEARCH	PROJECT H29
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FY 2002 Planned Program (Continued)

- Conduct a multi-center clinical study to investigate HIV drug resistance.
- Conduct a phase 1 study of a live virally delivered candidate HIV vaccine in Uganda.

Total 5885

FY 2003 Planned Program

Program transferred to the National Institutes of Health.

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	5834	5937	6073
Appropriated Value	5889	5937	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-52	0
b. SBIR / STTR	-174	0	0
c. Omnibus or Other Above Threshold Adjustments	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-54	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	-6073
Current Budget Submit (FY 2003 PB)	5661	5885	0

Change Summary Explanation: Funding: FY 2003 - Program responsibility for management and oversight of HIV R&D efforts have been transferred to the National Institutes of Health (NIH).

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603238A - Global Surveillance/Air Defense/Precision Strike T	PROJECT 177					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
177 JT ALS PS DEMO	20997	31986	31291	12930	12730	12920	13269

A. Mission Description and Budget Item Justification: Joint Precision Strike Demonstration's (JPSD) mission is to integrate innovative Operational Concepts and Tactics Techniques and Procedures (TTPs) with emerging technologies to significantly improve OSD/Army's Precision Strike (PS) capabilities. JPSD horizontally integrates state of the art software applications and tools across the Joint Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) seams to optimize sensor to shooter operations and solve critical joint problems.

The Integration and Evaluation Center (IEC) combines live and simulated entities into a joint virtual battlefield testbed for designing, conducting, assessing, and evaluating systems designs, and experiments to identify and quantify solutions for joint C4ISR and system solutions. The IEC is the foundation for JPSD's Simulation Based Acquisition evaluations and is the basis for developing the Joint Virtual Battlespace (JVB).

Joint Virtual Battlespace facilitates the assessments needed for the smart and timely acquisition decisions on the Future Combat System (FCS) and Objective Force (OF), while assessing the operational impact of concepts in a joint environment. JVB integrates existing models, creating a joint battlespace, which can be used to evaluate and determine the synergy of system-of-systems designs as compared to individual component systems. No other tool is available in the Army to do this operational, constructive and virtual, analysis support. The JVB includes many facets of the battlespace, such as terrain interactions, weather effects, mobility, networked sensors, human workload, joint forces, man-in-the-loop and robotics. This work contains no known duplication with any effort within the Military Departments. The Director, Joint Precision Strike Demonstration (JPSD) Project Office at Fort Belvoir, VA, executes this project for Program Manager FCS.

The Theater Precision Strike Operations (TPSO) Advanced Concept Technology Demonstration (ACTD) by use of state of the art software applications/tools provides the Commander in Chief, United Nations Command (CINCUNC) Korea with a significantly enhanced Theater wide capability to plan and conduct Counterfire, Precision Strike Engagements and Joint Battlespace Management. TPSO has also provided software applications for the CINC and his component commanders to perform a Near-Real-Time Counter Force (CF) Common Relevant Operational Picture (CROP).

The Joint Intelligence, Surveillance and Reconnaissance (JISR) ACTD is implementing a tactical networked sensor grid, using internet web based technologies, to horizontally integrate tactical and operational level ISR information from existing stove-piped legacy Service and joint C4ISR systems for CENTCOM (ARCENT and 1st MEF). JISR also integrates nontraditional tactical sensors (i.e., Firefinder radar and unattended ground sensors) into an ISR picture which allows the Early Entry Force (EEF) Commander and his higher headquarters to access and geospatially visualize all available ISR information using any workstation equipped with a browser.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603238A - Global Surveillance/Air
Defense/Precision Strike T**

PROJECT

177

The Joint Continuous Strike Environment (JCSE) ACTD provides the Combined/Joint Task Force (CJTF) with the capability to execute time critical targeting with four software modules (target prioritization; continuous weapons availability monitoring, optimized weapon-target pairing and dynamic airspace deconfliction).

The Joint Precision Strike Demonstration is a member of the Program Executive Office, Intelligence, Electronic Warfare, and Sensors (PEO -IEW&S), Fort Monmouth, NJ. The Prime contractor for the TPSO and JISR ACTDs and JVB is Raytheon Company, Bedford, MA. For the JCSE ACTD the prime contractor is General Dynamics - Information Systems, Arlington, VA. This program supports the Objective Force through the use of new technology insertions and the use of Simulation and Modeling for Acquisition, Requirements and Training (SMART) for the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 20295 TPSO - Participated in CINCUNC and Joint warfighting exercises, including RSO&I, UFL-01, Lucky Sentinel, Victory Focus, Urgent Victory, MEFEX, FBE-I, Unified Endeavor, and Roving Sands to refine TTPs and expand the Joint Warfighting Applications.
 - Planned and executed a simulation/stimulated demonstration, which included aspects of a scenario representative of the transition from an unreinforced Korean Theater to a reinforced Korean Theater. Both ROK and U.S. forces participated in a Man-In-The-Loop (MITL) fashion both in the Ground Component Commander Deep Operations Coordination Center (GCC DOCC) and at the other critical C2 nodes. Operated the objective, residual capability candidate systems developed during the TPSO ACTD in a realistic warfighting environment.
 - Conducted rapid software prototyping operations at the JPSD IEC to support training, upgrades and field support to major field exercises (RSO&I, UFL01, Lucky Sentinel, MEFEX, FBE-I, JEFX).
 - Conducted technical reviews and assessed the warfighting value added for Joint Software Application Tools provided to the theater and determined which software application tools exhibited sufficient maturity and capability to warrant qualification as an ACTD "Leave Behind".
 - Developed and implemented transition and sustainment plans to support the "Leave Behind" Systems for TPSO during the transition period(FY02-03), including a Battlespace Visualization system in the GCC DOCC. Provided hardware system upgrades; training support packages; in-country support technical team and 200+ Joint Warfighting Applications (JWAs) with some hosted on GCCS-K.
- 702 JCSE - Continued to evaluate and validate the value added of JCSE system integration in laboratory tests and with Joint Battle Center evaluations
 - Continued integration of JCSE into the Joint Targeting Toolbox (JTT) with a goal for JCSE to transition to the JTT Program Office.
 - Provided upgrades to the users software builds 4; participated in a number of Joint exercises, including ULCHI FOCUS LENS (UFL) 01.

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced technology development

**0603238A - Global Surveillance/Air
Defense/Precision Strike T**

177

FY 2001 Accomplishments: (Continued)

-Installed JCSE Version 4.x software modules at 7th Air Force for UFL01; on the USS Coronado for Fleet Battle Experiment-JULIET (FBE-I) and in the Combined Air Operations Center-Experimental (CAOC-X) at Langley AFB, VA.

Total 20997

FY 2002 Planned Program

- 13291 -TPSO-Participate in CINCUNC warfighting exercises to refine, enhance, and expand the functionality successfully demonstrated during TPSO ACTD's FY01 demonstration.

-Support the planned major CINCUNC exercises in the Korean Theater, providing refined, expanded, and enhanced JWA functionality to the Combined Forces Command's (CFC) Combined Effects Synchronization Cell (CESC), the 7th AF and 7th Fleet.

-Support Joint Exercises and related activities, including Millennium Challenge 02 and associated spirals, Navy Fleet Battle Experiment-JULIET, and Air Forces activities Joint Expeditionary Force Experiment (JEFX) and combined Air Operations Center-Experimental (CAOC-X).

-Conduct rapid software prototyping operations at the JPSD IEC to support training, upgrades and field support to major field exercises (RSO&I, UFL 02; Lucky Sentinel, MC02, MEFEX, FBE-J; JEFX).

-Continue to transition and sustain the Joint Warfighting Applications (JWA) in CINCUNC warfighter units.

-Continue to transition and sustain JWA applications in CENTCOM and its component ARFOR (3rd Army)and USAREUR'S (US V Corps) units and ~~XVIII AB~~ Prepare for the final transition and sustainment plans to support the TPSO "Leave Behind" Systems during the transition period (FY 02-03), including a Battlespace Visualization system in the CFC CESC; upgrade software applications; provision of training support packages; and in-country support technical team for 200+ JWAs with some hosted on GCCS-K.
- 1672 JISR - Migrate JISR ACTD prototype towards an objective architecture that allows for greater and more rapid enhancements to system functionality and integration of ISR data sources.

-Refine and enhance JISR interfaces to source systems based upon user defined TTP/CONOPS from the following exercises: Lucky Sentinel 02, MEFEX 02, Ulchi Focus Lens 02.

-Select, integrate and conduct end-to-end demonstration of non-traditional sensor feed(s) - 1 Army, 1 USMC.

-Support JISR participation in additional user stakeholders designated exercises and other complementary demonstration venues.

-Integrate field deployed JISR prototypes into garrison operations.

-Plan and execute formal assessments by Joint Inter-operability Test Center (JITC) and Joint C4ISR Battle Center (JBC) - with a to-be- determined warfighters assessment by CENTCOM (ARCENT and 1stMEF).

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced technology development

**0603238A - Global Surveillance/Air
Defense/Precision Strike T**

177

FY 2002 Planned Program (Continued)

- 725 -Identify and coordinate for Army brigade participation in late FY 02/03.
JCSE - Continue to upgrade, integrate and transition Joint Continuous Strike Environment (JCSE) software applications into the JTT program of record.
- 16298 -Demonstrate in Fleet Battle Experiment-JULIET(FBE-J) and UFL 02.
JVB - Integrate dynamic environment, NBC component simulations and CONOPS/tactics into the JVB framework.
-Integrate Joint Force-on-Force models with component simulations in the JVB framework.
-Incorporate initial FCS contractor concepts/models in JVB.
-Conduct virtual force-on-force experiments and provide data and results to the analysis community to support initial operational evaluations.
-Integrate model federation from the Research, Development and Engineering Center community.
-Incorporate additional models from the Department of Energy and other government agencies.
-Provide data on Network Centric Warfare and FCS survivability to Army analysts and the acquisition community.

Total 31986

FY 2003 Planned Program

- 19056 TPSO - Participate in CINCUNC warfighting exercises to refine, enhance, and expand the functionality demonstrated during FY01 Demonstrations, and enhanced during FY02.
-Support planned major CINCUNC exercises in the Korean Theater, providing refined, expanded, and enhanced Joint Warfighter Applications support to the CFC CESC, 7th AF and 7th Fleet.
-Conduct rapid prototyping operations at the JPSPD IEC to support training, upgrades and field support to major field exercises (RO&I, UFL 02, Lucky Sentinel, MC02, MEFEX, FBE-J, JEFX).
-Upgrade Joint Warfighting Applications in CENTCOM ARFOR (3rd Army) and USAREUR (US V Corps)units.
-Upgrade Joint Warfighter Applications into CINCUNC combat forces.
-Execute transition and sustainment plans to support the TPSO "Leave Behind" Systems during the final year of transition (FY03).
- 5049 JISR - Continue to evolve the objective architecture that allows for greater and more rapid enhancements to systems functionality and integration of ISR sources.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603238A - Global Surveillance/Air Defense/Precision Strike T	PROJECT 177
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FY 2003 Planned Program (Continued)

- Refine and enhance JISR interfaces to source systems based upon user defined TTP/CONOPS from the following exercises: Lucky Sentinel 03, MEFEX 03, and Ulchi Focus Lens 03.
- Continue to upgrade JISR objective prototype into CENTCOM (ARCENT and 1st MEF).
- Continue to plan and execute formal assessments by JITC and JBC with warfighters and other assessments by CENTCOM (ARCENT and 1stMEF).
- Identify initial leave behind capability.
- 7186 JVB - Incorporate advance behaviors into the JVB framework. Incorporate new vehicle models into JVB. Conduct experiments with new user defined operational concepts technology trades.
- Integrate contractor virtual and hardware prototypes into the JVB framework. Conduct experiments and operational analysis data of contractor final concepts in support of FCS milestone B decision.

Total 31291

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY 2002 PB)	21112	32267	22203
Appropriated Value	21307	32267	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-281	0
b. SBIR / STTR	0	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-310	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	9088
Current Budget Submit (FY 2003 PB)	20997	31986	31291

Change Summary Explanation: Funding - FY 2003: \$9088K increase to TPSO ACTD to execute transition and sustainment plans to support the TPSO "leave behind" systems during the final year of transition (FY03).

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603270A - EW TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	28825	24367	11600	10867	14556	18244	21648
K15 ADVANCED COMM ECM DEMO	5169	6526	3495	2278	5558	8953	12168
K16 NON-COMMO ECM TECH DEM	8755	7220	8105	8589	8998	9291	9480
K19 MULTIPLE INTEL REMOTED SENSOR SYSTEM - BLK 1	12017	4666	0	0	0	0	0
K20 SHORTSTOP	2884	5955	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates multi-intelligence remote sensor technologies and electronic warfare (EW) systems in support of the Army's Objective Force commanders. It addresses the need to locate, disrupt or destroy the enemy's command, control, and communications (C3) systems and infrastructure. The goal of this PE is to significantly enhance the Objective Force's conduct of offensive operations to win the information war. Both non-communications and communications applications are addressed by this PE. It also looks at communications countermeasures (CM) and communications counter-countermeasures (CCM) applications. Project K15 provides technology demonstrations in CM, information collection and reporting to transition to Army intelligence and electronic warfare (IEW) systems. This transformation will be accomplished through a phased improvement process. This project also supports demonstrations of automatic/automated fusion of intelligence, information, and data from multiple sources. Project K16 focuses on the feasibility and effectiveness of non-communications Electronic Countermeasures (ECM) and electronic support/electronic intelligence. This project provides self-protection from radar, electro-optical (EO), and infrared (IR) guided anti-aircraft artillery, surface-to-surface missiles, artillery, and top attack weapons. Further, it provides precise targeting information on non-communications emitters. Technologies developed and matured as part of this PE will be demonstrated in the integrated situation awareness (SA) and targeting advanced technology demonstration (ATD), and the integrated counter measures platform survivability effort. This work is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, Project Reliance, and the tri-service reliance agreements on EW. This system supports the Objective Force transition path of the TCP.

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603270A - EW TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
President's Budget (FY2002 PB)	30575	13868	11185
Appropriated Value	30859	24568	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-201	0
b. SBIR / STTR	-840	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-910	0	0
e. Rescissions	-284	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	415
Current Budget Submit (FY 2003 PB)	28825	24367	11600

Change Summary Explanation: Funding: FY 2002 - Congressional adds were made for Multi-functional Intelligence and Remote Sensor System, Project K19 (\$4700); and Shortstop Electronic Protection System, Project K20, (\$6000)

Projects With No R-2A:

- Project K19 (\$4700): The objective of this one-year Congressional add is to mature tactical communications, power management, sensor design, advanced processing techniques and methods of sensor delivery/emplacement for technology insertion into Multi-functional Intelligence and Remote Sensor System. No additional funding is required to complete this project.

- Project K20 (\$6000): The objective of this one year Congressional add is to perform threat analysis, architecture analysis, prototype hardware and software development, implementation, and test/evaluation to expand the Shortstop Electronic Protection System technology, capability and performance to include the selective disruption and usage denial of modern communication devices, in specific environments for specific duration. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603270A - EW TECHNOLOGY	PROJECT K15					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
K15 ADVANCED COMM ECM DEMO	5169	6526	3495	2278	5558	8953	12168

A. Mission Description and Budget Item Justification: This project improves the Objective Force's ability to conduct uninterrupted air and ground based intelligence collection and targeting operations in a hostile electromagnetic environment. Recent operations have re-enforced the necessity for timely and accurate gathering and dissemination of information and intelligence. This project provides flexible, modern systems to achieve information dominance, protect the force and shape the battlespace. It also investigates, researches, and demonstrates communications CM and CCM technologies to first intercept, identify, and locate tactical communications and then manipulate threat computer networks and their components. It demonstrates electronic attack products that have the ability to disrupt, deny, degrade or destroy computer networks and resident information/data. Knowledge gained will also be used to assess the vulnerability of US/friendly systems to cyber-attack and to develop protection capabilities. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 1462 - Integrated a wide-band, conformal antenna and specific emitter identification technology into advanced CM and intelligence collection models, prototype inserted in tactical software radio testbed.
- Performed battle lab simulation experiments to refine operational concepts and improve signal mapping, visualization, and analysis tools for Future Combat Systems (FCS).
- Demonstrated a multi-function RF collector prototype to search for, intercept, identify and locate low-power threat emitters.
- 3707 - Provided Objective Force with information operation capability to detect and recognize threat computers and resident information.
- Provided a stealthy information operation capability to disrupt, deny, degrade or destroy information resident in threat computers or computer networks.
- Designed and conducted distributed simulation experiments to support development efforts and training for integrated command and control (C2), protect and attack capabilities. Demonstrated in a field test for the digitized division.
- Provided results/recommendations to Program Executive Officer (PEO) Command, Control and Communications Systems and PEO Intelligence, Electronic Warfare and Sensors.
- Jointly developed a transition and integration plan.

Total 5169

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603270A - EW TECHNOLOGY

PROJECT

K15

FY 2002 Planned Program

- 1141 - Demonstrate the ability to protect the Army's tactical information systems by evaluating the effectiveness of attack tools against protection mechanisms in a laboratory demonstration. Validate the successful attainment of Tactical C2 Protect ATD exit criteria.
- 3335 - Demonstrate and evaluate the multi-function electronic collection and mapping system in a simulation model that reflects the FCS environment.
- 2050 - Complete tools for automated intelligence support system mission planning and military intelligence (MI) asset management tools.
- Complete antenna pattern test system mission planning tools for joint intelligence, surveillance, and reconnaissance (JISR) advance concept technology development (ACTD).
- Complete terrain reasoning tools for JISR ACTD.

Total 6526

FY 2003 Planned Program

- 2771 - Integrate advanced intelligence web applications into existing brigade intelligence systems to enhance situation awareness.
- 724 - Demonstrate warfighter RF collection system on surrogate Objective Force platforms.

Total 3495

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603270A - EW TECHNOLOGY	PROJECT K16
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
K16 NON-COMMO ECM TECH DEM	8755	7220	8105	8589	8998	9291	9480

A. Mission Description and Budget Item Justification: This project researches and demonstrates the Army's Objective Force non-communications Electronic Warfare sensors counter reconnaissance deception and CM technologies. The intent of this project is to provide Army aviation and ground vehicles with full dimensional protection using an integrated multi-spectral suite of precision warning sensors and countermeasures. This project demonstrates the feasibility and utility of these technologies to provide area and self-protection against optical, EO, IR and radar threats. The project will demonstrate integrated multi-spectral radar, laser and IR precision emitter location warning sensors. It will develop and demonstrate CM to provide Army aircraft and ground vehicles with full spectrum protection against advanced surface-to-air and anti-tank guided missiles to include integrated air defense systems. Additionally, this project will demonstrate a non-traditional use of electronic combat systems to provide precision targeting, combat identification, and real time SA updates. It also demonstrates the non-traditional use of standard equipment like a radio to perform another function, such as RF collection of threat emissions. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 7250 - Conducted distributed interactive simulation (DIS) experiments with aviation and ground users to evaluate integrated sensors and targeting functions, then defined demonstration scenarios and performance measures.
 - Completed development of compact, multi-wavelength missile warning sensor modules.
 - Continued development of data fusion software and circuit card modules that located and identified missile launches, radars, laser designators, laser range finders and laser beamriders.
 - Completed the development of data fusion software modules that generate SA displays and messages, and select and manage threat-specific countermeasure responses.
 - Incrementally inserted integrated situation awareness and targeting (ISAT) modules into a systems integration testbed and conducted hardware-in-the-loop simulation and testing to verify end-to-end functionality.
 - Completed development of precision angle of arrival laser warning sensor.
- 1505 - Developed and tested component technologies for an integrated countermeasures capability.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603270A - EW TECHNOLOGY

PROJECT

K16

FY 2001 Accomplishments: (Continued)

- Integrated and tested Defense Advanced Research Projects Agency (DARPA) and Army Research Laboratory (ARL) microwave and millimeter wave power modules which reduce transmitter weight and increase reliability and jamming power output.

Total 8755

FY 2002 Planned Program

- 5381 - Conduct DIS to evaluate ISAT feeds into the Joint Intelligence, Surveillance and Reconnaissance (JISR) Advanced Concept Technology Demonstrations (ACTD).
 - Integrate ISAT hardware and software in a UH-60 (Black Hawk) test aircraft.
 - Demonstrate through flight testing the overall ISAT capabilities in regard to exit criteria capability and transition the ISAT technologies to Program Executive Officer-Aviation.
- 1839 - Integrate and test integrated countermeasures capabilities in a ground vehicle.
 - Field test millimeter wave electronic countermeasures live fire top attack fuze jamming and deception of battlefield surveillance radars.

Total 7220

FY 2003 Planned Program

- 2755 - Complete anti-tank guided missile (ATGM), surface-to-air missile and anti-aircraft artillery modeling and simulation.
 - Integrate ground vehicle missile warning sensors with IR jammers for use against ATGMs with RF counter reconnaissance deception and jammer subsystems for use against surveillance radars and top attack munitions.
- 4075 - Demonstrate in a field test, RF collection system on surrogate RF radio platform to detect and geo-locate enemy's close battle, low power tactical communications.
 - Demonstrate ability of radios to network and pass threat situation awareness information to Battle Command Brigade and Below and JISR in under two minutes.
 - Demonstrate electronic mapping at vehicle, company and JISR levels.
 - Transition to Program Manager (PM) Prophet and PM Aerial Common Sensor (ACS).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603270A - EW TECHNOLOGY

PROJECT

K16**FY 2003 Planned Program (Continued)**

- 1275 - Perform final experiment to demonstrate data correlation, cueing, complete mission planning, and analysis tools.
 - Correlate imagery intelligence, human intelligence and signals intelligence into human centered decision making formats that can be quickly used at levels from combat vehicle to division commander.
 - Transition to JISR ACTD, PM Prophet and PM ACS.

Total 8105

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603313A - Missile and Rocket Advanced Technology
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COST (In Thousands)	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
Total Program Element (PE) Cost	48444	75396	87890	118564	88295	86086	69346
206 MISSILE SIMULATION	10341	15176	3139	3631	3337	3446	3514
263 FUTURE MSL TECH INTEGR(FMTI)	16972	29788	33506	52473	22773	12798	6363
493 RAPID FORCE PROJ DEMO	1115	0	0	0	0	0	0
550 COUNTER ACTIVE PROTECTION	6714	5436	8523	0	0	0	0
567 LCPK FOR 2.75 INCH ROCKETS	3689	1489	0	0	0	0	0
655 HYPERVELOCITY MISSILE TD	0	21007	42722	54589	54107	10307	266
704 ADVANCED MISSILE DEMO	0	0	0	7871	8078	59535	59203
713 STARSTREAK/STINGER LIVE FIRE TEST	9613	0	0	0	0	0	0
NA4 MISSILE RECYCLING PROGRAM	0	2500	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element demonstrates advanced missile technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability capabilities for the Objective Force, including the Future Combat Systems (FCS). Efforts are conducted through system simulation, design, demonstration, and test in laboratory and operational scenarios. This program element includes demonstrations of advanced tactical missiles, real-time hardware -in-the-loop simulations, and multi-role seeker technology efforts. The technologies in this PE enhance the capabilities of locating targets in clutter, lightweight missile launchers, precision guidance, and hypervelocity missile flight. The major efforts in this project are the Compact Kinetic Energy Missile (CKEM), Common Missile (CM), Low Cost Precision Kill (LCPK), NetFires and the Loitering Attack Munition for Aviation (LAM-A). The CKEM technology program will demonstrate a prime candidate to provide overwhelming lethality for the FCS Direct Fire System, with increased stowed rounds. The funding for this program was increased to accelerate prototype testing. The goal of the CKEM effort is to design, fabricate and demonstrate a direct-fire missile that offers a significant increase in cost/kill ratio and enhanced stowed-kills, when compared to current direct-fire weapon systems. The NetFires funding provides for acceleration and risk reduction for the NetFires Precision Attack Missile (PAM) effort. The LAM-A funding provides acceleration and risk reduction for development and demonstration of a long range precision strike munition for the Objective Force. The LAM-A demonstration will use the Loitering Attack Munition (LAM) being developed under the Netfires program and leverages technologies and sub-systems being developed by the Defense Advanced Research Projects Agency (DARPA). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan (AMP) and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Aviation and Missile Research, Development, and Engineering Center, U. S. Army Aviation and Missile Command, Redstone Arsenal, AL. Transition for this effort comes from work performed in PE 0602303A (Missile Technology).

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603313A - Missile and Rocket Advanced Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
President's Budget (FY2002 PB)	51629	59518	50774
Appropriated Value	52107	76018	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-622	0
b. SBIR / STTR	-1485	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-1700	0	0
e. Rescissions	-478	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	37116
Current Budget Submit (FY 2003 PB)	48444	75396	87890

Change Summary Explanation:

Significant Changes:

FY 2003 - Adjustments were made for Netfires Command, Control and Communications (C3) for risk reduction, Project D263 (\$26000) and No Slew Active Protection System (APS) to provide the technology for an FCS Block I APS based on the technology developed in the Counter Active Protection Systems (CAPS) project, Project D550 (\$6000).

Congressional Adds:

FY 2002 - Congressional adds were made for Missile Recycling Program, Project NA4 (\$2500); Standoff NATO International Precision Enhanced Rocket, Project 567 (\$1500); Aerospace Applications of VCM Composites Technology, Project 206 (\$2500); Wide Bandwidth Technology, Project 206 (\$3000) and Missile Simulation Technology, Project 206 (\$7000).

Projects with no R-2A:

-\$2500 Missile Recycling Program, Project NA4: The objective of this one year Congressional add is to conduct research and experiments to investigate techniques to recycle solid rocket motors of obsolete missiles.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603313A - Missile and Rocket Advanced Technology

Due to environmental regulations, the use of open burn/detonation techniques is no longer acceptable for disposal of the motors. No additional funding is required to complete this project.

- (\$1500) Standoff NATO International Precision Enhanced Rocket, Project 567: The objective of this one year Congressional add is to perform counter-countermeasure studies, review electronic packaging issues, and perform warhead performance test for the Low Cost Precision Kill effort. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603313A - Missile and Rocket Advanced Technology		PROJECT 206				
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
206 MISSILE SIMULATION	10341	15176	3139	3631	3337	3446	3514

A. Mission Description and Budget Item Justification: This project supports three separate, but related, tasks. The first task is the design, expansion, and improvement of hardware-in-the-loop (HWIL) simulation capabilities. The HWIL simulation is 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 and multi-mode guidance technologies such as those envisioned for the Common Missile and other systems within the Objective Force. The second task is Distributed Interactive Simulation (DIS) via a node to the Defense Advanced Research Evaluation Network (DREN). This effort will facilitate tying together the Modeling and Simulation capabilities of various Army agencies allowing cooperative simulation efforts such as the RDEC Federation, which is envisioned, for FCS and Objective Force evaluation. The third task is battlefield distributed simulation, which provides an all-analytical simulation of Objective Force weapon systems engaging multiple targets in a simulated battlefield environment, including the effects of natural and battle-caused obscurants and disturbances. Evaluation by means of HWIL provides cost-effective support to missile maturation throughout weapon system life cycles and permits a reduction in the number of flight tests actually performed. Work is performed by the Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. Major contractors are Boeing Defense and Space Group, Seattle, WA; and CSC-Nichols Research Corporation, Huntsville, AL. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1765 - Designed and implemented Common Missile (CM) HWIL simulation, including, semiactive laser mode and MMW signal radiation. Initiated trichroic beam combiner technology.
- Developed technology components applicable to implementation of a HWIL simulation capability for active IR, such as LADAR, guidance systems.

- 589 - Upgraded distributed simulation capabilities including the Advanced Prototype and Experimentation (APEX) lab, Battlefield Highly Immersive Virtual Environment (BHIVE), classified and unclassified Ethernet and fiber optic wide area and local network equipment to sufficient bandwidth, image processing power, and recent technological advances.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603313A - Missile and Rocket Advanced Technology

PROJECT

206

FY 2001 Accomplishments: (Continued)

- 7987 - One year congressional add for Missile Simulation Technology developed, designed, and built new manned simulators and virtual prototypes of future aviation and missile systems based upon battlefield highly immersive virtual environment technology (BHIVE) and system design data from collaborative environments; incorporated and demonstrated the Emissive Sources Imaging (ESI) Model with the PC based common missile class of models; developed, designed, and built real-time emulation of emissive smoke using parallel processing techniques applied to sensor analysis.

Total 10341

FY 2002 Planned Program

- 1994 - Support implementation of a HWIL simulation facility for CM by leveraging program management office (PMO) funds.
- Mature trichroic beam combiner technology for CM HWIL simulation.
- Further mature end-to-end HWIL simulation techniques with remotely located ground equipment (launchers, C4I, fire control sensors and units) connected to real-time HWIL missile components and simulations.
- 682 - Design and implement distributed simulation capabilities including the APEX BHIVE, classified and unclassified ethernet and fiber optic wide area and local network equipment to analyze FCS, CKEM, Netfires, the Objective Force and weaponization of manned and unmanned air and ground vehicles in conjunction with Battle Labs and other Research, Development and Engineering Centers (RDEC's).
- Investigate parallel processing techniques to provide image processing power to enhance obscuration modeling required by both real and virtual prototype simulators.
- 7000 - One-year Congressional Add to provide high fidelity, man-in-the-loop, simulation support to missile and missile platform development programs.
- 2500 - One-year Congressional Add to develop simulation / modeling capability to optimize component design and manufacturing, using volumetrically controlled manufacturing methods.
- 3000 - One-year Congressional Add to develop wide-bandwidth, low-latency connectivity of HWIL simulation and test facilities at Redstone Arsenal. Complete the "high" frame-rate communications, and establish connectivity between the Millimeter-wave Simulation System facility and the Flight Mission Simulator facility.

Total 15176

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603313A - Missile and Rocket Advanced Technology

PROJECT

206

FY 2003 Planned Program

- 2350 - Continue implementation of a HWIL simulation facility for CM.
 - Establish implementation plan for a product assurance/lot acceptance HWIL simulation facility for CM.
 - Implement an IR in-band target scene projector based on micro-electromechanical systems (MEMS) devices for HWIL simulation.
- 789 - Upgrade distributed simulation capabilities including the APEX BHIVE, classified and unclassified ether net and fiber optic wide area and local network equipment to incorporate recent technological advances and to insure compatibility to the Battle Labs and other Research, Development and Engineering Centers (RDEC's).
 - Utilize distributed simulation capabilities to analyze FCS, CKEM, the Objective Force and weaponization of manned and unmanned air and ground vehicles in conjunction with Battle Labs and other RDEC's.

Total 3139

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603313A - Missile and Rocket Advanced Technology	PROJECT 263
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
263 FUTURE MSL TECH INTEGR(FMTI)	16972	29788	33506	52473	22773	12798	6363

A. Mission Description and Budget Item Justification: This project demonstrates advanced tactical missile technologies including seekers, propulsion, airframes, and guidance and control for FCS and the Objective Force. The major efforts in this project are the Common Missile (CM), a second PAM contractor for the NetFires programs, and the acceleration of the Loitering Attack Munition-Aviation (LAM-A). CM technology is the demonstration and integration of multi-mode seeker concepts, controllable thrust rocket motors (gels or pintle-controlled solids), aided target recognition (ATR), and wide-band secure datalinks. Seeker technology will address imaging infrared and millimeter wave seeker technologies, combined with an existing semi-active laser, in order to provide precision strike and fire-and-forget guidance modes without major modifications to the host platform. Affordable, controllable thrust rocket motors, such as gelled bi-propellants or pintle-controlled solids, will be demonstrated to provide longer ranges and shorter flight times while increasing system robustness in the Air-to-Ground (ATG) and Ground-to-Ground (GTG) roles. ATR will be demonstrated permitting true fire-and-forget at targets beyond visual range. Finally, secure wide-band datalink hardware, allowing target position updates during missile flight, will be demonstrated. These CM efforts provides risk mitigation in support of a planned System Development and Demonstration (new AR 5000.2) start for CM and are supported by the Program Executive Officer Tactical Missiles. The CM technologies will be leveraged by the Netfires program to mature a common module family of missiles. The family of missiles will include direct fire, indirect fire, loiter attack - ground, loiter attack - aviation, air defense, and deep operations capabilities. The LAM-A effort will develop and demonstrate a long-range (60 km) precision strike munition for the Objective Force. The demonstration will use the LAM munition developed by the Netfires program and will leverage technologies and subsystem components being developed by DARPA. The full-scale system demonstrations for the air defense and deep operations will be completed in project D704, Advanced Missile Demonstration. Work is performed by the Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. Major contractors are TRW and TRW Space Electronics Group, Redondo Beach, CA; Raytheon Systems Company, Tucson, AZ; The Boeing Company, Huntsville, AL; Northrop-Grumman Corporation, Baltimore, MD; Lockheed Martin Fire Control Division, Orlando, FL; BAE North America, Austin TX; Thiokol, Elkton, MD; Atlantic Research Corporation, Gainesville, VA; Boeing, Rocketdyne, Canoga Park, CA; and Alliant Tech Systems, Inc. Rocket Center, WV. This program supports the Objective Force transition path of the TCP.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603313A - Missile and Rocket Advanced Technology

PROJECT

263

FY 2001 Accomplishments:

- 8376 - Conducted bench and tower test of prototype seekers.
- Completed preparations for seeker flight test program.
- Designed and fabricated scene generator and multi-mode seeker testbed.
- 4602 - Conducted controllable propulsion trade study for CM.
- Conducted analysis of alternative propulsion systems.
- Conducted analysis of fuel/oxidizer chemistry to enhance performance.
- Completed controllable thrust motor maturation.
- Conducted static test firings of controllable thrust motor.
- Explored ATR hardware/software for use on CM.
- Conducted guidance datalink feasibility.
- 3994 - Investigated aircraft integration issues for the Loiter Attack Munition - Aviation (LAM-A).
- Supported the DARPA Network Fires program, to include test, analysis, and simulation to reduce overall technical risk.
- Investigated low cost missile alternatives for soft targets.

Total 16972

FY 2002 Planned Program

- 7200 - Fabricate and assemble final seeker hardware for CM.
- Conduct seeker tower testing.
- Prepare seekers and range for Captive Flight Testing.
- 4200 - Complete final fabrication of propulsion system hardware and static testing of flight- type hardware.
- 651 - Explore datalink and ATR concepts for incorporation in CM designs.
- 12737 - Establish a second PAM contractor to increase competition and encourage cost reduction for the joint DARPA/Army Netfires program.
- Provide alternate PAM concepts.
- Accelerate flight testing of prototype NetFires missiles.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603313A - Missile and Rocket Advanced Technology

PROJECT

263

FY 2002 Planned Program (Continued)

- 5000 - Accelerate demonstration and flight testing of a full-scale LA M-A prototype.
 - Develop engineering design of soft launch boost motor and aircraft rail interface.
 - Purchase long lead-time items to build prototype missiles.
 - Develop test plans to include ballistic, controlled, and guided flight testing.

Total 29788

FY 2003 Planned Program

- 26000 - Initiate development of a miniaturized Small Unit Operations Situational Awareness System (SUO/SAS) radio for missile and ground vehicle applications.
 - Initiate software development of networking and fires/effects routed to higher command level and integrate software into existing FCS-C2 software.
 - Validate NetFires-SUO/SAS radio operations via Hardware in the Loop testing.- Validate NetFires-C3 operation in scenario based Hardware in the Loop/Software in the Loop testing.
- 1852 - Perform Captive Flight Testing of Trimode seekers for CM.
- 654 - Conduct final flight-type static testing of controllable propulsion system(s).
- 5000 - Accelerate flight testing of prototype Netfires missiles

Total 33506

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603313A - Missile and Rocket Advanced Technology	PROJECT 550
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
550 COUNTER ACTIVE PROTECTION	6714	5436	8523	0	0	0	0

A. Mission Description and Budget Item Justification: This project will mature and demonstrate technologies, which can be applied to anti-tank guided weapons (ATGW), including chemical warhead FCS and Objective Force weapons. This technology will improve the effectiveness of ATGW against threat armor equipped with active protection systems (APS). Current technology development is concentrated in the following areas; electronic warfare (EW) radio frequency (RF) countermeasure (RFCM) technology that jams or deceives the radar sensors of threat APS, and warhead integration to fire the missile warhead before being destroyed by the APS. Work is performed by the Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, Alabama; Phase IV Systems, Inc, Huntsville, AL. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 5402 - Completed brassboards of activity detector, first iteration antennas, and brassboard base band module.
 - Completed brassboard RF transceiver module using first iteration monolithic microwave integrated circuits (MMIC).
 - Completed hardware for functional demonstration of third generation RFCM using brassboard modules and components
 - Completed second iteration MMIC component development.
 - Began design and fabrication of third generation RF test bed.
 - Began integration to mis sile test bed airframes.
- 1312 - One year congressional add for Counter Active Protection Systems designed and fabricated alternate low cost RF transceiver module.

Total 6714

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603313A - Missile and Rocket Advanced Technology

PROJECT

550

FY 2002 Planned Program

- 5436 - Complete third generation MMIC component maturation.
 - Complete third generation RF test bed.
 - Complete final RF transceiver module prototype.
 - Complete full performance and functional demonstration of third generation RFCM prototype in dynamic test against APS second and third generation RF test beds.
 - Begin fabrication of twelve third generation RFCM flight prototypes.

Total 5436

FY 2003 Planned Program

- 6033 - Initiate design of conformal head assemblies, reduce size of radar receivers, and complete radar software. Perform radar integration and live interceptor/launcher testing.
- 2490 - Complete fabrication of twelve third generation RFCM flight prototypes.
 - Complete integration to missile test bed airframes.
 - Transition to missile system project management offices and prime contractors for flight test demonstrations with a Technology Readiness Level (TRL) of Six.

Total 8523

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603313A - Missile and Rocket Advanced Technology	PROJECT 655
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
655 HYPERVELOCITY MISSILE TD	0	21007	42722	54589	54107	10307	266

A. Mission Description and Budget Item Justification: Compact Kinetic Energy Missile (CKEM) ATD will enable the Objective Force, including FCS, by providing overwhelming lethality with a small, light, fast hypervelocity compact kinetic energy missile. CKEM will develop and demonstrate advanced hypervelocity missile technology necessary for the next generation kinetic energy weapon. CKEM will demonstrate enhanced system lethality with a 52 inch long, 65-lb. objective hypervelocity kinetic energy (KE) missile. Miniature guidance inertial measurement unit (IMU) technology will demonstrate high-g missile launch, independent of launcher attitude and provide precision kill at target impact ranges of 0.4-5 km. The program will develop, mature, and demonstrate advanced component and subsystem and system level technologies in a missile system configuration to achieve next-generation system level performance. Major contractors are Lockheed Martin, Dallas, TX; MILTEC/Boeing, Huntsville, AL; and Raytheon Company, Tucson, AZ. This program supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

Project not funded in FY 2001.

FY 2002 Planned Program

- 4699

 - Incorporate the results of the CKEM technology and component maturation efforts (in PE 0602303A, Missile Technology) and ensure compatibility with FCS and other Objective Force platform development efforts.
 - Incorporate the technology matured under PE 0602303A, Missile Technology, into a flight worthy component and demonstrate that the component meets the defined form, performance, interface and flight environmental requirements.
- 16308

 - Mature and validate critical component performance through subsystems and system integration and tests, leading to missile flight tests. Conduct critical issue and risk assessment phase of the system contract efforts with two prime contractors.
 - Validate high fidelity system simulation through hardware-in-the-loop of propulsion unit, guidance system, and hypervelocity aero-ballistic models.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603313A - Missile and Rocket Advanced Technology

PROJECT

655

FY 2002 Planned Program (Continued)

- Demonstrate enhanced lethality in system configuration to include novel penetrators for missile applications and quantification of lethality effects other than perforation.
- Incorporate hypervelocity technology into integrated tactical system concepts whose design has been demonstrated to meet the system performance, interface and flight environment requirements.
- Finalize ATD Management Plan and coordinate transition to system development and demonstration (SDD).

Total 21007

FY 2003 Planned Program

- 11000 - Provide two tactical hypervelocity missile systems ready for demonstration/validation in FY 2003-2006 and primed for SDD phase in FY 2006. Maintain competitive acquisition up to SDD with two system prime contractors.
- 8700 - Incorporate the technology (previously incorporated into a flight worthy component) into integrated tactical system whose design has been demonstrated to meet the defined form, performance, interface and flight environmental requirements.
- 16000 - Demonstrate technology maturation of Technology Readiness Level (TRL) 6 of component and integrated missile system concepts.
- 7022 - Validate critical component performance through subsystem and system integration testing

Total 42722

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603606A - Landmine Warfare and Barrier Advanced Technology						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	19922	25640	24104	27296	31221	32267	32880
608 COUNTERMINE & BAR DEV	17630	22718	21170	22429	23468	24318	24818
683 ANTI-PERSONNEL LANDMINE (APL) ALTERNATIVES	2292	2922	2934	4867	7753	7949	8062

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates robust countermine technologies for the U. S. Army. Countermine requirements to include in-stride detection and breaching, close-in detection, area clearance, and neutralization of landmines. This PE demonstrates the remote detection of minefields as well as individual landmine detection from handheld, ground, and aerial sensor systems. The landmines being studied include both metallic and low/non-metallic landmines. The use of wide-area multi-sensor fusion detection systems, coupled with small-area confirmation sensors, also will be emphasized. This multi-sensor approach has the potential to yield a high probability of landmine detection at very low false alarm rates. In addition, airborne mine detectors will also be assessed for contingency applications and matured for lightweight plug-and-play use in mission specific applications. Alternative systems for anti-personnel landmines and innovative concepts for minefield clearance will be explored. Advanced Concept Technology Demonstrations, Advanced Warfighting Experiments, and modeling and simulation activities will be conducted to assess the effectiveness of system concepts. Efforts within this PE are closely coordinated with the U.S. Marine Corps. The work in this program follows the Army Science and Technology Master Plan, the Army Modernization Plan and Project Reliance. The program also adheres to Tri-Service/Project Reliance Agreements on conventional air/surface weapons and ground vehicles. This PE contains no duplication with any other effort within the Army or the Department of Defense. It also is fully coordinated with PE 0603619A (Landmine Warfare and Barrier Advanced Development), PE 0602712A (Countermine Systems) and PE 0602709A (Night Vision Technology). This PE is managed by the Night Vision Electronic Sensors Directorate, Communications-Electronics Research Development and Engineering Center. This program supports the Objective Force transition path of the TCP.

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

February 2002

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603606A - Landmine Warfare and Barrier Advanced Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	20702	23062	23614
Appropriated Value	20894	25862	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-222	0
b. SBIR / STTR	-529	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-250	0	0
e. Rescissions	-193	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	490
Current Budget Submit (FY 2003 PB)	19922	25640	24104

Change Summary Explanation: Funding: FY 2002 - A Congressional add was made for Advanced Demining Technology, Project 608 (\$2800)

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development		PE NUMBER AND TITLE 0603606A - Landmine Warfare and Barrier Advanced Technology					PROJECT 608	
COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
608	COUNTERMINE & BAR DEV	17630	22718	21170	22429	23468	24318	24818

A. Mission Description and Budget Item Justification: This project matures countermining technologies for integration into future combat systems. Specific activities include remote detection of minefields and individual landmine detection from handheld, ground and aerial sensor systems. The landmines being studied include both metallic and low/non-metallic construction. Wide-area multi-sensor fusion detection systems, coupled with small-area confirmation sensors, will be evaluated in their potential to yield high probability of mine detection at very low false alarm rates. Airborne multispectral/hyperspectral mine detectors will be assessed for contingency applications and matured for lightweight plug-and-play use in mission specific applications. The expectation is robust approaches to finding surface-laid and buried mines in varying vegetation, soil and diurnal conditions. This project has the potential to provide advanced countermining capabilities to the dismounted soldier by adapting commercial or emerging Defense Advanced Research Projects Agency technologies for standoff mine detection. These technology areas include robotics, infrared and visual imagery, radio frequency, signal processing, electronic and physical mine marking and telemetry. The intent is to provide enhanced situational awareness to infantry and other dismounted forces prior to their entry into harms way. This project also evaluates area clearance systems under the Joint Area Clearance (JAC) advanced concept technology demonstration (ACTD) as a means to determine the best system to procure for rear area and supply route clearance operations. These efforts support ACTDs, Army Warfighting Experiment, modeling and simulation assessments and defines potential system effectiveness. This project supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 3450 - Evaluated scanning quadruple resonance (QR) and advanced mine detection sensors technologies to assess performance for vehicle mounted mine detection applications in the Objective Force.
- Established initial confirmation sensor technical benchmark.
- 13916 - Completed detailed design of filter wheel modification and fabricated a minefield-specific prototype of the modified advanced tactical unmanned aerial vehicle (TUAV) electro-optic(al) (EO/IR) sensor against surrogate minefields.
- Completed detailed design and initiated fabrication of a model lightweight multispectral (laser polarization and long wavelength infrared) detection sensor.
- Completed maturation and evaluation of advanced minefield detection algorithms and enhanced methods of airborne detection of buried and surface emplaced mines (increased probabilities of detection and reduced false detection rates).

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced technology development

**0603606A - Landmine Warfare and Barrier
Advanced Technology**

608

FY 2001 Accomplishments: (Continued)

- Evolved and designed a test and evaluation strategy that fully measures the ability of lightweight multi/hyperspectral technology to achieve the Army's airborne minefield detection requirements.
- 264 - Finalized JAC ACTD planning.
- Established user operational concept and performed component evaluation.
- Conducted initial Warfighter Exercises to evaluate mine clearance models.

Total 17630

FY 2002 Planned Program

- 6206 - Demonstrate integration of scanning quadruple resonance (QR) mine detection technology onto a vehicle platform.
- Evaluate QR system and mature advanced electromagnetic technologies for mine target detection.
- 3006 - Evaluate mine clearance models in focused JAC exercises with Army and U.S. Marine Corps user representatives and prepare interim military assessment of JAC capabilities.
- 1801 - Assess explosive detection chemical sensors, advanced electromagnetic techniques, and novel ground penetrating radars for use on small mobile robots for dismounted mine detection operations.
- 8905 - Complete field performance evaluation of the modified advanced TUAV EO/IR minefield detection sensor and aided target detection software suite.
- Assemble and integrate lightweight multispectral (laser polarization and long wavelength infrared (LWIR)) minefield detection sensor and begin system testing.
- 2800 - This one year Congressional add demonstrates a remotely operated, mine detection and mine clearing system. No additional funding is required to complete this project.

Total 22718

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603606A - Landmine Warfare and Barrier
Advanced Technology**

PROJECT

608

FY 2003 Planned Program

- 8507 - Complete trade studies for development of power, weight, and operational specifications of handheld, ground and aerial sensor systems.
 - Complete evaluation of handheld, ground and aerial sensor candidates.
 - Complete integration of prototype scanning quadruple resonance, advanced electromagnetic mine detection, or other sensor technologies on a vehicle platform and perform performance evaluation (probability of detection, false-alarm rate, position accuracy, and rate of advance).
- 2597 - Conduct military assessment of JAC capabilities and transition residual hardware to users.
- 3247 - Fabricate and test sensor component technologies for the robotic mine detection system. Identify appropriate robotic platform and begin sensor integration.
- 3663 - Complete field performance evaluation of the prototype lightweight multispectral (laser polarization and LWIR) minefield detection sensor and aided target detection system and transition technologies to an Army acquisition program.
- 3156 - Specify hardware configuration and software needs for a multisensor, forward looking mine detection model.

Total 21170

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603606A - Landmine Warfare and Barrier Advanced Technology	PROJECT 683					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
683 ANTI-PERSONNEL LANDMINE (APL) ALTERNATIVES	2292	2922	2934	4867	7753	7949	8062

A. Mission Description and Budget Item Justification: This project provides technology demonstrations in support of alternative systems for anti-personnel landmines (APLs) that help minimize the risks to non-combatants. This includes alternatives to anti-personnel submunitions used in mixed anti-tank (AT) landmine systems. The alternatives will include surveillance systems, command and control systems, and overwatch fires. These will be evaluated and matured in parallel in order to provide similar capabilities which are currently provided by APLs and APL submunitions in mixed AT systems. Distributed simulation will be used to evaluate new concepts and modify doctrine. Modeling components and system architectures will be constructed and evaluated in system field tests. This project supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 2292 - Modified and matured a new generation of expendable day/night imaging sensors, communication devices, low cost point detectors, and deterrent devices (lethal and non-lethal munitions) for force protection and landmine alternative roles.
- Tested and evaluated advanced technology brassboards for landmine alternatives concept demonstration.
- Matured generic technology simulations to support the concept demonstration phase of APL Track III program. Completed maturation of generic Track III munition control station simulator. Integrated communications model with generic control station to provide realistic communications link between the controller and remote munitions.
- Integrated Track III simulations into the Mounted Maneuver Battle Lab's FY 2001 Future Combat Command and Control Experiment to enable the operational evaluation of Track III concepts in the context of the Army Objective Force.

Total 2292

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603606A - Landmine Warfare and Barrier
Advanced Technology**

PROJECT

683**FY 2002 Planned Program**

- 2922 - Demonstrate the mobility of an adaptable network of expendable sensors and new deterrent devices in order to meet landmine alternatives requirements and Future Combat Systems protection roles.
- Test mobility concepts of adaptable network sensors and deterrent devices for landmine alternative missions.

Total 2922

FY 2003 Planned Program

- 2934 - Mature system concepts for landmine alternative mid-term solutions.
- Mature product improvements and transition Defense Advanced Research Projects Agency Track II concepts to the Track III landmine alternative system.

Total 2934

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603607A - JOINT SERVICE SMALL ARMS PROGRAM	PROJECT 627					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
627 JT SVC SA PROG (JSSAP)	11809	4388	6013	6413	6715	7140	7483

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates advanced technologies that integrate into individual and crew-served weapons to provide greater lethality, utility and range at a significantly reduced weight required for the Army Transformation to the Objective Force. Efforts include: the Objective Crew-Served Weapon (OCSW) Advanced Technology Demonstration (ATD) and Objective Individual Combat Weapon (OICW) System Enhancement. OCSW demonstrates the next generation crew-served weapon with improved combat effectiveness such as being able to hit protected personnel targets in defilade (obscured or non-visible), with a reduced weight of 65-75% over M2 machine guns, MK19 grenade machine guns and M240 machine guns. The system enhancement efforts will develop, demonstrate and transition lethality-enhancing and cost-reducing technologies into the OCSW and OICW. All Joint Service Small Arms Program (JSSAP) efforts follow the Joint Service Small Arms Master Plan (JSSAMP) and Service Mission Need Statements and Operational Requirement Documents. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the US Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Work in this PE is derived and fully integrated with the 6.2 efforts found in PE 0602623A (Joint Service Small Arms Program) and PE 0602624A (Weapons and Munitions Technology). Transition paths have been established in coordination with Product Manager (PM) Small Arms; USMC Director, Ground Weapons; and US Special Operations Command (SOCOM). This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 1840 - Demonstrated OCSW precision airburst (including rapid fire) with target practice-spotter rounds, utilizing integrated fire control with the first deliverable weapon.
- 1409 - Performed in an operational setting OCSW fire control evaluation and refinement of target tracking coupled laser steering for enhanced target acquisition and hit probability.
- 1060 - Completed OCSW virtual simulator for training support of ATD.
- 7500 - This one year Congressional add demonstrated a significantly more mature and robust OCSW design beyond the preliminary prototype establishing and established a Technology Readiness Level (TRL) of 6 facilitating a transitioning to PM Small Arms for Systems Development and Demonstration phase.

Total 11809

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology de velopment

PE NUMBER AND TITLE

0603607A - JOINT SERVICE SMALL ARMS PROGRAM

PROJECT

627

FY 2002 Planned Program

- 407 - Demonstrate OCSW gun launched (burst mode), fully functional, precision airburst fuze (including point detonation and self destruct functions) of the airbursting high explosive munition; complete fabrication of deliverable OCSW systems #2 and #3; complete fabrication of OCSW ammunition to support government ATD testing; conduct government technical feasibility and safety tests of OCSW system.
- 3981 - OICW System Enhancement: Update initial designs, fabricate test hardware, and evaluate in inert warheads the performance of micro-electro-mechanical systems (MEMS) based safe and arming (S&A) mechanism employing Micro Energetic Initiation (MEI). MEI provides a 75% volume/50% cost reduction in the fuze S&A.

Total 4388

FY 2003 Planned Program

- 1917 - Complete OCSW transition activities and ATD; conduct OCSW Milestone B Decision Review to initiate System Development and Demonstration phase
- 1996 - OICW System Enhancement: Identify technology solutions to direct airburst munition fragments toward the target to increase operational effectiveness.
- 2100 - OICW System Enhancement: Finalize design, fabricate test hardware and demonstrate in explosive warheads the performance of MEMS based S&A mechanism employing MEI. MEI provides a 75% volume/50% cost reduction in the fuze S&A. This technology will be leveraged by the OICW program.

Total 6013

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

February 2002

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603607A - JOINT SERVICE SMALL ARMS
PROGRAM

PROJECT
627

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	4428	5828	5923
Appropriated Value	4469	4428	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-40	0
b. SBIR/STTR Program	-119	0	0
c. Omnibus or Other Above Threshold Reprogramming	7500	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-41	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	90
Current Budget Submit (FY 2003 PB)	11809	4388	6013

Change Summary Explanation:Funding: FY 2001: Project 627 (+7500) increased to facilitate completion of the Objective Crew Served Weapon Advanced Technology Demonstration transition milestones.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)**February 2002**

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced technology development**0603654A - Line-Of-Sight Technology Demonstration****460****FY 2001 Accomplishments:**

- 517 - Completed fabrication of one Fire Unit structural prototype for Risk Reduction Flight test.
- 2067 - Completed fabrication of missile hardware for two Risk Reduction Flight tests.
- 2280 - Conducted two Risk Reduction Flight tests.
- 30930 - Continued Fire Unit electronic and interior mechanical detail designs; and initiated fabrication (including major subcontractors).
- 9816 - Continued Missile electronic and mechanical detail designs; and initiated fabrication (including major subcontractors).
- 432 - Continued tooling design and initiated fabrication.
- 1345 - Completed Fire Unit Software requirements analysis; initiated design, code, and test.
- 500 - Supported Dismounted Battlespace Battle Lab Early Soldier Involvement exercises.
- 2375 - Continued test equipment design, initiated fabrication.

Total 50262

FY 2002 Planned Program

- 37658 - Complete Fire Unit detail designs; continue fabrication, assembly and test of twelve prototypes.
- 24047 - Complete Missile detail designs; continue fabrication, assembly and test 37 prototypes.
- 1646 - Complete tool design and fabrication.
- 1130 - Complete Virtual Prototype Simulator Upgrade.
- 1202 - Complete Training Device designs; initiate fabrication.
- 896 - Support Early Soldier involvement training, and planning for ACTD Company in 82nd Airborne Division.
- 3280 - Complete Fire Unit and update Missile software design, code and unit level test; initiate system level test.

Total 69859

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced technology development

0603654A - Line-Of-Sight Technology Demonstration

460

FY 2003 Planned Program

- 13880 - Complete Fire Unit fabrication, assembly, and qualification testing.
- 8100 - Complete Missile fabrication, assembly, qualification testing, and flight testing.
- 720 - Complete Fire Unit Software system level test and certification.
- 160 - Complete Missile Software system level test and certification.
- 5423 - Support system ground and flight qualification tests, safety certification, and man-rating assessment.

Total 28283

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	50262	57384	28350
Appropriated Value	50727	70456	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-597	0
b. SBIR / STTR	0	0	0
c. Omnibus or Other Above Threshold Reduction	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-465	0	0
Adjustments to Budget Years Since FY2003 PB	0	0	-67
Current Budget Submit (FY 2003 PB)	50262	69859	28283

Change Summary Explanation: Funding - FY 2002 - A Congressional add was made for the LOSAT Technology Demonstration, Project 460 (\$13072). This Congressional add was a transfer from the Army Missile Procurement.

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603710A - NIGHT VISION ADVANCED TECHNOLOGY

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	41598	49389	36494	39336	36831	37170	39910
C65 DC65	2268	2844	2873	6809	6541	2687	2637
C67 DC67	6066	9104	5896	0	0	0	0
K70 NIGHT VISION ADV TECH	21531	24418	18129	22957	20856	22632	24856
K86 NIGHT VISION, ABN SYS	11733	9523	9596	9570	9434	11851	12417
NA1 THROUGH WALL SURVEILLANCE RADAR TECHNOLOGY	0	3500	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates tactical night vision and electronic sensor technologies to improve the Army's ability to operate in the dark, i.e., "own the night." Technologies and applications under this PE focus on reconnaissance, surveillance, target acquisition, air defense, and air/ground mobility. The goal is to increase survivability by providing capabilities to acquire, engage, and destroy targets at longer ranges in complex environments and conditions (e.g. day/night, obscured, smoke, bad weather). A system of networked, low-cost, distributed unmanned sensors has the potential to provide close-in battlefield situational awareness and beyond-line-of-sight targeting in areas shadowed by terrain features. Improved seamless sensor interfaces to command, control, communications, computers, and intelligence systems and networks will support the dissemination of information. Multispectral and hyperspectral sensors will provide the capability to detect obscured, concealed, and reduced signature threats. Multi-sensor suites will provide rapid, automatic target acquisition and will generate battlefield information/data. Enhanced wide field-of-view sensor technology will support dismounted, as well as air operations (e.g. nap-of-the-earth). Commander's head tracked sensor suites provide situational awareness for future combat system infantry carriers operating in close-in complex terrain. Advanced tactical reconnaissance and surveillance technologies will provide real-time/near-real-time capabilities for imagery intelligence, measurement and signature intelligence applications. Low power infrared (IR) sensors will provide lightweight, affordable day/night imaging capability to the soldier. Work in this PE is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan. It adheres to Tri-Service Reliance agreements on sensors and electronic devices, with oversight, and coordination provided by the Joint Directors of Laboratories. This PE contains no duplication with any effort within the Military Departments and is related to and fully coordinated with efforts in PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602270A (Electronic Warfare Technology), PE 0603774A (Night Vision Systems Advanced Development), and PE 0604710A (Night Vision Systems Engineering Development). Work in this PE is managed by the US Army Communications-Electronics Research, Development and Engineering Center, Fort Monmouth, NJ. Contractors include: Raytheon, Dallas, TX; Raytheon, El Segundo, CA; Fibertek, Herndon, VA; Questech, Falls Church, VA; Northrop-Grumman, Linthicum, MD; Lockheed-Martin Corp., Orlando, FL; Lockheed-Martin, Lexington, MA; Alliant, Hopkins, MA; EOIR, Spotsylvania, VA; Booz Allen Hamilton, McLean, VA; Omar McCall, Beltsville, MD; ThermoTrex Corporation; Nytech, Irvine, CA; Indigo, Santa Barbara, CA; Wescam, Sonoma, CA; and Mitex, San Antonio, TX. This program supports the Objective Force transition path of the TCP.

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

February 2002

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603710A - NIGHT VISION ADVANCED TECHNOLOGY

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	42746	37081	36147
Appropriated Value	43141	49781	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-392	0
b. SBIR / STTR	-1166	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-377	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	347
Current Budget Submit (FY 2003 PB)	41598	49389	36494

Change Summary Explanation:

Significant changes:

FY02 Congressional adds totaling \$12700 (as noted below) were added to this PE.

FY02 Congressional Adds:

- Project NA1 (\$3500) Through Wall Surveillance Radar Technology. The objective of this one year Congressional add is to demonstrate surveillance through walls and other urban obscurants.
- Project K86 (\$5000) BUSTER Backpack UAV. The objective of this one year Congressional add is to mature and evaluate a man-packed unmanned aerial vehicle. No additional funding is required to complete this project.
- Project K70 (\$1200) Helmet Mounted Infrared Sensor. The objective of this one year Congressional add is to improve situational awareness where visibility is obstructed as well as for use during search and rescue missions. No additional funding is required to complete this project.
- Project K70 (\$3000) Night-Vision Advanced Tech-Digital Fusion. The objective of this one year Congressional add is to mature small component image intensification technology, combined with thermal imagery. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603710A - NIGHT VISION ADVANCED TECHNOLOGY

Project with no R-2A:

- Project NA1 (\$3500) Through Wall Surveillance Radar Technology.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603710A - NIGHT VISION ADVANCED TECHNOLOGY	PROJECT K70					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
K70 NIGHT VISION ADV TECH	21531	24418	18129	22957	20856	22632	24856

A. Mission Description and Budget Item Justification: This project matures and demonstrates high-performance sensor/multi-sensor technologies in order to increase target detection range, extend target identification range, and reduce target acquisition (TA) timelines. The intent is to provide ground combat and amphibious assault vehicles with affordable compact sensor options for wide-area, long range, non-cooperative TA, and air defense. This project will demonstrate next-generation, distributed unattended ground sensor systems and will incorporate low-power infrared imaging and robust networking/communication technologies. The Multi-Function Staring Sensor Suite (MFS3) Advanced Technology Demonstration will demonstrate applications of a modular, reconfigurable sensor suite. MFS3 will integrate advanced, broadband, staring infrared (IR) sensor technologies with eye safe laser and acoustic technologies. This project also will mature a next generation, low power, and advanced uncooled IR sensor with applications for the Thermal Weapons Sights (TWS), Objective Crew Served Weapon (OCSW), Future Combat System troop carrier, Commander's Head Tracked Sensor Suite, Cost Effective Targeting System, and the Objective Individual Combat Weapon. This project evaluates cost effective targeting systems by demonstrating a combination of advanced, uncooled forward looking infrared (FLIR), short wave infrared (SWIR), and laser rangefinder/illuminator technologies for use on unmanned ground vehicles (UGVs). Additionally, the helmet mounted IR sensor development demonstrates a capability for Department of Defense firefighters to operate effectively in a smoke-filled environment. Other efforts include a commander's head-tracked sensor suite in order to provide increased mobility and 360 degrees situational awareness (SA) to commander/squad leaders during closed hatch vehicle operations. It also provides connectivity during dismounted infantry operations in both open and complex terrain. This project supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 13976 - Completed MFS3 system operational mode simulation with Mounted Maneuver Battlelab to optimize user interface.
 - Conducted user demonstrations and evaluations of manually operated, 3 field of view (FOV), broadband and mid-wave sensors. Characterized target recognition and identification performance. Specific emphasis was placed on demonstrating utility of the ultra narrow FOV for long range target identification. The United Kingdom Ministry of Defense participated in the planning and the conducting of the test.
 - Completed multispectral aided target recognition (ATR) data collection.
 - Matured aided target recognition (ATR) algorithm hardware/software (multispectral detection, moving target indication, and mid wave spatial detection/recognition).
- 3902 - Fabricated 640x480, uncooled focal plane arrays with increased sensitivity to enable man-portable and long range applications.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603710A - NIGHT VISION ADVANCED TECHNOLOGY

PROJECT

K70

FY 2001 Accomplishments: (Continued)

- Completed design of low power electronics and power management. Reduced power consumption by 60% compared to currently fielded systems such as the TWS.
- Completed design of lightweight optics, electronic, and mechanical interfaces to enable low power, uncooled IR sensor technology to be readily reconfigured for applications such as the individual soldier TWS or OCSW.
- Completed performance and design requirements and system concept modeling for cost effective targeting concepts.
- Performed data collection with long wave IR and SWIR sensors to support ATR algorithm development for unmanned ground vehicle (UGV) applications.
- Conducted field tests and demonstrated the Laser Illumination Viewing and Ranging system to the Dismounted Battlespace Battle Lab.
- 3653 - Fabricated a model Congressional special interest effort for fire fighting and damage control systems.
- Demonstrated and conducted user evaluations of fire fighting and damage control systems with military and civilian forces.

Total 21531

FY 2002 Planned Program

- 7740 - Integrate networked sensors into two man-in-the-loop simulations at the Mounted Maneuver Battle Lab and use with field experimentation to determine optimal mix of unattended sensors in order to provide beyond line of sight situational awareness and targeting.
- Integrate sensor information from suite of sensors deployed on unmanned platforms including surrogate small unmanned air vehicles (UAVs), UGV and unattended ground sensors that provide situational awareness and targeting data to tactical commanders.
- Construct command and control tools in order to optimize sensor deployment and data management.
- Complete preliminary design for cost effective targeting concepts by incorporating advanced, uncooled FLIR, SWIR, and microlaser technologies for UGVs.
- Design sensor components, optics, and stabilized gimbal assemblies in order to meet cost effective targeting concept cost goals.
- Perform data collection with latest sensor configurations for ATR algorithm development. Design processing architecture for UGV platform implementation.
- 3945 - Conduct demonstration of wide area, automatic target detection/recognition algorithm and hypothesis tracker using multispectral sensor suite.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603710A - NIGHT VISION ADVANCED TECHNOLOGY

PROJECT

K70

FY 2002 Planned Program (Continued)

- Complete hardware and algorithm development of acoustic sensors and demonstrate the performance.
- Integrate eye safe laser rangefinder and wide area search modes.
- 5960 - Fabricate model thermal imaging modules with high pixel density.
- Demonstrate imagery technology through laboratory characterization and data collection.
- 1753 - Establish performance and design requirements, system interoperability, and system modeling/simulation specifications for a head tracked SA sensor suite. Incorporate state of the art thermal imaging, image intensifier, fusion, and laser technologies for closed hatch operations to order to increase SA.
- Perform simulation of the gimbal mounted technologies of the head tracked system.
- Complete design of the head-tracked breadboard.
- 820 - Construct architecture for sensor integration, access, and management schema (SIAMS) to enable seamless access to tactical sensor data from Army and joint Command, Control, Communications, Computers and Intelligence systems using joint intelligence, surveillance, and reconnaissance (JISR) information agent technology.
- Provide sensor simulations to support development of JISR information agent software and warfighter simulation exercises.
- 1200 - This one year Congressional add is to mature a helmet mounted infrared sensor system. No additional funding is required to complete this project.
- 3000 - This one year Congressional add demonstrates combined/fused image intensification and thermal imagery. No additional funding is required to complete this project.

Total 24418

FY 2003 Planned Program

- 9122 - Design and begin fabrication of next generation unattended ground sensors with day/night imaging capabilities.
- Complete system trades and define baseline sensor architecture and data management systems for Objective Force sensors network.
- Investigate improved information processing to reduce false alarms and increase target acquisition probabilities for sensor networks.
- Complete detailed design and modeling of cost effective targeting concept of gimbal configuration for ground platform applications in support of Sensors for the Objective Force.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603710A - NIGHT VISION ADVANCED TECHNOLOGY

PROJECT

K70

FY 2003 Planned Program (Continued)

- Fabricate and test cost effective targeting concepts for sensor component hardware.
 - Build and test sensor models on surrogate small UAVs and UGVs.
 - Increase number of nodes in unattended ground sensor network. Demonstrate cross-cueing and C2 tools.
 - 2206 - Complete integration of MFS3 hardware into testbed platforms.
 - Conduct demonstration of MFS3 testbed in order to validate exit criteria for wide area search with multispectral ATR and long range passive target identification.
 - 4188 - Complete maturation of a model high pixel density thermal imaging camera and self contained weapon sight.
 - Demonstrate imagery technology through laboratory characterization and field data collection including live fire.
 - 2160 - Demonstrate capability of critical components used in the head tracked system for achieving closed hatch SA and connectivity for coordinated fights.
 - Complete head tracked breadboard technology and prove out user demonstration.
 - 453 - Provide sensor and SIAMS simulation support to JISR demonstration and evaluation in warfighter exercises.
- Total 18129

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603710A - NIGHT VISION ADVANCED TECHNOLOGY	PROJECT K86					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
K86 NIGHT VISION, ABN SYS	11733	9523	9596	9570	9434	11851	12417

A. Mission Description and Budget Item Justification: This project matures and demonstrates intelligence, surveillance, reconnaissance, targeting, and pilotage technologies in support of the Army's Objective Force airborne platforms. The goal is to significantly increase Army aviation survivability during nap-of-the-earth flights, day/night operations, and operations under adverse weather conditions. The technology efforts focus on improved night pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (ATR) capabilities for current and future helicopters (attack, scout, cargo, and utility). This project will potentially enhance distributed ground sensor networks by maturing a mini-class unmanned air vehicle (UAV) platform. Technologies will address automated flight control and ultra-light payloads. The air/land enhanced reconnaissance and targeting advanced technology demonstration (ATD) will display an on-the-move search, using a forward looking infrared (FLIR)/laser sensor suite. The advanced night vision goggles (ANVG) ATD demonstrates a lightweight, low cost, and panoramic night pilotage and driving capability for the soldier. The multi-mission common module UAV sensor ATD demonstrates a high performance electro-optic/infrared (EO/IR) payload, for transition to Program Manager, Program Manager Tactical UAV (PM TUAV), Night Vision Reconnaissance, Surveillance and Tactical Awareness (PM NVRSTA). Technologies matured under this project are also applicable to night flying requirements of the other Services and the Special Operations Command's rotary wing aircraft. This project supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 1480 - Fabricated sensor mockups for cockpit/equipment integration evaluations of the ANVG.
 - Completed critical design and began fabrication of air warrior version of ANVG sensor package.
 - Completed concept design of ground version of ANVG with thermal insert.
- 1925 - Integrated multi-mission UAV sensors on manned platform. Conducted instrumented flight-testing under dynamic flight conditions. Verified functionality of the payloads and down links.
 - Integrated high performance EO/IR and multi-hyperspectral sensor payloads on tactical UAV/manned reconnaissance platforms. Conducted operational demonstration and user warfighting experiments to support military assessments.
 - Matured and transitioned performance and technical design data to PM NVRSTA and PM TUAV. Supported final development of operational requirements and engineering specifications for TUAV Block 2 procurement.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603710A - NIGHT VISION ADVANCED
TECHNOLOGY**

PROJECT

K86**FY 2001 Accomplishments: (Continued)**

- 2560 - Completed integration of air/land enhanced reconnaissance and targeting technologies with demonstration aircraft. Conducted airborne flight evaluations to demonstrate increased operational benefits derived from ATR algorithm enhancements when performing search on-the-move, target acquisition, defilade/obscured and extended range target cueing.
 - Integrated multi-function laser with electro optic target acquisition sensor onto aircraft platform. Conducted performance demonstration and data collection.
 - Demonstrated rapid target insertion/algorithm training process to achieve automatic cueing against new/emerging target threats.
 - Matured and transitioned, performance and technical design data to support technology insertions decision by Program Evaluation Office Aviation platform managers.
 - Demonstrated and evaluated candidate future combat system (FCS) high performance on-board sensor combination.
- 5768 - Completed design and fabrication of man-portable small unmanned aerial vehicle (SUAV) platform for a Congressional interest effort.
 - Completed development and fabrication of launcher and ground control station for SUAV system.
 - Conducted assessment on infrared cameras for SUAV application.
 - Conducted field assessment and studies of SUAV operations to assess overall capabilities required for system integration into FCS concept strategy.

Total 11733

FY 2002 Planned Program

- 3713 - Conduct initial development and integration of FLIR with ANVG for ground applications.
 - Conduct field studies to quantify the value of additional field of view for ground applications and the benefits of infrared overlay.
 - Conduct flight test and evaluation of air version of ANVG.
- 810 - Implement sensor integration, access and management schema (SIAMS) architecture in a simulation environment. Demonstrate the capability to access and query, platform sensor data from the Army and Joint Command, Control, Communications, Computers and Intelligence systems.
 - Document SIAMS protocol, database management and interface specifications.
 - Integrate and demonstrate SIAMS in the improved remotely emplaced battlefield acoustic, seismic, sensor and firefinder radar.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603710A - NIGHT VISION ADVANCED
TECHNOLOGY**

PROJECT

K86**FY 2002 Planned Program (Continued)**

- Provide improved resolution sensor simulations to support the development of Joint Intelligence, Surveillance and Reconnaissance (JISR) information agent software. Support JISR demonstration and evaluation in warfighter simulation exercises.

- 5000 - This one year Congressional add demonstrates a backpack unmanned aerial vehicle. No additional funding is required to complete this project.

Total 9523

FY 2003 Planned Program

- 2635 - Conduct pre-System Development and Demonstration activities for ANVG.
- Conduct miniaturization/retrofit of ground version of ANVG with thermal insert.
- Perform ground test and evaluation of integrated FLIR and image intensifiers ANVG for infantry applications.
- 6034 - Integrate sensor prototypes, networked communication and sensor data management to form a network of distributed sensors deployed on unmanned air and ground platforms.
- Execute a field demonstration of beyond-line-of-sight situational awareness and target acquisition capabilities using distributed sensor platforms with networked communications and command and control tools for optimized sensor and data management.
- 927 - Perform system design and sensor trade studies for a real time surveillance and tactical awareness system. Demonstrate an advanced sensor and ATR system providing targeting information at real time rates for manned and unmanned rotorcraft for the Objective Force.

Total 9596

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603728A - Environmental Quality Technology Demonstrations						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	10685	7292	8980	9854	7172	4778	5571
002 ENVIRONMENTAL COMPLIANCE TECHNOLOGY	1553	2697	1843	1441	679	1396	2027
025 POLLUTION PREVENTION TECHNOLOGY	0	0	847	2403	3285	3382	3544
03E ENVIRONMENTAL RESTORATION TECHNOLOGY	0	1095	6290	6010	3208	0	0
03F CORROSION MEASUREMENT AND CONTROL	9132	0	0	0	0	0	0
EM3 PROTON EXCHANGE MEMBRANE FUEL CELL DEMO	0	3500	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to mature and demonstrate technologies which will assist Army installations in becoming environmentally compatible without compromising the readiness or training critical to the success of the Objective Force. This program includes technology demonstrations for: restoration of sites contaminated with toxic and/or hazardous materials (such as unexploded ordnance [UXO]) resulting from Army operations; pollution prevention to minimize the Army's use and generation of toxic chemicals and hazardous wastes; compliance with environmental laws by control, treatment, and disposal of hazardous waste products; and conservation of natural and cultural resources while providing a realistic environment for mission activities. This program will include demonstrations of proof of technological feasibility and assessment of operability and producibility that would lead to a capability for Army use, and includes technology transition from the laboratory to operational use. The program is supported by the Office of the Secretary of Defense's Technology Area Review and Assessment process. This program element develops and demonstrates technology to improve the Army's ability to achieve environmental restoration and compliance at its installations, at active and inactive ranges, and its rework and production facilities. Technologies demonstrated will focus on reducing the cost of remediation of Army sites contaminated by hazardous/toxic materiel. Other technologies will focus on reducing the cost of treating hazardous effluents from Army installations including ammunition plants, depots, and arsenals to satisfy increasingly stringent wastewater and air pollutant discharge standards. Army facilities are now subject to fines and facility shutdowns for violation of Federal, state, and local air and wastewater discharge regulations. These technologies are essential for cost-effective removal, control and reduced generation of wastes to satisfy hazardous waste cleanup and reduction goals, and to avoid future hazardous waste site cleanup and disposal costs and liabilities to the Army. Efforts under this program element will enable the Army's Objective Force to prevent pollution of the air, soil, and groundwater at installations, ranges, facilities, operations and to comply with the myriad of Federal, state, and host country regulations dealing with contaminated soil, groundwater, wastewater, air emissions, and solid wastes. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments.

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

February 2002

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603728A - Environmental Quality Technology Demonstrations

Work is performed by the U.S. Army Engineer Research and Development Center and the U.S. Army Materiel Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	11013	4826	9002
Appropriated Value	11116	7326	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-34	0
b. SBIR / STTR	-328	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-103	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	-22
Current Budget Submit (FY 2003 PB)	10685	7292	8980

Program Change Summary Explanation:

Significant Change:

FY02 (+\$2500) - Includes a Congressional reduction (-\$1000) in Environmental Restoration Technology, Project 03E, and a Congressional add (+\$3500) for Proton Exchange Membrane (PEM) Fuel Cell Demonstration, Project EM3. (Note: only for the demonstration of domestically produced PEM fuel cells on military facilities).

Projects with no R-2As include:

- (\$3500) Proton Exchange Membrane (PEM) Fuel Cell Demonstration, Project EM3: The objective of this one year Congressional add is to purchase, test, demonstrate and validate domestically produced PEM fuel cells for military applications. No additional funding is required to complete this project.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603728A - Environmental Quality Technology Demonstrations	PROJECT 002					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
002 ENVIRONMENTAL COMPLIANCE TECHNOLOGY	1553	2697	1843	1441	679	1396	2027

A. Mission Description and Budget Item Justification: The objective of this project is to mature and demonstrate technology for achieving environmental compliance at Army installations. Technology demonstrated within this project focuses on reducing the cost of treating hazardous effluents from Army installations including ammunition plants, depots and arsenals to satisfy increasingly stringent wastewater and air pollutant discharge standards. Army facilities are now subject to fines and facility shutdowns for violation of Federal, state, and local air and wastewater discharge regulations. This technology is essential to control and reduce the generation of wastes to satisfy hazardous waste reduction goals, and to avoid future hazardous waste disposal costs and liabilities to the Army. Efforts under this project will enable the Army to prevent pollution at installations while complying with the myriad of Federal, state, and host country regulations dealing with hazardous wastewater, air emissions, and solid wastes. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 864 - Demonstrated optimal selection of overcoatings and overcoating procedures resulting in a potential cost avoidance of up to 20 percent over current technologies.
- 689 - Demonstrated activated carbon fiber cloth absorber at McAlester Army Ammunition Plant for control of hazardous organic solvents.

Total 1553

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603728A - Environmental Quality Technology
Demonstrations**

PROJECT

002

FY 2002 Planned Program

- 1021 - Demonstrate in-situ extraction technologies for lead in soil to reduce lead levels to below the Environmental Protection Agency's level of concern (400ppm).
- 1676 - Demonstrate hazardous organic solvent emissions technologies to remove 95 percent of Hazardous Air Pollutants (HAP) and 20 percent cost reduction (baseline - 10,000 cfm unit at \$65/cfm).

Total 2697

FY 2003 Planned Program

- 661 - Demonstrate lead removal technologies that result in non-hazardous waste that leaches less than 5ppm lead.
- 1182 - Demonstrate optimized High Efficiency Particulate Air (HEPA)/carbon filter control schema for hazardous waste incineration in support of chemical demilitarization.

Total 1843

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603728A - Environmental Quality Technology Demonstrations	PROJECT 03E					
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
03E ENVIRONMENTAL RESTORATION TECHNOLOGY	0	1095	6290	6010	3208	0	0

A. Mission Description and Budget Item Justification: The objective of this project is to mature and demonstrate new and improved techniques for the restoration of Army sites contaminated with toxic and/or hazardous materials including unexploded ordnance (UXO). This project develops and demonstrates technology to improve the Army's ability to achieve cost-effective environmental restoration of contaminated sites at its installations, active and inactive ranges, and its rework and production facilities. Technologies demonstrated within this project focus on reducing the cost of remediation of Army sites contaminated by hazardous/toxic material and are directly linked to RDT&E Budget Activity 2 technology products originating from program element 0602720A, projects F25 and 835. These technologies are essential for cost-effective removal of hazardous and toxic chemicals and other contaminants to satisfy hazardous waste cleanup goals. Efforts under this project will enable the Army to prevent pollution of the air, soil, and groundwater at installations, ranges, facilities operations, and to comply with the myriad of Federal, state, and host country regulations dealing with contaminated soil and groundwater. This program includes demonstrations of proof of technological feasibility and assessments of operability and productivity that would lead to a capability for Army use, and includes technology transition from the laboratory to demonstration/validation funded under RDT&E program element 0603779A, project 04E. The program is supported by the Office of the Secretary of Defense's Technology Area Review and Assessment process. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:
 Project not funded in FY 2001.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603728A - Environmental Quality Technology Demonstrations

PROJECT

03E

FY 2002 Planned Program

- 547 - Conduct a demonstration of off-the-shelf UXO sensor fusion analysis methods and techniques for UXO detection/discrimination.
- Conduct a demonstration of predictive tools for UXO multi-contaminant transport processes in various earth media.
- 548 - Formulate a predictive model demonstration to determine explosives toxicity for avian and marine species.

Total 1095

FY 2003 Planned Program

- 2133 - Formulate a demonstration plan for a series of UXO detection/discrimination multi-sensing and processing methods, each tailored to a specific set of site environmental conditions.
- Complete a demonstration of off-the-shelf UXO sensor fusion analysis methods and techniques integrating advanced UXO sensor fusion analysis algorithms to be applied to developing UXO detection/discrimination sensing capabilities.
- Continue demonstration of an integrated suite of UXO detection multi-sensing and processing modes optimized for site-specific environmental characteristics.
- Demonstrate an optimized multi-sensor and data fusion analysis UXO detection/discrimination system.
- 4157 - Complete a demonstration of a predictive model to determine explosives toxicity for avian and marine species.
- Formulate a demonstration of a multi-species model for multi-contaminant pathways.
- Formulate and conduct a demonstration of a comprehensive model of UXO fate and transport as part of the Army Risk Assessment and Modeling System (ARAMS).
- Conduct demonstration of integrated bioaccumulation kinetics and toxicity parameters for terrestrial populations as part of ARAMS.
- Introduce multi-species/multi-contaminant pathways model as part of ARAMS demonstration.
- Introduce hazard/risk assessment linkage models for multi-terrestrial and aquatic ecosystems as part of ARAMS demonstration.
- Formulate and conduct a demonstration of fully functional multi-media version of the ARAMS.

Total 6290

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603734A - Military Engineering Advanced Technology						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	5006	4705	2921	10004	8831	5556	6233
T08 COMBAT ENG SYSTEMS	5006	4705	2921	10004	8831	5556	6233

A. Mission Description and Budget Item Justification: The objective of this program element is to mature and demonstrate technologies that provide capabilities required for the engineer and logistician to successfully plan, rehearse and execute missions in support of the Objective Force. Critical deficiencies exist in the Army's ability to rapidly acquire, update, maintain and distribute terrain data in support of both terrain and battlefield visualization; to apply physics-based reasoning to planning and executing mobility, counter-mobility, survivability, and general engineering missions; to conduct logistics -over-the-shore operations in adverse sea states; to establish in-transit visibility of materiel and supplies; and to manage logistics distribution and logistics automation. The demonstration projects in this program element focus on the technologies required to correct these critical deficiencies. Capabilities demonstrated will be applicable to missions at all echelons within the force structure during either combat operations or operations other than war. Demonstrations are integral components of Army Advanced Warfighting Experiments, Advanced Concept Technology Demonstrations, other Advanced Technology Demonstrations, and joint field training exercises. Emphasis is placed on rapid transition of technologies into Command and Control (C2) systems, combat models and simulations or simulators. This provides shared situational awareness, common representation of terrain and consistent predictions or assessments of mobility, counter-mobility, survivability, and logistics missions in the linkage of C2 systems, models, and simulations being developed by the Army to exploit information technologies. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

February 2002

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603734A - Military Engineering Advanced Technology

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	5160	4747	2927
Appropriated Value	5207	4747	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-42	0
b. SBIR / STTR	-154	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-47	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	-6
Current Budget Submit (FY 2003 PB)	5006	4705	2921

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603734A - Military Engineering Advanced Technology	PROJECT T08
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T08 COMBAT ENG SYSTEMS	5006	4705	2921	10004	8831	5556	6233

A. Mission Description and Budget Item Justification: The objective of this project is to mature and demonstrate advanced military engineering technologies that support the Objective Force. Enhanced Coastal Trafficability and Sea State Mitigation demonstrates an improved capability to conduct logistics-over-the-shore (LOTS) operations in support of the Army's force projection goals. The inability to operate in rough seas and over soft beaches currently limits LOTS operations. A Rapidly Installed Breakwater (RIB) mitigates severe seas and mechanical reinforcement stabilizes the beach. This results in a 60% increase in throughput. Joint Rapid Airfield Construction (JRAC) demonstrates the expedient upgrading of existing airfields. Current construction technologies take too long. JRAC's terrain based site selection algorithms, computer assisted construction equipment, and fast curing soil stabilization chemical technologies support Army force projection goals. The time required to double the throughput of a minimal airfield will be reduced from four to two days. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 3060 - Designed RIB XM 2001 (two segments aligned in a single leg) to include: fabrication of two interchangeable RIB segments and connectors; design, procurement, and testing of mooring system for RIB XM 2001; demonstration of RIB employment alternative(s).
- 395 - Completed final design of RIB Nose Section and initial design of RIB employment/deployment system.
- 251 - Completed final design of the Advanced Technology Demonstration (ATD) RIB to be used in FY 2002.
- 200 - Completed plans for FY 2002 ATD.
- 1100 - Provided plan, acquired materials for FY 2002 ATD sandy beach stabilization demonstration. Constructed demonstration beach road using three technologies that will be used in next year's ATD.

Total 5006

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603734A - Military Engineering Advanced
Technology**

PROJECT

T08**FY 2002 Planned Program**

- 3689 - Perform ATD Field Demonstration to include: fabrication of additional interchangeable RIB Segments; deployment of full scale partial length RIB; and employment/recovery of RIB by barge system.
- 396 - Design, procure, and deploy ATD RIB mooring system.
- 298 - Demonstrate ATD Beach Stabilization Technology.
- 322 - Design ATD RIB System and Beach Stabilization methodology.
- Fabricate additional segments to be used with the engineering development model tested in FY 2001.

Total 4705

FY 2003 Planned Program

- 998 - Select promising new construction technologies to enhance airfield construction productivity.
- 998 - Determine stabilizer technologies suitable for rapid stabilization of unsurfaced airfields.
- 925 - Select geospatial terrain visualization software, remote sensing techniques, and engineering requirements analysis procedures to support performance-based site selection of in-theater airfields.

Total 2921

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603772A - Advanced Tactical Computer Science and Sensor Tech						
COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Total Program Element (PE) Cost	16537	16366	21674	21794	23159	29030	31316
101 TACTICAL AUTOMATION	11537	13290	17911	16469	16376	20999	22589
243 SENSORS & SIGNALS PROC	5000	3076	3763	5325	6783	8031	8727

A. Mission Description and Budget Item Justification: This Program Element (PE) supports information dominance for the Army's Objective Force. It will allow forces to more effectively transfer and display digital information around the battlefield. The PE provides architectures and products to correct command and control (C2) deficiencies affecting rapid mobile operations. It addresses technologies necessary for integrated battlefield situational awareness (SA), force synchronization, data correlation, tactical surveillance, and combat identification. Additionally, the technologies support split-based, and on-the move (OTM) C2 operations. It also has application to radar/signal processing. Technology solutions from this PE will be demonstrated in the Agile Commander Advanced Technology Demonstration (ATD) and the Logistics C2 (Log C2) ATD. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. Work in this PE is related to and fully coordinated with PE 0602783A (Computer and Software Technology), PE 0602782A (Command, Control and Communications Technology), and PE 0602120A (Sensors and Electronic Survivability). The PE contains no duplication with any effort within the Military Departments. Work is performed by the US Army Communications-Electronics Command (CECOM), Fort Monmouth, NJ. This program supports the Objective Force transition path outlined in the TCP.

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

0603772A - Advanced Tactical Computer Science and Sensor Tech

<u>B. Program Change Summary</u>	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	15470	18513	20333
Appropriated Value	15613	16513	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-147	0
b. SBIR / STTR	-256	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	1323	0	0
e. Rescissions	-143	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	1341
Current Budget Submit (FY 2003 PB)	16537	16366	21674

Program Change Summary Explanation:

Significant Change:

FY02 (\$-2000) Congressional reduction in Project 101, GCSS Demonstration.

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

February 2002

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603772A - Advanced Tactical Computer Science and Sensor Tech	PROJECT 101
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COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
101 TACTICAL AUTOMATION	11537	13290	17911	16469	16376	20999	22589

A. Mission Description and Budget Item Justification: This program provides improved architectures and products for Objective Force information dominance. Program goals include improved force synchronization and reduced fratricide. This PE matures technologies necessary for display of a common view of the battlefield. It matures advanced computer science and technology (S&T) solutions addressing: (1) digital transfer and display of horizontal battlefield situational awareness (SA); (2) synchronization of combined and joint force operations; and (3) command and control (C2) on-the-move (OTM). This project researches and investigates key technologies in the following areas: automated decision support; advanced database development and distribution; data compression; dynamic digital display and manipulation; web-based architectures; and automated navigation/geopositioning. The Agile Commander ATD will demonstrate digital hardware and software technologies that provide agile, rapidly deployable, split-based C2 operation. The Logistics C2 ATD will mature course of action (COA) analysis and support software tools for combat service support and operational commanders. Joint developer/warfighter demonstrations will be conducted in coordination with the mounted, dismounted, battle command and combat service support battle labs. Products will be transitioned to the Program Executive Offices for integration. This project supports the Objective Force transition path of the TCP.

FY 2001 Accomplishments:

- 4362 - Demonstrated deliberate COA software with logistics data inputs and automatic alerts for rapid replanning and decision support software in the laboratory.
- Optimized weapon system management based on current fuel and ammunition levels to improve readiness and resource utilization.
- 5852 - Demonstrated initial semi-automated COA and course of action analysis (COAA) tools for dispersed, highly mobile and on-the-move (OTM) operations in the laboratory.
- Demonstrated a Microsoft Windows-based version of the advanced field artillery tactical data system.
- Matured and demonstrated initial terrain reasoning capability.
- 323 - Demonstrated a prototype collaborative planning capability by providing two logistics asset classes and operating integrated agent architecture of the Defense Advanced Research Projects Agency (DARPA) advanced logistics project with a tactical knowledge base for COAA.
- 1000 - Prepared pre-milestone B documentation and requested award proposal for system integration and demonstration of the warrior information network-tactical.

Total 11537

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603772A - Advanced Tactical Computer Science
and Sensor Tech**

PROJECT

101

FY 2002 Planned Program

- 3581 - Demonstrate logistics COA development software and intelligent agents in an advanced warfighting experiment or National Training Center rotation.
 - Demonstrate decision support software tools for combat commanders to plan crewing.
- 7348 - Demonstrate advanced COA generation software tools to support battle management and enable the commander to rapidly develop and compare courses of action in a collaborative environment that supports parallel planning at different echelons.
 - Develop initial mobile adaptive computing software.
 - Demonstrate prototype human-computer interface suite that integrates voice recognition with other modalities and includes high information content displays.
- 2361 - Evolve performance requirements for a common C2 and intelligence database to provide tactical forces a real-time, integrated Red and Blue forces picture with the capability to drill down to the underlying sensor data.
 - Define battlespace visualization requirements.
 - Adapt COA tools, traditionally designed for the maneuver commander, to integrate C2, intelligence and resource allocation data to reduce workload of mission planners.

Total 13290

FY 2003 Planned Program

- 6493 - Demonstrate reconstitution decision support software.
 - Transition COA and decision support software to CSSCS and automated data input software to Brigade and Below.
- 8461 - Mature DARPA Command Post of the Future (CPoF) visualization/presentation technologies.
 - Demonstrate COAA and wargaming capabilities and web-based intelligent agents for execution monitoring.
 - Demonstrate a scaleable and re-configurable command, control, communications, computer and intelligence (C4I) multi-role operator environment.
 - Integrate scaleable communications capabilities with mobile adaptive computing software, ensuring C2 under varying operating conditions.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)**February 2002**

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603772A - Advanced Tactical Computer Science
and Sensor Tech**

PROJECT

101**FY 2003 Planned Program (Continued)**

- 2957 - Demonstrate an integrated common C2 and intelligence database, battlespace visualization products and COA development tools that provide tactical forces a real-time Red and Blue forces picture with drill down capability to underlying sensor data.

Total 17911

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

February 2002

BUDGET ACTIVITY

3 - Advanced technology development

PE NUMBER AND TITLE

**0603772A - Advanced Tactical Computer Science
and Sensor Tech**

PROJECT

243

FY 2002 Planned Program

- 1276 - Conduct preliminary design review for the multi-mission radar program and develop simulation plan.
- 1800 - Conduct verification test to evaluate the achieved performance and determine the readiness of a FOPEN SAR for participation in an operational demonstration.
 - Conduct user tests to demonstrate the real-time application of a FOPEN SAR to meet the need of an all weather detection of concealed threat targets.
 - Demonstrate/validate the concept of operation to use the FOPEN SAR in support of potential users such as European Command and Southern Command.

Total 3076

FY 2003 Planned Program

- 3763 - Complete system design for the multi-mission radar.
 - Begin development of hardware (antenna, high speed/high through-put radar processor) and software (target classification, mission sorting algorithms).
 - Complete test and demonstration plans and conduct critical design review.

Total 3763

End of P&R Forms Report

Who: Mr James Glidewell When: 13-Feb-02 03:36 PM

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- * Commander, US Army Medical R&D Command, ATTN: SGRD-PR, Fort Detrick, Frederick, MD 21701-5012
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- * Commander, US Army Materiel Command, ATTN: AMCRD-AB, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001
- * Commander, US Army Materiel Command, ATTN: AMCAE-P, 5001 Eisenhower Avenue, Alexandria, VA 22333

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- * Commander, US Army Chemical Research, Development and Engineering Center, ATTN: SMCCR-CG, Aberdeen Proving Ground, MD 21010-5423
- * Commander, US Army Aviation and Troop Command, ATTN: AMSAT-D-C, 4300 Goodfellow Blvd, St. Louis, MO 63120-1798
- * Program Manager, Instrumentation, Targets and Threat Simulators, ATTN: AMCPM-ITTS, 12350 Research Parkway, Orlando, FL 32826-3276
- * Program Manager, Tank Main Armament Systems, ATTN: AMCPM-TMD PMD, Picatinny Arsenal, NJ 07805-5000
- * Program Executive Officer, Missile Defense, ATTN: SFAE-MD-HSV-R, Building 5250, Redstone Arsenal, Alabama 35898-5750
- * Program Executive Officer, Field Artillery Systems, ATTN: SFAE-FAS, Building 171, Picatinny Arsenal, Picatinny, NJ

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 - * Program Executive Officer, Tactical Wheeled Vehicles, ATTN: SFAE-TWV, Warren, MI 48397-5000
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 - * Program Executive Officer, Intelligence and Electronic Warfare, ATTN: SFAE-IEW-BM, Ft. Monmouth,
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35807-3801
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