Department of Defense
Fiscal Year (FY) 2012 Budget Estimates

February 2011

Army

Justification Book Volume 1

Research, Development, Test & Evaluation, Army

Volume 1 Table of Contents

FY 2012 RDT&E, ARMY
PROGRAM ELEMENT DESCRIPTIVE SUMMARIES

Introduction and Explanation of Contents

1. General. The purpose of this document is to provide summary information concerning the Research, Development, Test and Evaluation, Army program. The descriptive summaries are comprised of R-2 (Army RDT&E Budget Item Justification – program element level), R-2A (Army RDT&E Budget Item Justification – project level), R-3 (Army RDT&E Cost Analysis), R-4 (Schedule Profile Detail) and R-5 (Termination Liability Funding for MDAPs) Exhibits, which provide narrative information on all RDT&E program elements and projects through FY 2012.

2. Relationship of the FY 2012 Budget Submitted to Congress to the FY 2011 Budget Submitted to Congress. This paragraph provides a list of program elements/projects that are major new starts, restructures, developmental transitions, newly established, terminated or for which funding existed in the FY 11 budget but no longer exists in the FY 12 budget. Explanations for these changes can be found in the narrative sections of the Program Element R-2A Exhibits.

A. New Start Programs:

PE/PROJECT	PE TITLE	PROJECT TITLE
0604115/DS3	Technology Maturation Initiatives	Technology Maturation Initiatives
0203735/DS5	Combat Vehicle Improvement Program	Armored Multi Purpose Vehicle (AMPV)
0604808/434	Close Combat Capabilities Eng Dev	Anti-Personnel Landmine Alternatives
0603820/D20	UAS Modifications/Product Imp Prg	VTOL MODS/PIP
0603807/VS7	Medical Systems Advanced Dev	MEDEVAC Mission Equipment Package
0603817/S52	Soldier Systems – Adv Dev	Soldier Support Equipment – AD
0604270/VS6	EW Development	Integrated Electronic Warfare Sys
0604818/JN1	Army Tac Comm & Cont Hardware And Software	*Joint Network Node (JNN) Testing
0604820/E10	Radar Development	Sentinel
0203726/33C	Advanced Field Artillery Tactical Data System	Improved Position Azimuth Determining System (IPADs)
0303141/VU2	Global Combat Support System	Installation Fixed Base (IFB)

*Program Re-start

B. Program Element/Project Restructures:

Old PE/Project	New Project Title	New PE/Project
0601104/J22	Network Science and Technology Research Center	0601104/H50
0602787/878	Warfighter Health Prot and Perf Stds	0602787/869
0602787/879	Warfighter Health Prot and Perf Stds	0602787/869
0603005/C66	Tractor Nail	0603130/DS8
0603006/DF7	Tractor Eggs	0603131/DS9
0603308/978	Tractor Jute	0604131/DT1
0604270/L20	Common Missile Warning System (CMWS)	0604270/VU7
	Common Infrared Counter Measure (CIRCM)	0604270/VU8
0604805/589	Army Sys Engineering & Warfighting	0604805/593
0305204/114	RQ-7 Shadow UAV	0305233/RQ7
0305204/D10	RQ-11 Raven (MIP)	0305232/RA7
0604710/L76	Dismounted Fire Support Laser Targeting System	0604710/L79
0604817/482	Ground Combat ID	0604284/VU4
0605605/E97	DOD HELSTF	0605601/F30
0605857/061	Material Sustainment Support AD	0603804/K42
0203759/122	Joint Battle Command – Platform	0604805/593
0203801/DF8	Tractor Barn	0203808/DS1
0203801/DF9	Tractor PUMA	0203808/DS2

C. Developmental Transitions:

Old PE/Project	New Project Title	New PE/PROJECT
0603804/L04	Joint Light Tactical Vehicles (JLTV) – SD	0604804/L50
0603827/S49	Ground Soldier Ensemble	0604827/S75

D. Establishment of new FY 2012 Program Elements/Projects. (Does not include any major new starts)

TITLE	PE/PROJECT
Surface Science Research	0601102/VR9
Center for Advanced Research	0601104/VS2
Expeditionary Mobile Base Camp Technology	0602786/VT4
Expeditionary Mobile Base Camp Demonstration	0603001/VT5
Tractor Nails	0603130/DS8

Tractor Eggs	0603131/DS9
*High Performance Computing Modernization Program	0603461/DS7
Tractor Jute	0604131/DT1
Soldier Protective Equipment	0603827/VS4
Combat Service Support Systems – AD	0603804/VR8
Joint Effects Targeting Systems (JETs)	0604710/L79
Combat Service Support Systems	0604804/VR7
TWV Protection Kits	0604622/VR5

*transferred from RDT&E,DW PE 0603755D8Z

E. Program Terminations.

TITLE	PE/PROJECT
Electric Gun Technology	0602618/H75
Aircraft Weapons	0603003/435
BCT Non-Line-of-Sight Launch System	0604646/F72
BCT Reconnaissance (UAV) Platforms	0604662/FC3
Close Combat Capabilities Eng Dev	0604808/016

F. Programs for which funding existed in the FY 11 budget but no longer exists in the FY 12 budget.

PE/PROJECT	TITLE	Brief Explanation
0601104/J22	Network Science & Tech Res	Restructure to 0601104/H50
0602618/H75	Electric Gun Tech	Termination
0602787/878	Hlth Haz Mil Material	Restructure to 0602787/869
0602787/879	Med Fact Enh Sold Eff	Restructure to 0602787/869
0603003/435	Aircraft Weapons	Termination
0603005/C66	DC66	Restructure to 0603130/DS8
0603006/DF7	DF7	Restructure to 0603131/DS9
0603308/978	Space Control	Restructure to 0604131/DT1
0603804/K42	Material Sustainment Support	Transition to Army Supply System
0603804/L04	Jt Light Tact Vehicle (JLTV)-AD	Transition to 0604804/L50
0603827/S49	Ground Soldier System (GSS)	Transition to 0604827/S75
0604270/L20	ATIRCM/CMWS	Restructured to 0604270/VU7 & VU8
0604609/198	Target Defeating System	Completed R&D
0604609/200	Smoke/Obscurant System	Completed R&D
0604622/659	Family of Hvy Tac Veh	Transition to production

0604642/E40	LTV Prototype	Completed R&D
0604646/F72	BCT NLOS Launch Sys	Termination
0604710/L76	Dismounted Fire Support Laser Targeting System	Restructured to 0604710/L79
0604804/L47	Improved Environmental Control Unit	Transition to production
0604805/589	Army Sys Engr & Warfighting	Restructured to 0604805/593
0604808/016	Close Combat Capabilities ED	Termination
0604817/482	Ground Combat ID	Restructured to
0605013/087	Distributed Learning System	Transition to production
0604662/FC3	BCT Reconnaissance (UAV) Platforms	Termination
0605605/E97	DOD HELSTF	Restructured to 0605601/F30
0203759/122	Jt Battle Command Platform	Restructured to 0604805/593
0203801/DF8	DF8	Restructured to 0203808/DS1
0203801/DF9	DF9	Restructured to 0203808/DS2
0305204/114	Tactical Unmanned Aerial Vehicles (MIP)	Restructured to 0305233/RQ7
0305204/D10	SUAV (MIP)	Restructured to 0305233/RA7
0305208/D15	MUSE & TES TADSS (MIP)	Completed R&D

3. **Classification:** This document contains no classified data Appropriately cleared individuals can obtain further information on Classified/Special Access Programs by contacting the Department of the Army (ASA(ALT)) Special Programs Office.

4. **Performance Metrics.** Performance metrics may be found in the Department's Performance Budget Justification Book, dated February 2012.

Department of the Army

FY 2012 RDT&E Program

President's Budget 2012/13

Summary

Exhibit R-1

10-Feb-2011

Thousands of Dollars

Summary Recap of Budget Activities	FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
Basic research	420,190	406,873	436,920	0	436,920
Applied Research	1,321,605	841,364	869,332	0	869,332
Advanced technology development	1,366,194	696,592	976,812	0	976,812
Advanced Component Development and Prototypes	982,111	804,148	753,084	0	753,084
System Development and Demonstration	4,285,025	5,035,046	4,190,788	0	4,190,788
Management support	1,487,815	1,142,383	1,048,671	8,513	1,057,184
Operational system development	1,843,989	1,553,445	1,403,837	0	1,403,837
Total RDT&E, Army	11,706,929	10,479,851	9,679,444	8,513	9,687,957

Appropriation: 2040 A RDT&E, Army

10-Feb-2011

Line No	Program Element Number	Act	Item	Thousands of Dollars FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
			Basic research					
1	0601101A	01	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	19,278	21,780	21,064		21,064
2	0601102A	01	DEFENSE RESEARCH SCIENCES	196,921	195,845	213,942		213,942
3	0601103A	01	UNIVERSITY RESEARCH INITIATIVES	96,409	91,161	80,977		80,977
4	0601104A	01	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	107,582	98,087	120,937		120,937
			Total: Basic research	420,190	406,873	436,920	0	436,920
			Applied Research					
5	0602105A	02	MATERIALS TECHNOLOGY	88,022	29,882	30,258		30,258
6	0602120A	02	SENSORS AND ELECTRONIC SURVIVABILITY	82,449	48,929	43,521		43,521
7	0602122A	02	TRACTOR HIP	13,807	14,624	14,230		14,230
8	0602211A	02	AVIATION TECHNOLOGY	44,810	43,476	44,610		44,610
9	0602270A	02	ELECTRONIC WARFARE TECHNOLOGY	23,581	17,330	15,790		15,790
10	0602303A	02	MISSILE TECHNOLOGY	69,871	49,525	50,685		50,685
11	0602307A	02	ADVANCED WEAPONS TECHNOLOGY	19,906	18,190	20,034		20,034
12	0602308A	02	ADVANCED CONCEPTS AND SIMULATION	22,070	20,582	20,933		20,933
13	0602601A	02	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	79,649	64,740	64,306		64,306
14	0602618A	02	BALLISTICS TECHNOLOGY	73,456	60,342	59,214		59,214
15	0602622A	02	CHEMICAL, SMOKE AND EQUIPMENT DEFEATING TECHNOLOGY	8,706	5,324	4,877		4,877
16	0602623A	02	JOINT SERVICE SMALL ARMS PROGRAM	9,001	7,893	8,244		8,244
17	0602624A	02	WEAPONS AND MUNITIONS TECHNOLOGY	140,727	42,645	39,813		39,813
18	0602705A	02	ELECTRONICS AND ELECTRONIC DEVICES	134,946	60,859	62,962		62,962
19	0602709A	02	NIGHT VISION TECHNOLOGY	48,250	40,228	57,203		57,203
20	0602712A	02	COUNTERMINE SYSTEMS	27,892	19,118	20,280		20,280
21	0602716A	02	HUMAN FACTORS ENGINEERING TECHNOLOGY	30,395	21,042	21,801		21,801
22	0602720A	02	ENVIRONMENTAL QUALITY TECHNOLOGY	17,545	18,364	20,837		20,837
23	0602782A	02	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	31,691	25,573	26,116		26,116
24	0602783A	02	COMPUTER AND SOFTWARE TECHNOLOGY	9,896	6,768	8,591		8,591
25	0602784A	02	MILITARY ENGINEERING TECHNOLOGY	60,536	79,189	80,317		80,317

Appropriation: 2040 A RDT&E, Army

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
26	0602785A	02	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	16,358	22,198	18,946		18,946
27	0602786A	02	WARFIGHTER TECHNOLOGY	37,040	27,746	29,835		29,835
28	0602787A	02	MEDICAL TECHNOLOGY	231,001	96,797	105,929		105,929
	Total:		Applied Research	1,321,605	841,364	869,332	0	869,332
			Advanced technology development					
29	0603001A	03	WARFIGHTER ADVANCED TECHNOLOGY	51,596	37,364	52,979		52,979
30	0603002A	03	MEDICAL ADVANCED TECHNOLOGY	336,741	71,510	68,171		68,171
31	0603003A	03	AVIATION ADVANCED TECHNOLOGY	104,229	57,454	62,193		62,193
32	0603004A	03	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	92,638	64,438	77,077		77,077
33	0603005A	03	COMBAT VEHICLE AND AUTOMOTIVE ADVANCED TECHNOLOGY	261,689	89,499	106,145		106,145
34	0603006A	03	COMMAND, CONTROL, COMMUNICATIONS ADVANCED TECHNOLOGY	12,074	8,102	5,312		5,312
35	0603007A	03	MANPOWER, PERSONNEL AND TRAINING ADVANCED TECHNOLOGY	7,220	7,921	10,298		10,298
36	0603008A	03	ELECTRONIC WARFARE ADVANCED TECHNOLOGY	55,903	50,359	57,963		57,963
37	0603009A	03	TRACTOR HIKE	10,945	8,015	8,155		8,155
38	0603015A	03	NEXT GENERATION TRAINING & SIMULATION SYSTEMS	25,895	15,334	17,936		17,936
39	0603020A	03	TRACTOR ROSE	13,997	12,309	12,597		12,597
40	0603105A	03	MILITARY HIV RESEARCH	29,277	6,688	6,796		6,796
41	0603125A	03	COMBATING TERRORISM - TECHNOLOGY DEVELOPMENT	11,366	10,550	12,191		12,191
42	0603130A	03	TRACTOR NAIL			4,278		4,278
43	0603131A	03	TRACTOR EGGS			2,261		2,261
44	0603270A	03	ELECTRONIC WARFARE TECHNOLOGY	23,766	18,350	23,677		23,677
45	0603313A	03	MISSILE AND ROCKET ADVANCED TECHNOLOGY	83,649	84,553	90,602		90,602
46	0603322A	03	TRACTOR CAGE	11,741	9,986	10,315		10,315
47	0603461A	03	HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM			183,150		183,150
48	0603606A	03	LANDMINE WARFARE AND BARRIER ADVANCED TECHNOLOGY	35,765	26,953	31,541		31,541
49	0603607A	03	JOINT SERVICE SMALL ARMS PROGRAM	8,683	9,151	7,686		7,686
50	0603710A	03	NIGHT VISION ADVANCED TECHNOLOGY	81,157	39,912	42,414		42,414
51	0603728A	03	ENVIRONMENTAL QUALITY TECHNOLOGY DEMONSTRATIONS	16,584	15,878	15,959		15,959
52	0603734A	03	MILITARY ENGINEERING ADVANCED TECHNOLOGY	40,423	27,393	36,516		36,516

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
53	0603772A	03	ADVANCED TACTICAL COMPUTER SCIENCE AND SENSOR TECHNOLOGY	50,856	24,873	30,600		30,600
	Total:		Advanced technology development	1,366,194	696,592	976,812	0	976,812
			Advanced Component Development and Prototypes					
54	0603024A	04	UNIQUE ITEM IDENTIFICATION (UID)	1,990				
55	0603305A	04	ARMY MISSLE DEFENSE SYSTEMS INTEGRATION	80,079	11,455	36,009		36,009
56	0603308A	04	ARMY SPACE SYSTEMS INTEGRATION	126,189	27,551	9,612		9,612
57	0603327A	04	AIR AND MISSILE DEFENSE SYSTEMS ENGINEERING	165,515				
58	0603619A	04	LANDMINE WARFARE AND BARRIER - ADV DEV	29,399	15,596	35,383		35,383
59	0603627A	04	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ADV DEV	5,607	2,425	9,501		9,501
60	0603639A	04	TANK AND MEDIUM CALIBER AMMUNITION	33,202	42,183	39,693		39,693
61	0603653A	04	ADVANCED TANK ARMAMENT SYSTEM (ATAS)	96,269	136,302	101,408		101,408
62	0603747A	04	SOLDIER SUPPORT AND SURVIVABILITY	40,392	76,456	9,747		9,747
63	0603766A	04	TACTICAL ELECTRONIC SURVEILLANCE SYSTEM - ADV DEV	17,023	17,962	5,766		5,766
64	0603774A	04	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	8,000				
65	0603779A	04	ENVIRONMENTAL QUALITY TECHNOLOGY - DEM/VAL	20,203	4,695	4,946		4,946
66	0603782A	04	WARFIGHTER INFORMATION NETWORK-TACTICAL - DEM/VAL	164,014	190,903	297,955		297,955
67	0603790A	04	NATO RESEARCH AND DEVELOPMENT	4,848	5,060	4,765		4,765
68	0603801A	04	AVIATION - ADV DEV	13,177	8,355	7,107		7,107
69	0603804A	04	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	56,153	80,490	19,509		19,509
70	0603805A	04	COMBAT SERVICE SUPPORT CONTROL SYSTEM EVALUATION AND ANALYSIS	9,898	14,290	5,258		5,258
71	0603807A	04	MEDICAL SYSTEMS - ADV DEV	32,851	28,132	34,997		34,997
72	0603827A	04	SOLDIER SYSTEMS - ADVANCED DEVELOPMENT	75,833	48,323	19,598		19,598
73	0603850A	04	INTEGRATED BROADCAST SERVICE	1,469	970	1,496		1,496
74	0604115A	04	TECHNOLOGY MATURATION INITIATIVES			10,181		10,181
75	0604131A	04	TRACTOR JUTE			15,609		15,609
76	0604284A	04	JOINT COOPERATIVE TARGET IDENTIFICATION - GROUND (JCTI-G) / TECHNOLOG			41,652		41,652
77	0305205A	04	ENDURANCE UAVS		93,000	42,892		42,892
	Total:		Advanced Component Development and Prototypes	982,111	804,148	753,084	0	753,084

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
			System Development and Demonstration					
78	0604201A	05	AIRCRAFT AVIONICS	76,491	89,210	144,687		144,687
79	0604220A	05	ARMED, DEPLOYABLE HELOS	61,643	72,550	166,132		166,132
80	0604270A	05	ELECTRONIC WARFARE DEVELOPMENT	168,496	177,669	101,265		101,265
81	0604280A	05	JOINT TACTICAL RADIO		784			
82	0604321A	05	ALL SOURCE ANALYSIS SYSTEM	12,562	30,674	17,412		17,412
83	0604328A	05	TRACTOR CAGE	20,564	23,194	26,577		26,577
84	0604601A	05	INFANTRY SUPPORT WEAPONS	64,930	80,337	73,728		73,728
85	0604604A	05	MEDIUM TACTICAL VEHICLES	5,460	3,710	3,961		3,961
86	0604609A	05	SMOKE, OBSCURANT AND TARGET DEFEATING SYS - ENG DEV	939	5,335			
87	0604611A	05	JAVELIN		9,999	17,340		17,340
88	0604622A	05	FAMILY OF HEAVY TACTICAL VEHICLES	8,072	3,519	5,478		5,478
89	0604633A	05	AIR TRAFFIC CONTROL	8,453	9,892	22,922		22,922
90	0604642A	05	LIGHT TACTICAL WHEELED VEHICLES	1,140	1,990			
91	0604646A	05	NON-LINE OF SIGHT LAUNCH SYSTEM	88,205	81,247			
92	0604660A	05	FCS MANNED GRD VEHICLES & COMMON GRD VEHICLE	231,103				
93	0604661A	05	FCS SYSTEMS OF SYSTEMS ENGR & PROGRAM MGMT	847,011	568,711	383,872		383,872
94	0604662A	05	FCS RECONNAISSANCE (UAV) PLATFORMS	92,444	50,304			
95	0604663A	05	FCS UNMANNED GROUND VEHICLES	122,418	249,948	143,840		143,840
96	0604664A	05	FCS UNATTENDED GROUND SENSORS	39,664	7,515	499		499
97	0604665A	05	FCS SUSTAINMENT & TRAINING R&D	685,524	610,389			
98	0604710A	05	NIGHT VISION SYSTEMS - ENG DEV	56,992	52,549	59,265		59,265
99	0604713A	05	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	2,010	2,118	2,075		2,075
100	0604715A	05	NON-SYSTEM TRAINING DEVICES - ENG DEV	29,187	27,756	30,021		30,021
101	0604716A	05	TERRAIN INFORMATION - ENG DEV			1,596		1,596
102	0604741A	05	AIR DEFENSE COMMAND, CONTROL AND INTELLIGENCE - ENG DEV	32,450	34,209	83,010		83,010
103	0604742A	05	CONSTRUCTIVE SIMULATION SYSTEMS DEVELOPMENT	32,126	30,291	28,305		28,305
104	0604746A	05	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	11,737	14,041	14,375		14,375
105	0604760A	05	DISTRIBUTIVE INTERACTIVE SIMULATIONS (DIS) - ENG DEV	15,184	15,547	15,803		15,803
106	0604778A	05	POSITIONING SYSTEMS DEVELOPMENT (SPACE)	7,275				

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
107	0604780A	05	COMBINED ARMS TACTICAL TRAINER (CATT) CORE	25,241	27,670	22,226		22,226
108	0604802A	05	WEAPONS AND MUNITIONS - ENG DEV	99,626	24,345	13,828		13,828
109	0604804A	05	LOGISTICS AND ENGINEER EQUIPMENT - ENG DEV	35,046	41,039	251,104		251,104
110	0604805A	05	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ENG DEV	57,040	90,736	137,811		137,811
111	0604807A	05	MEDICAL MATERIEL/MEDICAL BIOLOGICAL DEFENSE EQUIPMENT - ENG DEV	37,572	34,474	27,160		27,160
112	0604808A	05	LANDMINE WARFARE/BARRIER - ENG DEV	89,064	95,577	87,426		87,426
113	0604814A	05	ARTILLERY MUNITIONS - EMD	40,856	26,371	42,627		42,627
114	0604817A	05	COMBAT IDENTIFICATION	7,740	29,884			
115	0604818A	05	ARMY TACTICAL COMMAND & CONTROL HARDWARE & SOFTWARE	72,820	60,970	123,935		123,935
116	0604820A	05	RADAR DEVELOPMENT			2,890		2,890
117	0604822A	05	GENERAL FUND ENTERPRISE BUSINESS SYSTEM (GFEBS)	23,712	13,576	794		794
118	0604823A	05	FIREFINDER	19,534	24,736	10,358		10,358
119	0604827A	05	SOLDIER SYSTEMS - WARRIOR DEM/VAL	20,602	20,886	48,309		48,309
120	0604854A	05	ARTILLERY SYSTEMS - EMD	152,935	53,624	120,146		120,146
121	0604869A	05	PATRIOT/MEADS COMBINED AGGREGATE PROGRAM (CAP)	570,831	467,139	406,605		406,605
122	0604870A	05	NUCLEAR ARMS CONTROL MONITORING SENSOR NETWORK	6,860	7,276	7,398		7,398
123	0605013A	05	INFORMATION TECHNOLOGY DEVELOPMENT	108,146	23,957	37,098		37,098
124	0605018A	05	ARMY INTEGRATED MILITARY HUMAN RESOURCES SYSTEM (A-IMHRS)		100,500	68,693		68,693
125	0605450A	05	JOINT AIR-TO-GROUND MISSILE (JAGM)	118,459	130,340	127,095		127,095
126	0605455A	05	SLAMRAAM		23,700	19,931		19,931
127	0605456A	05	PAC-3/MSE MISSILE		62,500	88,993		88,993
128	0605457A	05	ARMY INTEGRATED AIR AND MISSILE DEFENSE (AIAMD)		251,124	270,607		270,607
129	0605625A	05	MANNED GROUND VEHICLE	76,861	934,366	884,387		884,387
130	0605626A	05	AERIAL COMMON SENSOR		211,500	31,465		31,465
131	0303032A	05	TROJAN - RH12		3,697	3,920		3,920
132	0304270A	05	ELECTRONIC WARFARE DEVELOPMENT		21,571	13,819		13,819
	Total:		System Development and Demonstration	4,285,025	5,035,046	4,190,788	0	4,190,788
			Management support					
133	0604256A	06	THREAT SIMULATOR DEVELOPMENT	23,120	26,158	16,992		16,992

Line No	Program Element Number	Act	Item	Thousands of Dollars FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
134	0604258A	06	TARGET SYSTEMS DEVELOPMENT	13,183	8,614	11,247		11,247
135	0604759A	06	MAJOR T&E INVESTMENT	49,942	42,102	49,437		49,437
136	0605103A	06	RAND ARROYO CENTER	17,257	20,492	20,384		20,384
137	0605301A	06	ARMY KWAJALEIN ATOLL	157,391	163,788	145,606		145,606
138	0605326A	06	CONCEPTS EXPERIMENTATION PROGRAM	26,168	17,704	28,800		28,800
139	0605502A	06	SMALL BUSINESS INNOVATIVE RESEARCH	273,678				
140	0605601A	06	ARMY TEST RANGES AND FACILITIES	346,015	393,937	262,456	8,513	270,969
141	0605602A	06	ARMY TECHNICAL TEST INSTRUMENTATION AND TARGETS	82,054	59,040	70,227		70,227
142	0605604A	06	SURVIVABILITY/LETHALITY ANALYSIS	44,728	41,812	43,483		43,483
143	0605605A	06	DOD HIGH ENERGY LASER TEST FACILITY	7,307	4,710	18		18
144	0605606A	06	AIRCRAFT CERTIFICATION	3,745	5,055	5,630		5,630
145	0605702A	06	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	8,173	7,185	7,182		7,182
146	0605706A	06	MATERIEL SYSTEMS ANALYSIS	20,970	18,078	19,669		19,669
147	0605709A	06	EXPLOITATION OF FOREIGN ITEMS	5,403	5,460	5,445		5,445
148	0605712A	06	SUPPORT OF OPERATIONAL TESTING	78,360	68,191	68,786		68,786
149	0605716A	06	ARMY EVALUATION CENTER	63,961	61,450	63,302		63,302
150	0605718A	06	ARMY MODELING & SIM X-CMD COLLABORATION & INTEG	5,885	3,926	3,420		3,420
151	0605801A	06	PROGRAMWIDE ACTIVITIES	76,503	73,685	83,054		83,054
152	0605803A	06	TECHNICAL INFORMATION ACTIVITIES	77,926	48,309	63,872		63,872
153	0605805A	06	MUNITIONS STANDARDIZATION, EFFECTIVENESS AND SAFETY	84,951	53,338	57,142		57,142
154	0605857A	06	ENVIRONMENTAL QUALITY TECHNOLOGY MGMT SUPPORT	4,991	3,195	4,961		4,961
155	0605898A	06	MANAGEMENT HQ - R&D	15,772	16,154	17,558		17,558
156	0909980A	06	JUDGMENT FUND REIMBURSEMENT	226				
157	0909999A	06	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS	106				
	Total:		Management support	1,487,815	1,142,383	1,048,671	8,513	1,057,184
			Operational system development					
158	0603778A	07	MLRS PRODUCT IMPROVEMENT PROGRAM	26,624	51,619	66,641		66,641
159	0603820A	07	WEAPONS CAPABILITY MODIFICATIONS UAV			24,142		24,142
160	0102419A	07	AEROSTAT JOINT PROJECT OFFICE	317,132	372,493	344,655		344,655

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
161	0203347A	07	INTELLIGENCE SUPPORT TO CYBER (ISC) MIP		2,360			
162	0203726A	07	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	29,127	24,622	29,546		29,546
163	0203735A	07	COMBAT VEHICLE IMPROVEMENT PROGRAMS	169,400	204,481	53,307		53,307
164	0203740A	07	MANEUVER CONTROL SYSTEM	36,131	25,540	65,002		65,002
165	0203744A	07	AIRCRAFT MODIFICATIONS/PRODUCT IMPROVEMENT PROGRAMS	240,321	134,999	163,205		163,205
166	0203752A	07	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	767	710	823		823
167	0203758A	07	DIGITIZATION	8,218	6,329	8,029		8,029
168	0203759A	07	FORCE XXI BATTLE COMMAND, BRIGADE AND BELOW (FBCB2)		3,935			
169	0203801A	07	MISSILE/AIR DEFENSE PRODUCT IMPROVEMENT PROGRAM	37,731	24,280	44,560		44,560
170	0203802A	07	OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS	3,979				
171	0203808A	07	TRACTOR CARD	19,249	14,870	42,554		42,554
172	0208053A	07	JOINT TACTICAL GROUND SYSTEM	13,189	12,403	27,630		27,630
173	0208058A	07	JOINT HIGH SPEED VESSEL (JHSV)	2,961	3,153	3,044		3,044
174	0301359A	07	SPECIAL ARMY PROGRAM					
175	0303028A	07	SECURITY AND INTELLIGENCE ACTIVITIES	17,348		2,854		2,854
176	0303140A	07	INFORMATION SYSTEMS SECURITY PROGRAM	61,313	118,090	61,220		61,220
177	0303141A	07	GLOBAL COMBAT SUPPORT SYSTEM	138,764	125,569	100,505		100,505
178	0303142A	07	SATCOM GROUND ENVIRONMENT (SPACE)	32,453	33,694	12,104		12,104
179	0303150A	07	WWMCCS/GLOBAL COMMAND AND CONTROL SYSTEM	13,683	13,024	23,937		23,937
180	0305204A	07	TACTICAL UNMANNED AERIAL VEHICLES	262,655	54,300	40,650		40,650
181	0305208A	07	DISTRIBUTED COMMON GROUND/SURFACE SYSTEMS	191,253	119,202	44,198		44,198
182	0305219A	07	MQ-1 SKY WARRIOR A UAV		123,156	137,038		137,038
183	0305232A	07	RQ-11 UAV		1,599	1,938		1,938
184	0305233A	07	RQ-7 UAV		7,805	31,940		31,940
185	0307207A	07	AERIAL COMMON SENSOR (ACS)	115,432				
186	0307665A	07	BIOMETRICS ENABLED INTELLIGENCE		14,114	15,018		15,018
187	0708045A	07	END ITEM INDUSTRIAL PREPAREDNESS ACTIVITIES	106,259	61,098	59,297		59,297
	Total:		Operational system development	1,843,989	1,553,445	1,403,837	0	1,403,837

Exhibit R-1

Appropriation: 2040 A RDT&E, Army

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Line No	Program Element Number	Act	Item	Thousands of Dollars				
				FY2010	FY2011	FY2012	FY2012 OCO	FY2012 Total
Total:	RDT&E, Army			11,706,929	10,479,851	9,679,444	8,513	9,687,957

Master Program Element Table of Contents (by Budget Activity then Line Item Number)

Budget Activity 01: Basic Research
Appropriation 2040: Research, Development, Test & Evaluation, Army

Master Program Element Table of Contents (Alphabetically by Program Element Title)

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Master Exhibit R-1
(Listing by Budget Activity, then Program Element Number)

BA# 01: Basic Research

				Cost ($ in Millions)				
Line#	**BA#**	**PE#**	**PE Title**	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**
01	01	0601101A	In-House Laboratory Independent Research	19.278	21.780	21.064	-	21.064
02	01	0601102A	DEFENSE RESEARCH SCIENCES	196.921	195.845	213.942	-	213.942
03	01	0601103A	University Research Initiatives	96.409	91.161	80.977	-	80.977
04	01	0601104A	University and Industry Research Centers	107.582	98.087	120.937	-	120.937
Total: Basic Research				420.190	406.873	436.920	-	436.920

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*				R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	19.278	21.780	21.064	-	21.064	20.692	21.501	21.948	22.411	Continuing	Continuing
91A: *ILIR-AMC*	13.203	17.205	16.301	-	16.301	15.940	16.436	16.821	17.202	Continuing	Continuing
91C: *ILIR-MED R&D CMD*	4.352	2.860	2.817	-	2.817	2.809	2.858	2.906	2.955	Continuing	Continuing
91D: *ILIR-CORPS OF ENGR*	1.095	1.075	1.066	-	1.066	1.067	1.088	1.105	1.119	Continuing	Continuing
91E: *ILIR-ARI*	0.155	0.152	0.151	-	0.151	0.151	0.154	0.155	0.158	Continuing	Continuing
F16: *ILIR-SMDC*	0.473	0.488	0.729	-	0.729	0.725	0.965	0.961	0.977	Continuing	Continuing

Note

FY12 funding increase to support Competitive ILIR.

A. Mission Description and Budget Item Justification

This program element (PE) supports basic research investigations at the Army laboratories through the In-House Laboratory Research (ILIR) program. Basic research lays the foundation for future developmental efforts by identifying fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge. The ILIR program serves as a catalyst for major technology breakthroughs by giving laboratory directors flexibility in implementing novel research ideas and by nurturing promising, young scientists and engineers. It is also used to attract and retain top doctoral degreed scientists and engineers. The ILIR program also provides a source of competitive funds for peer reviewed efforts at Army laboratories to stimulate high quality, innovative research with significant opportunity for payoff to Army warfighting capability. This PE supports ILIR at the Army Materiel Command's (AMC) six Research, Development, and Engineering Centers (Project 91A); at the six Medical Research and Materiel Command (MRMC) laboratories (Project 91C); at the Corps of Engineer's seven laboratories at the US Army Engineer Research, and Development Center (ERDC) (Project 91D); at the Army Research Institute for the Behavioral and Social Sciences (ARI) (Project 91E); and at the Space and Missile Defense Command (SMDC) (Project F16).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

The work in this PE is performed by the AMC, Aberdeen Proving Grounds, MD, MRMC, Ft. Detrick, MD, the ERDC, Vicksburg, MS, the ARI, Arlington, VA, and the SMDC, Huntsville, AL.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army					DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*		R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*			
B. Program Change Summary ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**
Previous President's Budget	19.568	21.780	19.139	-	19.139
Current President's Budget	19.278	21.780	21.064	-	21.064
Total Adjustments	-0.290	-	1.925	-	1.925
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	0.198	-			
• SBIR/STTR Transfer	-0.488	-			
• Adjustments to Budget Years	-	-	1.925	-	1.925

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91A: *ILIR-AMC*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
91A: *ILIR-AMC*	13.203	17.205	16.301	-	16.301	15.940	16.436	16.821	17.202	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

The project funds basic research within the Army Materiel Command's (AMC) Research, Development, and Engineering Centers and lays the foundation for future developmental efforts by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

The work in this program is performed by the Edgewood Chemical and Biological Center, Aberdeen Proving Grounds, MD within AMC, the Armaments Research, Development, and Engineering Center, Picatinny, NJ, the Tank and Automotive Research, Development, and Engineering Center, Warren, MI, the Natick Soldier Research, Development, and Engineering Center, Natick, MA, the Aviation and Missile Research, Development, and Engineering Center, Huntsville, AL, and the Communications and Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Edgewood Chemical Biological Center	0.898	3.007	0.832
Description: Funds basic research in chemistry, biology, biotechnology, and aerosol for counter improvised explosive devices (IEDs), obscurants, and/or target defeat. ***FY 2010 Accomplishments:*** Conducted experiments that exploit recent advances in panomics for molecular toxicology; exploit rational molecular design for the design of functional self-organizing supramolecular self-assembly; exploit the complex behavior of mass transport in microporous systems; exploit the application of controlled coherent laser radiation to direct the dynamics of quantum systems; and characterize chemical and biochemical phenomena occurring at or near solid surfaces and interfaces. ***FY 2011 Plans:*** Conduct fundamental studies in surface science, specifically furthering the characterization of chemical and biochemical phenomena occurring at or near solid surfaces and interfaces; molecular programming techniques for bio-energy production; rational design of nano- biomolecular, abiotic structures; the interaction of matter and transfer of energy at the nanoscale and			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91A: *ILIR-AMC*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
interfacial phenomena of particulate matter; and the controlled synthesis of nanomaterials to enable the controlled propagation of electromagnetic energy or to drive photonic behavior. ***FY 2012 Plans:*** Will continue basic research efforts in the areas of rational molecular and nano-system design for the design of functional abiotic structures, reconfigurable self-organizing systems, novel nanoparticles and supramolecular self-assembly; and will also continue investigations in synthetic biology using new molecular programming techniques for creating biofuels and materials. Will continue fundamental research in surface science in PE 0601102A, Project VR9, Surface Science Research.			
Title: Armaments Research, Development and Engineering Center ***Description:*** Funds basic research in weapons component development, explosives synthesis/detection and area denial. ***FY 2010 Accomplishments:*** Researched ways to synthesize more powerful explosives with insensitive munition (IM); investigated technologies for detection and neutralization of improvised explosive devices (IEDs) and other explosives; researched sensors/sensor fusion for area denial, investigated smaller more lethal warheads and composite materials. ***FY 2011 Plans:*** Conduct further basic research into synthesizing more powerful explosives with IM properties, technologies for detection and neutralization of IEDs/explosives, sensors/sensor fusion for area denial, smaller more lethal warheads and composite materials. ***FY 2012 Plans:*** Will solicit new efforts to further basic research in areas such as advanced materials and nanotechnologies, more powerful energetics including those with IM properties, counter terrorism technologies, power and energy systems, smaller more lethal warheads and composite materials.	1.588	1.684	1.674
Title: Tank-Automotive Research, Development and Engineering Center ***Description:*** Funds basic research in ground vehicle technologies to include power, mobility, and unmanned systems. ***FY 2010 Accomplishments:*** Developed high performance control algorithms for unmanned ground vehicles in heterogeneous off-road terrain environments; used fuzzy logic C-mean clustering algorithms for vehicle terrain classification; and investigated JP-8 heat release combustion chemistry as a function of cetane number and nozzle geometry. ***FY 2011 Plans:***	1.224	1.201	1.202

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91A: *ILIR-AMC*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Develop reinforcement-based Learning and Control for Robots Using Ethical Behavior Frameworks; investigate photophysical response measurements for directed energy carbon-60 colloid materials; and use event-driven control strategies to couple remote dynamical systems. ***FY 2012 Plans:*** Will develop and investigate models for nanofluid coolants and lubricants; will develop and investigate durability and blast models for composite materials, including carbon nanotube reinforced composite; and will develop algorithms for bio-inspired object recognition for unmanned systems.			
Title: Natick Soldier Research, Development and Engineering Center ***Description:*** Funds basic research in food sciences, textiles, and lightweight materials with potential for individual protection. ***FY 2010 Accomplishments:*** Solicited new concepts for basic research efforts with broad applicability to science and technology that enable advancement of developments such as electro-textiles, multifunctional fibers, advanced nutrient delivery, performance enhancing biomechanics and precision airdrop systems. ***FY 2011 Plans:*** Continue fundamental research of nanoelectronics that has the potential to provide new nanomaterials and nanoarchitectures that could help revolutionize the performance and miniaturization of optoelectronic devices; further the understanding of fundamental principles, which govern Botulinim Neurotoxin catalytic activity and binding of peptide and aptamers to this catalytic domain that may lead to new technologies, which couple toxin capture and inactivation. ***FY 2012 Plans:*** Will create zwitterionic 3-dimensional nanofibrous architectures for antifouling and food pathogen sensing; will conduct fundamental studies on novel metal oxides for tuned optical response; and will explore understanding of the lysis mechanisms of peptides for antimicrobial protection.	1.350	1.323	1.358
Title: Aviation and Missile Research, Development and Engineering Center: Missile Efforts ***Description:*** Funds basic research in guided missile and rocket systems, directed energy weapons, unmanned vehicles, and related components. ***FY 2010 Accomplishments:***	2.234	2.243	2.264

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91A: *ILIR-AMC*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Explained why complex networks can respond consistently to external signals; explored phase locked harmonic generation of light; experimentally demonstrated a quantum electromagnetic field sensor; and experimentally demonstrated terahertz holographic imaging of obscured objects/IEDs. ***FY 2011 Plans:*** Experimentally demonstrate and evaluate performance of chaotic antenna arrays and electronic steering based on lag synchronization in chaotic circuits; experimentally demonstrate inhibition of absorption in opaque materials through a phase locking dynamic and theoretical and experimental investigations of nanoplasmonic switches. ***FY 2012 Plans:*** Will solicit new concepts for basic research efforts with broad applicability to science and technology that support exploratory and advanced development for guided missile and rocket systems, directed energy weapons, unmanned vehicles, and related components.			
Title: Aviation and Missile Research, Development and Engineering Center: Aviation Efforts ***Description:*** Funds basic research for aviation enabling technologies in the areas of aerodynamics, structural dynamics, and material science. ***FY 2010 Accomplishments:*** Conducted dynamic stall testing of advanced active and passive concepts with an emphasis on the fundamental flow physics of unsteady separation of turbulent boundary layers; developed microscopic particle image velocimetry for identification of flow reversal and separation in unsteady turbulent boundary layers; and developed an analytical framework that enables the systematic evaluation of autonomous unmanned aerial system path planning algorithms. ***FY 2011 Plans:*** Investigate the effectiveness of fluidic oscillators to control separation for bluff body flow and also initiate computational fluid dynamics and computational structural dynamics methods for accurate rotor stability analysis. ***FY 2012 Plans:*** Will investigate inflow dynamics and wake physics at high advance ratios and will investigate dielectric barrier discharge plasma devices for reduced bluff body drag.	1.657	1.623	1.622
Title: Communications-Electronics Research, Development, and Engineering Center ***Description:*** Funds basic research for communication and network enabling technologies in the areas of antenna design, network management, power generation and storage, and also sensors.	1.400	1.487	1.476

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91A: *ILIR-AMC*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Explored new metamaterial to significantly improve antenna signature and power handling capacity; conducted research in network science to investigate novel neural management tools for optimum network performance; researched separator-electrolyte sub-components for high voltage electrochemical cells; and developed a novel approach for extensions of advanced signal processing from a cooperative regime (known parameters) to a non-cooperative regime. ***FY 2011 Plans:*** Investigate new anode and cathode materials for electrochemical couples with increased kinetic properties; perform research on developing cost-effective metamaterial antenna fabrication concept; perform research and experimental validation of the derived theoretical limits of explosive ordnance interference cancelation systems intended to enable communications during jamming; perform experimental validation of new cognitive radio techniques for blind signal interception; investigate fundamental parameters affecting Shockley-Reed-Hall defect centers in narrow gap infrared (IR) semiconductors (e.g., III-V and II-VI epitaxial compounds); research and investigate novel conducting polymers for use as explosive specific sensors and as low power displays; and explore new measurement methodologies (e.g., catholuminescence) for studying IR detector defects at the atomic level. ***FY 2012 Plans:*** Will perform research for developing cognitive algorithm and intelligent cognitive network with optimized managed resources, and flexible and reconfigurable radio frequency (RF) technologies; will explore RF interaction of nano-tubes and metamaterial for wideband signal amplification and also electromagnetic radiation; will explore control theory in addressing the uncertainty and latency in the cognitive ad-hoc network; will perform research on sensor network scenarios that can perform blind signal sensing and classification of weak signals; will investigate alternative separator and electrolytes for high energy/power electrochemical couples; will concentrate on reducing the parasitic (non-electrochemical) reactions between synthesized separator and electrolyte and high energy electrode components; and will investigate new metallic polymers for next generation infrared sensors.			
Title: Peer Reviewed Proposal Efforts ***Description:*** Funds peer reviewed proposals in basic research to provide increased quality and responsiveness in exploring new technological concepts that are highly relevant to Army needs. This funding also enhances recruitment, development, and retention of outstanding scientists and engineers engaged in high quality basic research for the Army, which provides a constant flow of new knowledge to Army laboratories. ***FY 2010 Accomplishments:***	2.852	4.637	5.873

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91A: *ILIR-AMC*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Awarded 5 new projects in network/internet optimization of detection capabilities; IR detectors and focal plane arrays for night vision, surveillance, target acquisition, searching, tracking and missile seeking; and effect of vortex interactions not only on the tip vortex formation, but also on the lift and drag aircraft wings. ***FY 2011 Plans:*** Conduct basic research efforts to develop and maintain a cadre of active research scientists who can distill and extend results from worldwide research in areas of interest to the Army. ***FY 2012 Plans:*** Will solicit new basic research efforts aimed at developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research in areas of interest to the Army.			
Accomplishments/Planned Programs Subtotals	13.203	17.205	16.301

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91C: *ILIR-MED R&D CMD*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
91C: *ILIR-MED R&D CMD*	4.352	2.860	2.817	-	2.817	2.809	2.858	2.906	2.955	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this project is to address investigator-driven medical and force health protection basic research initiatives performed at the six US Army Medical Research and Materiel Command laboratories. Research areas address countermeasures against infectious diseases, defense against environmental extremes and operational hazards to health, mechanisms of combat trauma and innovative treatment and surgical procedures, and medical chemical/biological warfare threats.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, MD; US Army Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, MD; US Army Medical Research Institute of Infectious Diseases, Fort Detrick, MD; US Army Institute of Environmental Medicine, Natick, MA; US Army Institute of Surgical Research, Fort Sam Houston, TX; US Aeromedical Research Laboratory, Fort Rucker, AL; and the Telemedicine and Advanced Technology Research Center, Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Independent Research Efforts	2.910	2.860	2.817
Description: Funds basic research in medical and force health protection.			
FY 2010 Accomplishments: The ILIR program funded innovative in-house basic research proposals that focus on research to explore treatments and countermeasures against militarily relevant infectious diseases; defense against environmental extremes and operational hazards to health; and mechanisms of combat trauma and innovative treatment and surgical procedures.			
FY 2011 Plans: The program funds innovative in-house basic research proposals that will focus on research to explore treatments and countermeasures against militarily relevant infectious diseases; defense against environmental extremes and operational hazards to health; mechanisms of combat trauma and innovative treatment and surgical procedures, and medical chemical/biological warfare threats.			
FY 2012 Plans: The program will fund innovative in-house basic research proposals that will focus on research to explore treatments and countermeasures against militarily relevant infectious diseases; defense against environmental extremes and operational hazards			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91C: *ILIR-MED R&D CMD*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
to health; mechanisms of combat trauma and innovative treatment and surgical procedures; and medical chemical/biological warfare threats.			
Title: Peer Reviewed Proposal efforts ***Description:*** Funds peer reviewed proposals in basic research to provide increased quality and responsiveness in exploring new technological concepts that are highly relevant to Army needs. This funding also enhances recruitment, development, and retention of outstanding scientists and engineers engaged in high quality basic research for the Army, which provides a constant flow of new knowledge to Army laboratories. ***FY 2010 Accomplishments:*** Solicited new and continuing basic research efforts aimed at developing and maintaining a cadre of active basic research scientists who can initiate new research as well as extend results from worldwide research and apply them to Army problems.	1.442	-	-
Accomplishments/Planned Programs Subtotals	4.352	2.860	2.817

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91D: *ILIR-CORPS OF ENGR*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
91D: *ILIR-CORPS OF ENGR*	1.095	1.075	1.066	-	1.066	1.067	1.088	1.105	1.119	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project funds In-house Laboratory Independent Research (ILIR) in the areas of geospatial research and engineering, military engineering, and environmental quality/installations at the seven laboratories within the Corps of Engineer's US Army Engineer Research and Development Center (ERDC).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

The work in this project is performed by the U.S. Army ERDC, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Geospatial Research and Engineering/Military Engineering/Environmental Quality and Installations	1.095	1.075	1.066
Description: Funds basic research in the areas of geospatial research and military engineering as well as environmental quality and installations. ***FY 2010 Accomplishments:*** Investigated reduction potentials for military compounds through the application of computationally feasible approximations for predicting reduction-oxidation reaction potentials of explosives and their environmental transformation products; determined whether mineral surfaces or surface chemical processes can be exploited to promote the adsorption and transformation of nitroaromatic compounds and other explosives munitions on military training, testing and demolition ranges. ***FY 2011 Plans:*** Investigate a set of theoretical algorithms for poly-disperse soil packings based upon historical granular research and using simulations to validate performance; and continue basic research efforts focused on fundamental questions in science relevant to military application such as signature physics, next generation remote sensing, and ecological risk of military unique emerging contaminates in the environment. ***FY 2012 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91D: *ILIR-CORPS OF ENGR*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will complete basic research efforts for ultra-compact soils for soil mechanics systems; will investigate vegetation photopigment decay for remote sensing of hazardous materials; and will investigate DNA pattern formation upon non-directed assembly at a functionalized surface for Army relevant compounds.			
Accomplishments/Planned Programs Subtotals	1.095	1.075	1.066

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT 91E: *ILIR-ARI*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
91E: *ILIR-ARI*	0.155	0.152	0.151	-	0.151	0.151	0.154	0.155	0.158	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project provides funding for In-house Laboratory Independent Research (ILIR) in the Army Research Institute for Behavioral and Social Sciences (ARI). This project supports basic research in the Cognitive Sciences and is focused on theories, approaches, and models from the Behavioral and Social Sciences that have the highest potential to improve human performance. Improved recruiting, selection, assignment, training, leader development, performance, performance assessment, organizational dynamics, and retention are the goals.

Work in this project is performed by the Army Research Institute, Arlington, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Army Research Institute	0.155	0.152	0.151
Description: Funds basic research in cognitive, behavioral, and social sciences to improve Soldier recruiting, assignment and retention and providing fundamental knowledge for human performance and organizational behavioral research. ***FY 2010 Accomplishments:*** Identified relevant variables for longitudinal modeling of career performance using latent curve analysis. ***FY 2011 Plans:*** Identify key training aspects of synthetic teammates in virtual worlds that will promote training transfer to a team performance setting. ***FY 2012 Plans:*** Research will focus on topics such as improving training in complex environments, leader and team performance, identifying attributes critical to Soldier recruiting, assignment and retention as well as providing fundamental knowledge for human performance and organizational behavioral research.			
Accomplishments/Planned Programs Subtotals	0.155	0.152	0.151

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601101A: *In-House Laboratory Independent Research*	**PROJECT** 91E: *ILIR-ARI*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT F16: *ILIR-SMDC*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
F16: *ILIR-SMDC*	0.473	0.488	0.729	-	0.729	0.725	0.965	0.961	0.977	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this project is to provide funding for In-house Laboratory Independent Research (ILIR) in the Space and Missile Defense Command (SMDC) Technical Center. This basic research on lasers and directed energy lays the foundation for future developmental efforts on high energy lasers and directed energy systems for missile defense by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, the Army Science and Technology Master Plan.

Work in this project is performed by the Army SMDC, Huntsville, AL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: SMDC In-house Laboratory Independent Research (ILIR)	0.473	0.488	0.729
Description: Funds basic research to investigate laser propagation phenomenology for application in modeling and simulation and future directed energy weapons design.			
FY 2010 Accomplishments: Investigated beam propagation codes versus real laser beam propagation down an open air range to improve the accuracy of beam propagation codes and to improve understanding of the impact of various atmospheric phenomena, to include a detailed mapping of the beam path unrivaled to date via Schlieren, optical sensors, and weather metrology data; conducted an experiment implementing quantum optics rather than classical optics for beam propagation to compare the two approaches for computational ease, accuracy, and time requirements; and set up a laboratory tabletop version of a high energy laser adaptive optic system and developed algorithms for sensing and correcting for atmospheric distortion in open loop (without a wavefront sensor or beacon).			
FY 2011 Plans: Use prior year data to develop more complex beam propagation experimentation to improve the beam propagation knowledge, codes, and algorithms for Adaptive Optics systems for directed energy weapons; begin scaling to higher powers using a 2 KW fiber laboratory laser.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601101A: *In-House Laboratory Independent Research*	PROJECT F16: *ILIR-SMDC*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will conduct modeling and simulation studies and experiments for new laser technology and beam propagation concepts to enable understanding of next generation high energy laser systems.			
Accomplishments/Planned Programs Subtotals	0.473	0.488	0.729

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*				R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	196.921	195.845	213.942	-	213.942	219.116	223.721	227.464	233.405	Continuing	Continuing
305: *ATR RESEARCH*	2.321	2.401	2.433	-	2.433	2.462	2.508	2.554	2.597	Continuing	Continuing
31B: *INFRARED OPTICS RSCH*	2.648	2.721	2.787	-	2.787	2.831	2.887	2.946	2.996	Continuing	Continuing
52C: *MAPPING & REMOTE SENS*	2.744	2.841	2.915	-	2.915	2.979	3.038	3.097	3.150	Continuing	Continuing
53A: *BATTLEFIELD ENV & SIG*	3.195	3.341	3.435	-	3.435	3.530	3.611	3.697	3.760	Continuing	Continuing
74A: *HUMAN ENGINEERING*	5.627	6.971	8.019	-	8.019	8.227	8.361	8.718	9.005	Continuing	Continuing
74F: *PERS PERF & TRAINING*	5.643	5.549	6.766	-	6.766	7.023	7.148	7.266	7.389	Continuing	Continuing
F20: *ADV PROPULSION RSCH*	3.303	3.429	3.996	-	3.996	4.193	4.272	4.355	4.429	Continuing	Continuing
F22: *RSCH IN VEH MOBILITY*	0.554	0.576	0.588	-	0.588	0.601	0.612	0.624	0.635	Continuing	Continuing
H42: *MATERIALS & MECHANICS*	5.889	6.975	8.461	-	8.461	8.676	8.835	8.990	9.143	Continuing	Continuing
H43: *RESEARCH IN BALLISTICS*	8.042	8.318	9.063	-	9.063	9.224	9.395	9.563	9.726	Continuing	Continuing
H44: *ADV SENSORS RESEARCH*	6.241	9.695	10.005	-	10.005	10.148	10.319	10.662	11.046	Continuing	Continuing
H45: *AIR MOBILITY*	2.306	2.399	2.449	-	2.449	2.497	2.543	2.588	2.632	Continuing	Continuing
H47: *APPLIED PHYSICS RSCH*	2.894	5.009	5.087	-	5.087	5.187	5.258	5.540	5.996	Continuing	Continuing
H48: *BATTLESPACE INFO & COMM RSC*	11.200	13.685	15.726	-	15.726	17.250	18.285	18.890	19.211	Continuing	Continuing
H52: *EQUIP FOR THE SOLDIER*	1.026	1.078	1.105	-	1.105	1.134	1.158	1.181	1.201	Continuing	Continuing
H57: *Single Investigator Basic Research*	62.870	73.075	78.257	-	78.257	79.027	80.262	79.933	82.453	Continuing	Continuing
H66: *ADV STRUCTURES RSCH*	1.805	1.889	1.942	-	1.942	1.996	2.040	2.089	2.125	Continuing	Continuing
H67: *ENVIRONMENTAL RESEARCH*	0.886	0.967	0.997	-	0.997	1.018	1.039	1.072	1.090	Continuing	Continuing
S13: *SCI BS/MED RSH INF DIS*	10.296	10.652	10.900	-	10.900	11.121	11.348	11.447	11.445	Continuing	Continuing
S14: *SCI BS/CBT CAS CARE RS*	6.352	6.818	9.709	-	9.709	9.853	9.211	9.481	9.833	Continuing	Continuing
S15: *SCI BS/ARMY OP MED RSH*	7.003	8.839	6.320	-	6.320	6.687	7.628	7.655	7.592	Continuing	Continuing

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army									DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*				R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*							
T14: *BASIC RESEARCH INITIATIVES - AMC (CA)*	26.860	-	-	-	-	-	-	-	-	Continuing	Continuing
T22: *SOIL & ROCK MECH*	2.284	2.358	4.926	-	4.926	4.531	4.631	5.281	5.525	Continuing	Continuing
T23: *BASIC RES MIL CONST*	1.727	3.839	1.901	-	1.901	1.970	2.005	2.042	2.077	Continuing	Continuing
T24: *Signature Physics and Terrain State Basic Research*	1.508	1.573	1.616	-	1.616	1.660	1.693	1.727	1.756	Continuing	Continuing
T25: *Environmental Science Basic Research*	7.690	8.106	8.234	-	8.234	8.562	8.719	8.870	9.021	Continuing	Continuing
T61: *Basic Research Initiatives - MRMC (CA)*	1.592	-	-	-	-	-	-	-	-	Continuing	Continuing
T63: *ROBOTICS AUTONOMY, MANIPULATION, & PORTABILITY RSH*	1.181	1.463	1.857	-	1.857	1.935	1.969	2.001	2.035	Continuing	Continuing
T64: *SCI BS/SYSTEM BIOLOGY AND NETWORK SCIENCE*	1.234	1.278	2.198	-	2.198	2.794	2.846	2.895	2.937	Continuing	Continuing
VR9: *SURFACE SCIENCE RESEARCH*	-	-	2.250	-	2.250	2.000	2.100	2.300	2.600	Continuing	Continuing

Note

FY12 funding increase for high priority efforts.

A. Mission Description and Budget Item Justification

This program element (PE) fosters fundamental scientific knowledge and contributes to the sustainment of US Army scientific and technological superiority in land warfighting capability and military problems related to long-term national security needs, investigates new concepts and technologies for the Army's future force, and provides the means to exploit scientific breakthroughs and avoid technological surprises. The PE fosters innovation in Army niche areas (such as lightweight armor, energetic materials, night vision) and areas where there is no commercial investment due to limited markets (e.g., vaccines for tropical diseases). It also focuses university single investigator research on Army areas of interest (e.g., high-density compact power and novel sensor phenomenologies). The in-house portion of the program capitalizes on the Army's scientific talent and specialized facilities to transition knowledge and technology into the appropriate developmental activities. The extramural program leverages the research efforts of other government agencies, academia, and industry.

The work in this PE is coordinated and integrated between four primary contributors: the Army Research, Development, and Engineering Command (RDECOM); the US Army Engineer Research and Development Center (ERDC); the Army Medical Research and Materiel Command (MRMC); and the Army Research Institute for

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601102A: *DEFENSE RESEARCH SCIENCES*

Behavioral and Social Sciences (ARI). The basic research program is coordinated with the other Services via Defense Basic Research Advisory Group and other inter-Service working groups.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this PE is primarily managed by: the US Army Research Laboratory (ARL), Adelphi, MD; the RDECOM, Aberdeen, MD; the Medical Research and Materiel Command (MRMC), Ft. Detrick, MD; the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS; and the US Army Research Institute for the Behavioral and Social Sciences (ARI), Arlington, VA.

Projects T14 and T61 fund Congressional interest items.

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	197.471	195.845	188.160	-	188.160
Current President's Budget	196.921	195.845	213.942	-	213.942
Total Adjustments	-0.550	-	25.782	-	25.782
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	3.053	-			
• SBIR/STTR Transfer	-3.603	-			
• Adjustments to Budget Years	-	-	25.782	-	25.782

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 305: *ATR RESEARCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
305: *ATR RESEARCH*	2.321	2.401	2.433	-	2.433	2.462	2.508	2.554	2.597	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates automatic target recognition (ATR) research to enhance the effectiveness of Army systems while simultaneously reducing the workload on the Soldier. This project focuses on the fundamental underpinnings of aided and unaided target detection and identification techniques for land warfare scenarios including tagging, tracking, and locating (TTL) of non-traditional targets. This research enables Army systems that can act independently of the human operator to detect and track targets including clandestine tracking of non-cooperative targets. Such capabilities are needed for smart munitions, unattended ground sensors, and as replacements for existing systems, such as land mines. Critical technology issues include low depression angle, relatively short range, and highly competing clutter backgrounds. The resulting research will provide fundamental capability to predict, explain, and characterize target and background signature content, and reduce the workload on the analyst. This research is aimed at evaluating the complexity and variability of target and clutter signatures and ultimately utilizing that knowledge to conceptualize and design advanced ATR paradigms to enhance robustness and effectiveness of land warfare systems. ATR research strategies include emerging sensor modalities such as spectral and multi-sensor imaging. This research supports several technology efforts including multi-domain smart sensors, third generation Forward Looking Infrared, and advanced multi-function laser radar (LADAR).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: ATR Algorithms	1.318	1.387	1.417
Description: Investigate new algorithms to improve aided/unaided target detection and identification.			
FY 2010 Accomplishments: Enhanced hyperspectral anomaly detections and validated rapid reconstruction of hyperspectral images by using 3D compressed sensing techniques and developed novel fusion detection and classification algorithms based on learning theory.			
FY 2011 Plans: Develop restoration techniques for atmospheric turbulence distorted imagery and new anomaly detection algorithms based on novel computational imaging methods.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 305: *ATR RESEARCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will research automatic machine perception algorithms that provide enhanced situational awareness; will investigate fast algorithms for feature extraction and scene understanding from hyperspectral and multimodal data.			
Title: Tagging, Tracking and Locating (TTL) ***Description:*** Conduct basic research to support advances in state-of-the-art clandestine TTL for non-traditional hostile force and non-cooperative targets. Specific technical objectives, products, and deliverables are in accordance with the Hostile Forces TTL Capabilities Development Document and the TTL Science and Technology Roadmap. This effort will directly support ARL's efforts in applied research and the Communications-Electronics Research, Development, and Engineering Center's advanced research in clandestine TTL. ***FY 2010 Accomplishments:*** Conducted research that is leading to improvements in the performance of hyperspectral imaging against a variety of environmental and target conditions and further refined the design of the Micro Electro Mechanical Systems (MEMS) based tag; investigated Radio Frequency (RF) TTL enhancements and flexible ultrasonic tags; explored RF techniques and technologies for TTL, investigated advances in RF Integrated Circuits for an RF Tag and modeled an enhanced IR Tag. ***FY 2011 Plans:*** Investigate and validate an enhanced capability in hyperspectral imaging and target detection for tracking and locating. Fabricate an RF tag sample and validate an enhanced capability in hyperspectral target detection for tracking & locating. Complete investigations for the MEMS and flexible ultrasonic tags. ***FY 2012 Plans:*** Will begin research efforts in the areas of imaging and tagging for TTL enhancements and applications.	1.003	1.014	1.016
Accomplishments/Planned Programs Subtotals	2.321	2.401	2.433

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 31B: *INFRARED OPTICS RSCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
31B: *INFRARED OPTICS RSCH*	2.648	2.721	2.787	-	2.787	2.831	2.887	2.946	2.996	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports Army research in materials and devices for active and passive infrared (IR) imaging systems and radio frequency (RF) photonics. This research aims to generate new technologies for unprecedented battlefield situational awareness and to continue the dominance of Army units during night operations. To achieve these objectives, IR focal plane arrays (FPAs), and interband cascade lasers with significantly improved performance, lower cost, and increased operating temperatures are required. This research has direct application to Army ground vehicles, aviation platforms, weapon systems, and the individual Soldier. Research is focused on material growth, detector and laser design, and processing for large area multicolor IR FPAs and interband cascade lasers. The principal efforts are directed towards novel materials for detectors and lasers, and investigating energy band-gap structures in semi-conductor materials to enhance the performance of lasers and IR FPAs. In the area of RF Photonics near-IR modeling and nanofabrication techniques are applied to the design and fabrication of IR photonic-crystal waveguide structures having customized IR properties. Micro Electro Mechanical System (MEMS) configurations are incorporated into the photonic-crystal waveguide structures to enable reconfigurable IR waveguide properties. Customized IR photonic materials and components in conjunction with fiber optic interconnects are applied to the control of microwaves. The technical goals are to manage and control defects in the raw, unprocessed materials, maintaining quality control in the fabrication of the devices and arrays, limiting introduction of impurities in the material, surface passivation of the devices so that they are resistant to degradation over time and thermal management, particularly as it applies to interband cascade lasers.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Conduct research into IR Focal Plane Arrays, RF Photonics, and to increase situational awareness in open and complex terrain.	2.648	2.721	2.787
Description: Conduct research into IR Focal Plane Arrays, RF Photonics, and to increase situational awareness in open and complex terrain; improve target detection, identification, and discrimination; and enhance missile threat IR countermeasure (IRCM) protection.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 31B: *INFRARED OPTICS RSCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Used fiber optic integrated circuits to improve mode control of an ultra-low-noise microwave oscillator; measured Long Wave Infrared (LWIR) superlattice quantum efficiency and minority carrier lifetime (particles that carry an electric charge) at higher operation temperature. ***FY 2011 Plans:*** Apply fiber-optic RF-photonic techniques to the advancement of opto-electronic processing of military signals; develop nano-fabrication techniques in order to create a novel photonic waveguide structure that could be a substitute for a fiber optic cable; investigate large area dual color LWIR/Midwave Infrared detector arrays; investigate methods for the improvement of minority carrier lifetimes in the type II strained layer superlattice materials that will result in improved FPA performance. ***FY 2012 Plans:*** Will continue development on laser research for IR countermeasures to include detailed studies on the thermal characteristics of Midwave Infrared (MWIR) lasers for IRCM; will investigate environmental effects of RF-photonic devices and reduce their vibration and temperature sensitivity for improved reliability; will continue development of nano-fabrication techniques to achieve chip-scale RF photonic devices; and will investigate methodologies for quantum well infrared detector arrays to be fabricated up to 2K x 2K focal plane arrays.			
Accomplishments/Planned Programs Subtotals	2.648	2.721	2.787

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 52C: *MAPPING & REMOTE SENS*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
52C: *MAPPING & REMOTE SENS*	2.744	2.841	2.915	-	2.915	2.979	3.038	3.097	3.150	Continuing	Continuing

Note

Not applicable to this item

A. Mission Description and Budget Item Justification

This basic research project increases knowledge of the terrain with a focus on improving the generation, management, analysis/reasoning, and modeling of geospatial data, and the exploitation of multi-sensor data. This fundamental knowledge forms the scientific "springboard" for the future development of applications, techniques, and tools to improve the tactical commander's knowledge of the battlefield. Results of this research are used to extract and characterize 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 and tactical geospatial sensor technology to provide real-time terrain intelligence, command and control, and targeting support. This research uses terrain and environmental data to improve situational awareness and enhance information dominance, leading to increased survivability, lethality, and mobility. The research provides the theoretical underpinnings for PE 0602784A (Military Engineering Technology), project 855 (Mapping and Remote Sensing).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Sensor Phenomenology and Spatial-Temporal Pattern Discovery	2.744	2.841	2.915
Description: Funding provided for the following research. ***FY 2010 Accomplishments:*** Examined the synthesis of high quantum yield optical reporters for remote sensing: also, created new interest measures for multi-scale spatial-temporal cascade patterns. ***FY 2011 Plans:*** Explore the relationship of magnetic core nanomaterials and the stand-off recovery of these materials as sensors using Surface-Enhanced Raman Scattering (SERS); also, investigate social network concepts to better assess important interaction within and between our adversaries, directly relating objects, events, actions, and trajectories within a spatial-temporal domain. ***FY 2012 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 52C: *MAPPING & REMOTE SENS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will investigate the effects of underground anomalies on the spectral properties of surface vegetation; also, will create a specific mathematical boundary for determining if a trajectory is an outlier.			
Accomplishments/Planned Programs Subtotals	2.744	2.841	2.915

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 53A: *BATTLEFIELD ENV & SIG*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
53A: *BATTLEFIELD ENV & SIG*	3.195	3.341	3.435	-	3.435	3.530	3.611	3.697	3.760	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates an in-depth understanding of the complex atmospheric boundary layer associated with high-resolution meteorology, the transport, dispersion, optical properties and characterization of chemical and biological aerosols, and the propagation of full-spectrum electro-magnetic and acoustic energy. The future Army will operate in very complex environments (e.g., urban, mountainous, forested and jungle terrain) requiring new approaches to understanding, characterizing, and depicting environmental phenomena and their effects on military systems, personnel and operations. The lack of a complete understanding of the meteorological aspects of the complex microscale boundary layer in which the Army operates continues to impact our abilities to provide predictable, actionable, accurate and timely tactical environmental intelligence to battlefield commanders. This project focuses on producing the foundational environmental science research to characterize the atmospheric boundary layer and deliver novel capabilities and techniques including urban turbulence characterization for its effects on micro platforms and sensor payloads, high resolution urban wind flow modeling for more efficient and accurate prediction of the transport and dispersion of obscurants and chemicals, battlefield aerosol characterization for soldier health, characterization and identification of bio-warfare agents, environmental effects on acoustic and electromagnetic signal propagation in urban and other complex domains for improved target location and imaging, exploration of previously unexploited regions of the acoustic and electro-optic spectrum, and formulation of objective analysis tools that can assimilate on-scene all-source 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, effective surveillance and reconnaissance, and the mobility required for future warfighter mission planning and execution operations.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Adelphi, MD/White Sands Missile Range, NM.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Research in optical and acoustical propagation in the atmosphere	1.996	1.976	2.032
Description: Research in optical and acoustical propagation in the atmosphere for enhanced Intelligence, Surveillance, and Reconnaissance capabilities for the future force to support situational understanding and rapid targeting.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 53A: *BATTLEFIELD ENV & SIG*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Designed algorithms for atmospheric propagation of acoustic signatures in urban and complex terrain; developed processing techniques for enhancing target contrast and minimizing background clutter for infrared polarimetric imagery; and measured Raman spectra of individual particles. ***FY 2011 Plans:*** Develop acoustic propagation algorithms for complex urban domains accounting for multiple building structure effects; exploit broader frequency acoustic propagation including ultrasound; investigate and employ the capabilities of Two-dimensional Angular Optical Scattering and Ultra Violet-Laser Induced Fluorescence technologies for the characterization of hazardous particles in the atmosphere. ***FY 2012 Plans:*** Will characterize atmospheric propagation effects on emerging technologies including Terahertz spectroscopy and imaging systems; will perform investigations and analyses of environmental impacts on thermal and infrared polarimetric images; will investigate the use of high resolution, multi-spectra, Light Detection And Ranging techniques for the detection of atmospheric aerosols and trace gases; will investigate the effects of ozone and other atmospheric constituents on the fluorescence spectra of bioaerosols; will measure fluorescence and absorption cross sections of aerosolized bio-warfare simulants/agents using laser-induced fluorescence and photoacoustic spectroscopy; will investigate the use of active wind screens for infrasound sensors to reduce sensor footprint on the ground; will investigate whether the influence of acoustic waves on the ionosphere can be used for the detection of anomalous events.			
Title: Predictive Modeling of the Boundary Layer ***Description:*** Increase survivability and improve situational awareness through research to enhance accuracy of predictive modeling of the boundary layer and improve the ability to function effectively ***FY 2010 Accomplishments:*** Investigated methods for optimizing aircraft routes in adverse weather conditions; extended the physical interactions in the urban microscale 3 Dimensional Wind Field (3DWF) model to produce a 2D Atmospheric Boundary Layer Environment (ABLE) wind model that improves fidelity for simulation and prediction of wind fields in urban and complex terrain. ***FY 2011 Plans:*** Investigate ensemble modeling techniques leading to fine-scale battlefield probabilistic weather and effects forecasting; produce improved theory and characterization of atmospheric turbulence using sonic anemometer arrays for more realistic mechanical and optical turbulence models, develop biologically inspired approaches to improved environmental awareness and reactions for	1.199	1.365	1.403

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 53A: *BATTLEFIELD ENV & SIG*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
autonomous systems; and extend the ABLE microscale wind model from 2D to 3D using advances in high-performance modeling to improve wake flow predictions in complex and urban terrain . ***FY 2012 Plans:*** Will verify and validate the 3D ABLE model against well established measured and modeled data from complex and urban domain; will investigate modeling techniques deriving probabilistic weather impacts forecasts for future decision support tools; and will develop new approaches to adverse weather route optimization algorithms for air and ground applications.			
Accomplishments/Planned Programs Subtotals	3.195	3.341	3.435

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 74A: *HUMAN ENGINEERING*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
74A: *HUMAN ENGINEERING*	5.627	6.971	8.019	-	8.019	8.227	8.361	8.718	9.005	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project focuses on improving Soldier-system performance in future force environments. Research is on key phenomena underlying Soldier performance such as auditory spatial orientation (perception of azimuth, elevation and distance of sounds) within uncertain, degraded acoustic conditions; extending and protecting auditory and cognitive performance; human performance in automated, mixed-initiative (human control-machine control) environments; communications in hearing-degraded conditions; visual scanning and target detection; Soldier emotion and fatigue states; integration across multiple sensory modalities; perceptual-motor behavior ; collaborative (team) and independent multi-task, multi-modal, multi-echelon Soldier-system performance, all cast against the influx of emerging Transformation-driven technological solutions and opportunities. Technical barriers include lack of methods for describing, measuring, and managing the interplay of these relatively novel phenomena in the consequent task due to situational complexity and ambiguity that characterize operations in the future force. Technical solutions are being pursued in the areas of data generation and algorithm development in these emerging environments in order to update and improve our understanding of performance boundaries and requirements and enable neuroengineering. These solutions include multi-disciplinary partnerships, metrics, simulation capabilities, and modeling tools for characterizing Soldier-system performance, and provide a shared conceptual and operational framework for militarily relevant research on cognitive and perceptual processes. In the area of translational neuroscience, which is the transition of basic neuroscience research to relevant applications, research is carried out to examine leading edge methodologies and technologies to improve the measurement and classification of neural states and behavior in operationally-relevant environments, to examine the potential application of neuroscience theories to autonomous systems to improve Soldier-system interactions, to model the relationship between brain structure and cognitive performance for understanding individual differences and injury, and to assess how neural pathways implicated in functional processing can be enhanced through dynamic system interface technologies for improving in-theatre performance and training.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Research to characterize and enhance Soldier performance	1.300	1.991	1.952
Description: Characterize and enhance human auditory performance of the dismounted warrior in complex environments while protecting the hearing of the Soldier.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 74A: *HUMAN ENGINEERING*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Investigated and determined optimum ear coverage by infantry helmets; investigated localization of impulse noises in a reverberant environment. ***FY 2011 Plans:*** Conduct initial experiments to quantify the contributions of visual, auditory, tactile, kinesthetic and narrative factors to an individual Soldier's immersive experiences; develop measures to capture how individuals perceive the effectiveness/contribution of immersion in simulation environments. ***FY 2012 Plans:*** Will determine the effects of ear coverage, from wearing infantry helmets, on auditory localization for modeling of Soldier mission performance.			
Title: Soldier performance ***Description:*** Characterize key issues underlying Soldier decision making such as computer modeling and social network analyses to investigate the quality of information flow in a defined command and control structure, investigations into situational understanding and prediction in uncertain environments, and identifying usability deficiencies and mismatches between battle command processes and technology enhancements. ***FY 2010 Accomplishments:*** Conducted investigations of situational understanding and prediction in uncertain environments; identified usability deficiencies and mismatches between battle command processes and technology enhancements; and investigated the effects of information presentation on the Soldier's ability to perceive information. ***FY 2011 Plans:*** Begin development of cognitive models predictive of team decision making; continue work on determining effects of information quality and presentation on Soldier system performance. ***FY 2012 Plans:*** Will transfer lessons learned from the development of a cognitive model-based architecture for robotics control to the Robotics Collaborative Technology Alliance; will continue studies which correlate electroencephalograph data with response times to perceptual stimulus events that will further the validation of the perceptual component of the cognitive model Adaptive Control of Thought-Rational (ACT-R).	2.180	2.294	2.205
Title: Translational Neuroscience ***Description:*** Integrating neuroscience with traditional approaches to understanding Soldier behavior to enable systems designs that maximize Soldier performance. Formerly titled Research in Neuroergonomics.	1.078	1.551	3.062

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 74A: *HUMAN ENGINEERING*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Explored the feasibility of using dry, wireless neurophysiological sensors suitable for high-density arrays in operationally-relevant environments; identified and modeled specific neural processes underlying visual scanning and target identification. ***FY 2011 Plans:*** Advance state-of-the-art in data analytic capabilities to extract brain-relevant information from multi-dimensional data arrays obtained in operationally-relevant contexts; validate models of neural mechanisms underlying visual scanning and explore the neural processes underlying human interaction with autonomous systems. ***FY 2012 Plans:*** Will investigate closed loop interaction between emotional/fatigue state monitors and computer systems that adapt to the emotion/ fatigue state of the user; will develop normative models that account for the variability in individual differences on performance; will explore functional connectivity of multivariate datasets for assessment of performance measures; will investigate predictive metrics for neural processing and/or cognitive performance that are linked to particular cognitive differences among individuals.			
Title: Cognition and Neuroergonomics ***Description:*** Devise and show fundamental translational principles for neuroscience-based research and theory to complex operations settings in three focus areas: Soldier-system information transfer, commander-level decision making, and individualized analysis and assessment of cognitive performance in operational environments. ***FY 2010 Accomplishments:*** Investigated perceptual-motor interactions, including those between sensory-perceptual channels and motor systems; explored the complex effects of information quality and quantity on physical and cognitive performance; explored the neural representations of command-level decision making through identification of information representation; examined factors leading to successful or faulty decisions, including biases, heuristics, implicit versus explicit knowledge, context and stressor; identified key individual differences, stressors, and investigated their impact on neural processing and cognitive performance; explored the appropriate neuro-sensing approaches for assessment in operational environments. ***FY 2011 Plans:*** Explore models of information presentation, including multi-modal and adaptive displays; examine the effects of information systems on physical and cognitive performance; examine how the nervous system filters large-scale, multi-dimensional data sets for decision making; identify individual differences in neural processing underlying successful and unsuccessful decision making; identify key individual differences and stressors and investigate their impact on neural processing and cognitive performance; explore the appropriate neuro-sensing approaches for assessment in operational environments; explore methods for state	1.069	1.135	0.800

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 74A: *HUMAN ENGINEERING*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
detection and signal processing techniques for signal integration; develop static algorithms that account for the variability in individual differences and/or environmental stressors on performance. ***FY 2012 Plans:*** will investigate closed loop interaction between emotional/fatigue state monitors and computer systems that adapt to the emotion/ fatigue state of the user; will develop normative models that account for the variability in individual differences on performance; will explore functional connectivity of multivariate datasets for assessment of performance measures; and will investigate predictive metrics for neural processing and/or cognitive performance that are linked to particular cognitive differences among individuals.			
Accomplishments/Planned Programs Subtotals	5.627	6.971	8.019

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 74F: *PERS PERF & TRAINING*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
74F: *PERS PERF & TRAINING*	5.643	5.549	6.766	-	6.766	7.023	7.148	7.266	7.389	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project funds behavioral and social science basic research in areas with high potential to improve personnel selection, training, leader development, human performance, and the human and social dynamics of network operations. Research covers areas such as assessment of practical intelligence as an aptitude that can be measured across job domains; develop principles and potential methods for training and sustaining complex tasks arising from digital, semi-automated, and robotic systems requirements; determine potential methods for faster learning, improved skill retention, and adaptable transfer of training to new tasks; discern likely methods for developing leader adaptability and flexibility as well as for speeding the maturation process; discover and evaluate the basic cognitive principles that underlie effective leader-team performance; better understand the role of emotions in regulating behavior; and improve the match between Soldier skills and their jobs to optimize performance. Research is focused on fundamental issues that will improve the Army's capability to: (1) select, classify, train, and/or develop Soldiers and leaders who are adaptable in novel missions and operational environments, can function effectively in digital, information rich, and semi-autonomous environments, can effectively collaborate in quickly formed groups and when distributed in high stress environments, and possess interpersonal and intercultural skills and attributes relevant to Joint-Service and multi-national operations; (2) accelerate the training of leadership, interpersonal, and emotional skills that traditionally develop over long periods of time and through direct experience; and (3) focus on the human cognitive and social domains - understanding individual, unit, and organizational behavior within the context of complex networked environments that will be essential for synergy between technology and human performance.

Research in this project is complementary to and fully coordinated with efforts funded in PE 0602785A (Project 790).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Defense of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the US Army Research Institute for the Behavioral and Social Sciences (ARI), Arlington, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Human Behavior	3.784	3.764	4.770
Description: Funding is provided to better select, classify, train, and/or develop Soldiers and leaders.			
FY 2010 Accomplishments: Achieved a better understanding of the interplay between cognition and emotion in training, performance, and socio-cultural interactions; linked training methods and learning principles to performance; systematically examined how nonverbal behaviors			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT 74F: *PERS PERF & TRAINING*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
are encoded and decoded in human communications in a variety of settings (focus was on training, leadership, and negotiation settings); and determined whether and how nonverbal behaviors affected outcomes in these environments. ***FY 2011 Plans:*** Conduct basic research in the areas of psychological measures of individual abilities, implicit and explicit learning, cognition, and social influence. ***FY 2012 Plans:*** Will conduct research in the areas of the leadership and team performance in complex environments; will analyze the impact of training methods on learner performance; will investigate how a neurophysiologic state (i.e., affect) influences perception; identify cognitive strategies of experts that can be used to develop efficient training protocols.			
Title: Network-Human Science ***Description:*** Funding is provided for better understanding individual, unit, and organizational behavior within the context of complex networked environments. ***FY 2010 Accomplishments:*** Created new computational measures of leadership and organizational expertise in on-line networks and distinguished novices from experts in order to rate the reliability of the contributed information; researched matching individuals needing information to other individuals who were able to share it; investigated the dynamics that foster a thriving online community. ***FY 2011 Plans:*** Continue basic research on variables that influence the interaction of individuals and teams within distributed environments. ***FY 2012 Plans:*** Will conduct research to understand organizational dynamics and unit cohesion; will conduct research on how language usage influences social dynamics; will analyze the influences of human performance in complex networked environments.	1.859	1.785	1.996
Accomplishments/Planned Programs Subtotals	5.643	5.549	6.766

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601102A: *DEFENSE RESEARCH SCIENCES*	**PROJECT** 74F: *PERS PERF & TRAINING*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT F20: *ADV PROPULSION RSCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
F20: *ADV PROPULSION RSCH*	3.303	3.429	3.996	-	3.996	4.193	4.272	4.355	4.429	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project funds research to increase the performance of small air-breathing engines and power trains to support improved system mobility, reliability, and survivability, and ultimately serve to reduce the logistics cost burden for the future. Problems addressed include the need for greater fuel efficiency and reduced weight in these propulsion systems. Technical barriers to advanced propulsion systems are the inadequacy of today's materials to safely withstand higher temperature demands, the lack of capability to accurately simulate the flow physics and the mechanical behavior of these systems, including the engine and drive train. The Army is the lead Service in these technology areas (under Project Reliance) and performs basic research in propulsion, as applicable to rotorcraft and tracked and wheeled vehicles. Technical solutions are being pursued through analysis, code generation, and evaluations to improve engine and drive train components and investigate advanced materials. Component level investigations include compressors, combustors, turbines, energy sources and conversion, injectors, pistons, cylinder liners, piston rings, gears, seals, bearings, shafts, and controls.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL) at the NASA Glenn Research Center, Cleveland, OH.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Thermal Materials	2.295	2.389	2.948
Description: Investigates new materials needed to withstand the higher temperature regimen of advanced high performance engines, and evaluates improved tools and methods that will accurately simulate the flow physics and the mechanical behavior of future engines and drive trains which will contribute to the design of more fuel efficient and reliable propulsion systems.			
FY 2010 Accomplishments: Investigated optimum fiber architecture needed to fabricate uncooled turbine components for increased fuel efficiency and developed improved sand trajectory modeling methodology to improve the safety, durability, and reliability of turbine engines.			
FY 2011 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT F20: *ADV PROPULSION RSCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Complete computational assessment of gear windage for various gear rotational conditions and compare with validation results to identify and mitigate power losses. ***FY 2012 Plans:*** Will develop a modeling and simulation capability that will be used to predict and compare the automotive, thermal, and electromechanical performance of next-generation Army wheeled tactical and combat vehicle power train concepts; and will investigate the design of more fuel efficient propulsion system.			
Title: Reliable Small Engines for Unmanned Systems ***Description:*** Develops improved tools and methods to enhance the reliability and fuel efficiency of small engines for air and ground vehicles and to enable the use of heavy fuels. ***FY 2010 Accomplishments:*** Utilized validated suite of system simulation tools to identify and improve component and system operation of current and potential Army small engine applications. ***FY 2011 Plans:*** Evaluate potential for improving fuel consumption and reliability of heavy fuel engine concepts for small (<100 HP) system applications. ***FY 2012 Plans:*** Will evaluate the performance of a representative Army unmanned vehicle engine at simulated altitude conditions.	1.008	1.040	1.048
Accomplishments/Planned Programs Subtotals	3.303	3.429	3.996

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT F22: *RSCH IN VEH MOBILITY*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
F22: *RSCH IN VEH MOBILITY*	0.554	0.576	0.588	-	0.588	0.601	0.612	0.624	0.635	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts research in support of advanced military vehicle technology with emphasis on advanced propulsion, sophisticated vehicle dynamics and simulation, and advanced track and suspension concepts. Advanced propulsion research will dramatically improve power density, performance and thermal efficiency for advanced adiabatic diesel engines, transient heat transfer, high temperature materials and thermodynamics. This project also supports state-of-the-art simulation technologies to achieve a more fundamental understanding of advanced high-output military engines. The subject research is directed at unique, state-of-the-art phenomena in specific areas such as: non-linear ground vehicle control algorithms, using off-road terrain characteristics; and instantaneous diesel engine optimizations, using advanced analytical and experimental procedures.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

This work is performed at the Tank and Automotive Research, Development and Engineering Center (TARDEC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Advanced Mathematical Algorithms for Improved Vehicle Efficiency	0.554	0.576	0.588
Description: Funding is provided for the following effort: ***FY 2010 Accomplishments:*** Developed engineering models for JP-8 ignition and combustion profiles; explored reduced chemical kinetics JP-8 ignition models; and further investigated vehicle-human interaction dynamics. ***FY 2011 Plans:*** Continue developing JP-8 engineering models for combustion and ignition as a function of fuel ignition quality; continue exploring e vehicle-human interaction dynamics; and study better modeling techniques for vehicle-terrain interaction dynamics. ***FY 2012 Plans:*** Will expand JP-8 ignition models to include wide varying ignition quality fuels; will explore and develop robust multidisciplinary design optimization techniques with advanced materials for reducing ground vehicle weight while improving or maintaining ground vehicle mobility, reliability and survivability.			
Accomplishments/Planned Programs Subtotals	0.554	0.576	0.588

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT F22: *RSCH IN VEH MOBILITY*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H42: *MATERIALS & MECHANICS*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H42: *MATERIALS & MECHANICS*	5.889	6.975	8.461	-	8.461	8.676	8.835	8.990	9.143	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds the Army's basic research in materials science, which includes research into key phenomena enabling the creation and production of revolutionary materials that will provide higher performance, lighter weight, lower cost, improved reliability, and environmental compatibility for Army unique applications. The current approach of using materials to gain added functionality for Army systems is to use a layered approach, whereby each layer provides added capability (i.e. ballistic, chemical/biological, signature, etc.) but ultimately makes the system too heavy and too expensive. Technical solutions are being pursued through understanding the fundamental aspects of chemistry and microstructure that influence the performance and failure mechanisms of ceramics, advanced polymer composites, and advanced metals, with the goal of creating hierarchically organized materials systems that possess multifunctional attributes at greatly reduced weight and cost. These advanced materials will enable revolutionary lethality and survivability technologies for the future. This research supports materials technology applied research in PE 0602105A, project H84.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Microscopic/Nanostructural Materials	2.235	2.759	2.481
Description: Devise new materials and design capabilities, based upon fundamental concepts derived at the microscopic and nano-structural levels, for the future force.			
FY 2010 Accomplishments: Researched grain boundary engineering of ceramics to improve fracture tolerance at low and high rates and characterized materials using a combination of electron microscopy and crystallographic orientation tools to identify optimum microstructures for ballistic protection.			
FY 2011 Plans: Research novel processing method concepts for improved armor ceramics; and characterize multifunctional materials systems seeking performance at minimum weight.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H42: *MATERIALS & MECHANICS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will provide a theoretical basis for the selection of kinetically stabilizing alloying elements in nanocrystalline materials; and will prove grain size stabilization in nanocrystalline metallic systems by experimental methods..			
Title: High Deformation Rate Materials ***Description:*** Develop fundamental understanding necessary to design, process and characterize materials specifically intended for high loading rate applications. ***FY 2010 Accomplishments:*** Investigated the relationships existing between high rate properties and prior processing and characterized nanoscale materials using high resolution microscopic analytical methods for feedback to processing and modeling research for protection materials. ***FY 2011 Plans:*** Perform research relating high rate properties and microstructures to ballistic property observations; and use model results of static and transient electric/magnetic/flow fields to identify new materials and mechanisms. ***FY 2012 Plans:*** Will model and experimentally determine property relationships in piezoelectric materials; and will describe the chemical state of emerging high rate materials with a view toward optimizing materials properties for ballistic environments.	1.838	2.124	2.465
Title: Materials Research and Processing at Small Scale ***Description:*** Elucidate and exploit unique structure, processing, and property relationships that occur in materials at small length scales and develop methods to tailor the physical, chemical and mechanical response of these materials to enable unprecedented performance improvements in materials properties. ***FY 2010 Accomplishments:*** Performed materials research to relate properties observed at small scale to microstructure and performed research relating ballistic model output to processing, properties and microstructure. ***FY 2011 Plans:*** Determine the relationship between textile properties and fabrication methods; and characterize novel protective materials using state of the art microscopy tools. ***FY 2012 Plans:***	1.816	2.092	3.515

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H42: *MATERIALS & MECHANICS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will develop tools for the characterization of hierarchically structured materials for an understanding of the synthesis and mechanics of bio-inspired materials; and will determine quantum effects on materials design to enable unprecedented performance improvements in materials properties.			
Accomplishments/Planned Programs Subtotals	5.889	6.975	8.461

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H43: *RESEARCH IN BALLISTICS*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H43: *RESEARCH IN BALLISTICS*	8.042	8.318	9.063	-	9.063	9.224	9.395	9.563	9.726	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project seeks to improve the understanding of the chemistry and physics controlling the propulsion, launch, and flight of gun launched projectiles and missiles, and to understand the interaction of these weapons with armored targets. This research results in basic new knowledge, which allows the formulation of more energetic propellants, more accurate and non-lethal (NL)/lethal projectiles and missiles, and advanced armors for increased survivability of Army combat systems. This effort supports the Office of the Secretary of Defense Advanced Energetics Initiative to mature the fundamental technologies required to transition the next generation of energetic materials into field use. This research supports survivability and lethality technology applied research in PE 0602618A, project H80.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Aberdeen Proving Ground, Adelphi, MD, and Research Triangle Park, NC.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: National Advanced Energetics Initiative	2.518	2.672	2.963
Description: Expand and confirm physics-based models and validation techniques to enable design of novel insensitive propellants/explosives with tailored energy release for revolutionary Future Force survivability and weapons effectiveness. ***FY 2010 Accomplishments:*** Provided new theoretical descriptions, quantum mechanical models, and real-time, in-situ validation measurements of energy storage and release mechanisms in non-traditional condensed phase materials such as structural nano-reactives, metastable polymerics, strained crystals, and diamond-like explosives. ***FY 2011 Plans:*** Link atomistic descriptions of disruptive energy storage and release mechanisms to new mesoscale models to describe space-time fluctuating microstructure behavior critical to understanding reactive behavior at the continuum modeling level. ***FY 2012 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H43: *RESEARCH IN BALLISTICS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will investigate rapid energy release from new classes of materials subjected to extreme physical constraints and characterize through high performance computer models and experiments.			
Title: Launch and flight of gun launched projectiles as well as missiles ***Description:*** mprove the fundamental understanding of the mechanisms controlling the launch and flight of gun launched projectiles and missiles, and understand the interaction of these weapons with armored targets. ***FY 2010 Accomplishments:*** Identified the controlling mechanisms through modeling and validation that are responsible for the ballistic effectiveness of ceramic materials; expanded the reactive material ignition model to include a variety of reactive materials with different terminal effects; and adjusted the urban material failure model to account for numerous urban construction materials. ***FY 2011 Plans:*** Establish a validation technique that directly probes and quantifies the fundamental mechanism responsible for brittle material ballistic performance; develop suitable post-ignition thermal and equation of state models for reactive material ignition products; and quantify the terminal ballistic effects of a variety of urban construction materials impacting the human body through extensive modeling and sub-scale experiments. ***FY 2012 Plans:*** Will explore non-linear aerodynamics of complex shapes to advance next generation extended range precision munitions; Will explore non-traditional modeling techniques for using on-board projectile flight information to enable affordable non-GPS guidance; and will perform first generation mapping of the shock and blunt impact effects on the mechanical state of human bone and tissues and the effects on specified connective centers in the human brain.	2.580	2.686	2.479
Title: Extramural research in non-lethal (NL) control methods ***Description:*** Extramural research in non-lethal (NL) control methods to exploit potentially innovative approaches that offer unique battlefield and homeland defense capabilities. ***FY 2010 Accomplishments:*** Conducted research on high rate response of biological materials, cause of injury, and injury mechanisms for development of novel protection concepts; researched energy flow processes at interfaces to develop precise control of explosive effects; and focused on the analysis and understanding of hyper-spectral image data and the development of rigorous mathematical models and hierarchical statistical techniques to characterize impacts. ***FY 2011 Plans:***	0.927	0.932	0.996

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H43: *RESEARCH IN BALLISTICS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Develop fast hierarchical Bayesian inference algorithms and fusion techniques to combine results obtained from analyzing hyper-spectral imagery with information obtained from other sources such as biological validation or knowledge base for increased battlefield awareness. ***FY 2012 Plans:*** Will focus on the development of new models for automated image analysis and understanding with emphasis on crowd behavior analysis through examining the spatio-temporal pattern of crowd behavior as well as abnormal event detection in crowds for situation awareness and crowd control; will also study relationships between molecular structure, decomposition pathways, and potential energy surfaces for ground and excited electronic states of energetic compounds using laboratory-based spectroscopic and advanced electronic structure methods to enable more accurate predictions of the performance properties of speculative energetic compounds.			
Title: Armor Research ***Description:*** Develop fundamental knowledge of mechanisms that can be exploited to ensure the next generation of lightweight and efficient armor technologies. ***FY 2010 Accomplishments:*** Developed models for armor plate acceleration that do not utilize explosive materials; obtained laboratory derived mesoscale modeling parameters for ceramic materials to enable modeling of ceramic armor materials at the micro-structural level; and studied a thermodynamically-consistent equation of state theory. ***FY 2011 Plans:*** Formulate and validate explosive-free plate acceleration models and equation of state models into continuum mechanics codes; and will use the mesoscale modeling approach to identify ceramic material microstructures that will result in their improved ballistic resistance. ***FY 2012 Plans:*** Will evaluate novel reactive armor and electromagnetic armor mechanisms to include inferring real-time geometry of penetration into thick armor sections induced with electromechnical stresses.	2.017	2.028	2.625
Accomplishments/Planned Programs Subtotals	8.042	8.318	9.063

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H43: *RESEARCH IN BALLISTICS*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H44: *ADV SENSORS RESEARCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H44: *ADV SENSORS RESEARCH*	6.241	9.695	10.005	-	10.005	10.148	10.319	10.662	11.046	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project conducts basic research to produce future generations of sensors with capabilities beyond those currently being employed. Technical barriers include the fundamental speed and bandwidth limitations of current materials and devices, the efficiency of current algorithms, current computing architectures, organic material lifetimes, the understanding of the fundamental concepts of quantum cryptography, and spatial resolution of current radio frequency (RF) sensors. The technical approach is to exploit large scale electromagnetic (EM) models to predict and explain target and clutter scattering behavior, digital and image processing modules and algorithms, beam propagation and material modeling of nonlinear optical effects, hazardous material detection, remote sensing and intelligent system distributive interactive simulations, unique sensor development, sensor data feature and information fusion, and battlefield acoustic signal processing algorithms. Research performed under this project supports survivable sensor systems, organic thin film transistor technology and organic light emitting diode technology for affordable rugged flexible displays. Payoffs include low cost compact flexible displays for the Soldier and for the Army, improved radar signal processing techniques that will allow existing systems to improve spatial resolution, improved ultra wideband radar technology for detection of explosives including mine detection, through the wall sensing and robotics perception, improved sensor approaches and signal processing techniques for enhanced acoustic/seismic sensing systems in noisy environments, distributed sensor data fusion in ad hoc networks, improved cryptography techniques, and hazardous material and event sensing. This project also funds research in the development of biologically inspired materials for use as sensors as well as for power generation and storage.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Adaptive, Active, and Intelligent Optical Systems	1.708	1.761	1.779
Description: Adaptive, active, and intelligent optical systems for high-data-rate military communications and directed energy applications.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H44: *ADV SENSORS RESEARCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Explored long range atmospheric laser beam propagation paths for military reconnaissance, laser communications, and directed energy applications. ***FY 2011 Plans:*** Devise target-in-loop (TIL) laser beam control techniques for Army long range and tactical scenario engagements. ***FY 2012 Plans:*** Will develop image processing software that includes super resolution, fusion, and adaptive optics for application to enhance laser communication technologies; and will validate image processing software in realistic battlefield conditions to improve real-time situational awareness through greater fidelity of battlefield imagery.			
Title: Improving Sensor and Display Capabilities ***Description:*** Create more survivable and secure systems and displays, improve hazardous material monitoring, and investigate new magnetic sensor technologies for personnel and improvised explosive device (IED) detection. ***FY 2010 Accomplishments:*** Integrated conductive organic materials and high stability organic light emitting diode (OLED) with flexible backplanes and conducted experiments with a Micro Electric Mechanical System (MEMS) low-noise magnetic sensor; modeled metamaterial antennas and explored their theoretical limits. ***FY 2011 Plans:*** Optimize conducting organic materials for flexible display and electronics, investigate 3-D Synthetic Aperture Radar imaging using wide-angle simulation data of complex buildings for through-the-wall sensing research, develop conductive organic materials and thin film transistors and integrate into flexible electronic devices. Research networked fusion concepts across distributed multimodal sensor nodes and develop novel magnetic sensors with enhanced performance. Fabricate and evaluate metamaterial inspired antennas based on theoretical simulations. ***FY 2012 Plans:*** Will fabricate and further investigate metamaterial inspired antennas based on theoretical simulations; will develop, apply and validate advanced computational models of 3-dimensional realistic ground surfaces to aid in defining theoretical performance limits of low frequency wideband radar technology for the detection of landmines and IEDs; will research phenomenology of features associated with sensing human motion and concepts for fusion of new features to reduce false alarms; will continue optimization of conductive organic materials and high stability OLEDs for transition into OLED displays to include development of thin-film transistors and transparent electrodes for flexible electronics applications.	2.500	2.644	2.685
Title: Biologically-Inspired Sensing and Power Generation	2.033	2.290	3.052

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H44: *ADV SENSORS RESEARCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: Investigate biological systems to develop biologically-inspired materials for use as sensors as well as for power generation and storage. ***FY 2010 Accomplishments:*** Investigated bacteria that remediate energetic materials and produced small organic molecules useful as fuels, bio-inspired structural materials for energy absorption, bio-inspired batteries, and biologically directed assembly of electronic structures. ***FY 2011 Plans:*** Manipulate bacteria for improved remediation of energetic materials and generation of organic fuels, investigate electric properties of bio-assembled materials for battery applications, investigate mechanical properties of bio-inspired structural materials, and investigate the electronic properties of bio-assembled electronic structures. ***FY 2012 Plans:*** Will investigate methods to redesign cellular proteins to converge the signaling from different cellular receptors to a common output signal suitable for electronic device detection; will manipulate bio-assembled electronic structures by controlled deposition of infrared (IR) sensitive materials and characterize the resulting complexes; will complete characterization of 2-D assembly of nucleic acid templates in non-aqueous solvents for patterning of semiconductor seed particles for IR and photovoltaic devices; will continue iterative modeling and experimental evaluation of models for remediation of energetics and generation of organic fuels to reflect new information collected from systems biology approaches.			
Title: Multi-Scale Modeling for Novel Materials ***Description:*** Funding is provided for the following efforts: ***FY 2011 Plans:*** Perform fundamental studies of materials to identify and model physics and atomic interactions that define the electronic properties and characteristics, such as bandgap structure and control material deformation, progressive / catastrophic failure, and phase response across length scales; evolve interface physics between nano- and meso-scales up to the continuum; create new multi-scale experimental techniques and characterization methods to probe materials nano- and microstructure, including defects and at interfaces, and response under extreme conditions. Supporting computational research investigates and develops scalable interdisciplinary data models to address spatial one-way coupling of software on massively parallel petaflop systems, and multi-core computing systems. ***FY 2012 Plans:*** Will continue to perform fundamental studies of materials to identify and model physics and atomic interactions that define the electronic and optical properties and characteristics, such as bandgap structure, carrier transport, diffusion rates, defects, control	-	3.000	2.489

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H44: *ADV SENSORS RESEARCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
material deformation, progressive / catastrophic failure, and phase response across length scales; will evolve interface physics between nano- and meso-scales up to the continuum; will expand upon and continue to create new multi-scale experimental techniques and characterization methods to probe materials nano- and microstructure, including defects and at interfaces, and response under extreme conditions; will develop web-based security scheme for external and internal project users; will develop multi-scale computational science environment to facilitate coupling of different software; will establish methods to support high performance computing users and software developers.			
Accomplishments/Planned Programs Subtotals	6.241	9.695	10.005

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H45: *AIR MOBILITY*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H45: *AIR MOBILITY*	2.306	2.399	2.449	-	2.449	2.497	2.543	2.588	2.632	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project supports basic research in aerodynamics for manned and unmanned rotary wing aircraft. The goal of this effort is to develop improved tools and methods to analyze, evaluate, and assess rotorcraft unique aerodynamic properties in conventional helicopter and tilt rotor aircraft. The efforts in this project will result in a better understanding of rotorcraft aeromechanics and will result in improved performance, safety and, ultimately, improved combat effectiveness of the manned and unmanned rotorcraft in the future force. This project supports the future force by providing research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing aircraft.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Aviation & Missile RDEC, Aero-Flight Dynamics Directorate at NASA Ames Research Center, CA and Langley Research Center, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Rotary Wing Aerodynamics	2.306	2.399	2.449
Description: Funding is provided for the following effort ***FY 2010 Accomplishments:*** Investigated interacting vortex wakes for rotors in close proximity and identified the high speed aeromechanics boundaries of compound helicopter configurations. ***FY 2011 Plans:*** Develop improved and validated hover performance methods, investigate the ability of pressure sensitive paint to acquire unsteady pressure measurements for both fuselage and rotor blades. ***FY 2012 Plans:*** Will assess facility effects on existing highest quality single rotor hover data; will investigate natural laminar flow wings for improved rotorcraft performance; and will explore high performance computing methodology for difficult rotorcraft phenomenon.			
Accomplishments/Planned Programs Subtotals	2.306	2.399	2.449

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H45: *AIR MOBILITY*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H47: *APPLIED PHYSICS RSCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H47: *APPLIED PHYSICS RSCH*	2.894	5.009	5.087	-	5.087	5.187	5.258	5.540	5.996	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project performs basic research on electronic materials and structures as well as energetic batteries and fuel cells to enable higher performance and more efficient electronic systems. This includes nanoelectronic devices for low-power and high-frequency applications; sensors, emissive nonlinear and nanophase electrode, and electronic materials; thin heterostructure systems where quantum confinement effects are important; advanced batteries and more efficient fuel cells for hybrid power; and the manipulation of cold atoms on a chip for application to very sensitive sensors and ultra-stable atomic clocks. These investigations will impact the development of power sources and specialty electronic materials for the Army's future force, including improved wide band gap semiconductor performance in electric vehicles and advanced radar systems. Applications of cold atom chips include gyroscopes and accelerometers for inertial navigation units in global positioning system (GPS) denied environments, gravitational sensors for detecting underground facilities, very-low-phase noise precision oscillators for low-velocity Doppler radar, and atomic clocks for GPS denied environments as well as for future space-based timing applications. Technical barriers affecting performance, weight, cost, and power consumption will be addressed.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Research Focuses on Nanoelectronic Devices and Sensors	2.894	3.002	3.086
Description: Materials for advanced batteries; fuel cells and reformers for Soldier and vehicle power; electronic materials structures and defects of high-temperature wide-band-gap semiconductors for high-power electronic applications; cold-atom chip devices for advanced sensors and ultra-stable atomic clocks; and integration of nanoenergetics and micro electro mechanical system (MEMS) for fusing and microrobotic applications.			
FY 2010 Accomplishments: Loaded and launched cold atoms into an atom waveguide; integrated nanoporous energetic silicon with MEMS acceleration switch and investigated carbon based materials for application to nanoelectronic devices; used computer modeling to understand			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H47: *APPLIED PHYSICS RSCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
ionic transport within membranes for electrochemical devices; developed mechanisms for Solid Electrolyte Interface formation to aid in designing battery components. ***FY 2011 Plans:*** Attempt to split a cold atom cloud in an atom chip waveguide. Integrate nanoporous energetic silicon with MEMS microthruster devices and develop nanoelectronic devices. Develop new battery electrode prospects by bio-inspired processes from Institute for Collaborative Biotechnologies, PE 0601104A/project H05. ***FY 2012 Plans:*** Will study the coherence properties of a split cold atom cloud in an atom chip waveguide; will investigate energetic energy conversion methods for on-chip pulsed power; will examine existing models for graphene materials growth for potential use in nanoelectronic devices; will investigate next generation wide band gap power device materials such as Aluminum Nitride and diamond, will conduct modeling of electron transport in alkaline membrane electrode assemblies, and will model physical properties of Silicon (Si) anodes for Lithium ion batteries and structure property relationships of Si anodes.			
Title: Advanced Energy Science Research ***Description:*** Conduct materials research and multi-scale modeling that will lead to advances in energy storage, harvesting, and conversion for a wide range of Army applications. ***FY 2011 Plans:*** Conduct research to advance novel materials by design approach of modeling and theoretical computations to predict characteristics and performance a priori for energy storage and conversion materials; investigate multidisciplinary approaches for novel energy harvesting (light, heat, vibration, isotope, biological energy, sources); investigate emerging nanostructured materials (carbon nanotube, graphene, silicon carbide, diamond) for energy storage electrodes, thin films, and energy conversion applications. ***FY 2012 Plans:*** Will conduct research to design, fabricate and characterize materials properties in coordination with planned modeling and theoretical computations for energy storage and conversion materials; will conduct research in developing computational tools in multi-scale modeling supporting electrochemical energy materials development; will design and experiment novel energy harvesting (light, heat, vibration, isotope, biological energy, sources) methods; will investigate, emerging nanostructured materials (carbon nanotube, graphene, silicon carbide, diamond) for energy storage electrodes, thin films, and energy conversion applications.	-	2.007	2.001
Accomplishments/Planned Programs Subtotals	2.894	5.009	5.087

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601102A: *DEFENSE RESEARCH SCIENCES*	**PROJECT** H47: *APPLIED PHYSICS RSCH*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H48: *BATTLESPACE INFO & COMM RSC*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H48: *BATTLESPACE INFO & COMM RSC*	11.200	13.685	15.726	-	15.726	17.250	18.285	18.890	19.211	Continuing	Continuing

Note

Not applicable to this item

A. Mission Description and Budget Item Justification

This project supports basic research to enable intelligent and survivable command and control, communication, computing, and intelligence (C4I) systems for the future force. As the combat force structure decreases and operates in more dispersed formations, information systems must be more robust, intelligent, interoperable, and survivable if the Army is to retain both information and maneuver dominance. This research supports the Army's new Network Science initiative and in the process addresses the areas of information assurance, the related signal processing for wireless battlefield communications, document and speech machine translation, and intelligent systems for C4I. Major barriers to achieving the goals are 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, resource-constrained sensor networks, diverse networks with dynamic topologies, high-level multi-path interference and fading, jamming and multi-access interference, levels of noise in speech signals and document images, new low-density languages, and information warfare threats. The intelligent systems for C4I research will focus on providing the agent technology capabilities that will produce highly relevant tactical events for mounted or dismounted commanders, leaders and soldiers; improve the timeliness, quality and effectiveness of actions; and speed the decision-making process of small teams operating in complex natural or urban terrain.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Communication for Tactical Networks	1.671	1.568	1.687
Description: Perform research to provide communications capability for a fully mobile, fully communicating, and situationally aware force operating in a highly dynamic, wireless, mobile networking environment populated by hundreds to thousands of networked nodes.			
FY 2010 Accomplishments:			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Performed validation analysis to extract tractable models of network behavior to enhance military network design tools. ***FY 2011 Plans:*** Use network behavior models and scaling laws to develop cognitive networking protocols to enhance the performance of tactical mobile networks. ***FY 2012 Plans:*** Will develop techniques to characterize the quality of information and develop an understanding and potential metrics for impact on network behavior.			
Title: Data to Knowledge to Support Decision Making ***Description:*** Design and implement a laboratory scale common information-processing infrastructure, inclusive of service oriented architecture for networking processes that aids in the transformation of data into actionable intelligence to support decision-making under uncertainty. ***FY 2010 Accomplishments:*** Extended scene recognition algorithms to mobile platforms to support biologically inspired collaborative behaviors; investigated local and global policy aware information exchange and information exploitation algorithms in collaboration with the Network Science CTA initiative. ***FY 2011 Plans:*** Conduct validations in a laboratory environment to assess the impact of scene recognition algorithms on Situation Understanding. ***FY 2012 Plans:*** Will extend scene recognition to scene understanding algorithms, assessing them and their associated machine learning approaches on collaborating mobile platforms.	1.480	1.636	1.761
Title: Information Processing for Mobile Ad-Hoc Networks (MANET)s ***Description:*** Perform research in protecting information in highly mobile wireless tactical environments with severe bandwidth, energy, and processing constraints and operating without reliance on centralized security services. ***FY 2010 Accomplishments:*** Refined and evaluated the dynamic security services architecture for mobile tactical networks for assured Soldier communications. ***FY 2011 Plans:***	1.710	1.765	1.899

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Investigate techniques for incorporating security constraints in networking protocols. ***FY 2012 Plans:*** Will investigate and develop techniques for securing information flows in mobile wireless tactical environments.			
Title: Multi-Lingual Computing Research ***Description:*** Establish formal methods for bridging language barriers in tactical environments, incorporating state of the art techniques in machine translation and natural language processing. ***FY 2010 Accomplishments:*** Developed and assessed novel metrics for evaluating new multi-engine machine translation architectures. ***FY 2011 Plans:*** Conduct laboratory validations to assess multi-engine machine translation concepts, addressing scalability and robustness in noisy environments. ***FY 2012 Plans:*** Will formalize techniques for adapting data flows to increase the effectiveness of multi-engine translation techniques; and will develop methods to support decision making from machine translated segments.	1.082	1.222	1.315
Title: Network Science for MANETs and Tactical Communications ***Description:*** Study the behavior of mobile ad-hoc networks (MANETs) as part of the Army's Network Science initiative. Emphasis is on mobile communications networks research with the Army's University Affiliated Research Center, the Institute for Collaborative Biotechnology at the University of California - Santa Barbara. ***FY 2010 Accomplishments:*** Developed and compared component based analytical models with executable models to enable the design of robust tactical networks. ***FY 2011 Plans:*** Develop algorithms, techniques and metrics for robust local/global network optimization using cognitive and communication network metrics. ***FY 2012 Plans:*** Will develop algorithms for the analysis of complicated large-scale network structures.	1.001	1.036	1.114
Title: Advanced Computing	2.500	2.599	3.797

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APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H48: *BATTLESPACE INFO & COMM RSC*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: Investigate computing and networking architectures, algorithms, as well as visualization for advanced battle command applications of C4I system. ***FY 2010 Accomplishments:*** Investigated algorithms, approaches, and methodologies for battle command applications that exploit emerging mobile hybrid computing architectures. Battle command applications included large-scale battlefield network modeling; real-time algorithms to assist network emulations; comprehensive data representation, models and analysis techniques; information fusion of different data types; and engineering design based approaches. ***FY 2011 Plans:*** Implement large-scale battlefield network modeling; develop real-time algorithms to assist network emulations; develop models and analysis techniques; establish information fusion of different data types for battle command applications that exploit emerging mobile hybrid computing architectures. ***FY 2012 Plans:*** Will validate battle command applications developed on mobile hybrid computing architectures, namely, large-scale network electromagnetic propagation; will develop real time algorithms for network emulations, and network simulators; will develop new methods for battle command information visualization; will explore programming models and battle command applications for the next generation Intel High Performance Computing architectures, namely, cloud on a chip, and secure enclaves.			
Title: Network Science Technology Experimental Center ***Description:*** Supports in-house Network Science studies in conjunction with the Network Science and Technology Research Center (PE 0601104A/project J22) and is coordinated through the Network Sciences CTA (0601104A/project H50). ***FY 2010 Accomplishments:*** Devised advanced computing based tools to accelerate scenario/model development that allowed coupling of different models, verification and validation, and enhanced multi-disciplinary collaboration through common user interfaces, scalable library routines, pre-processing, scalable optimization routines, and post-processing analysis tools. ***FY 2011 Plans:*** Extend the wireless emulation and simulation tools to support the modeling of networks of 1000s of nodes with high-fidelity propagation models and realistic traffic models. The simulation and emulation tools are linked to field validations to extend the scale of the network evaluated. These efforts significantly improve the understanding of network behaviors under a full range of operational conditions, significantly improving the design of NCW technologies. ***FY 2012 Plans:***	1.756	3.859	4.153

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will expand capabilities toward extensive integration of wireless communications emulation with academic and industrial experimental facilities developed under the Network Sciences CTA; will initiate a comprehensive program of multi-disciplinary experiments with wireless emulation utilized as hardware in the loop; will document experimental and theoretical results describing and predicting impact of mobility and adversarial attacks on the dynamics of information quality delivered through mobile communication networks to include observed phenomena of the characteristics of network reliability perceptions and trust on battle command decision making; will research social network analysis metrics and techniques for integrating these with traditional communications and information network analysis methods.			
Accomplishments/Planned Programs Subtotals	11.200	13.685	15.726

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H52: *EQUIP FOR THE SOLDIER*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H52: *EQUIP FOR THE SOLDIER*	1.026	1.078	1.105	-	1.105	1.134	1.158	1.181	1.201	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project supports basic research to achieve technologies for the Soldier of the future which focus on core technology areas that include mathematical modeling, physical and cognitive performance, polymer science/textile technology, nanotechnology, biotechnology, and combat ration research. Effort is targeted on enhancing the mission performance, survivability, and sustainability of the Soldier by advancing the state-of-the-art in the sciences underlying human performance, clothing, and protective equipment to defend against battlefield threats and hazards such as ballistics, chemical agents, lasers, environmental extremes, and ration shortfalls.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Defense of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work is performed and managed by the Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Equipment for the Soldier	1.026	1.078	1.105
Description: This project supports basic research to achieve technologies for the Soldier of the future which include mathematical modeling, physical and cognitive performance, polymer science/textile technology, nanotechnology, biotechnology, and combat ration research. ***FY 2010 Accomplishments:*** Used novel computational methodologies to understand techniques necessary to simulate dynamics/interactions of fluid structure systems undergoing topology change as would be found in parachutes, parafoils and flexible structures. ***FY 2011 Plans:*** Continue fundamental work in supporting the goals of understanding cognition while performing multiple tasks; explore novel approaches to representing body geometry in biomechanical applications to address fundamental errors in measurement and analysis techniques of earlier human limb mass property studies; and conduct experiments to improve the understanding of the basic phenomena of the biomimetic approach to metal oxide formation for the production of novel multifunctional materials. ***FY 2012 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H52: *EQUIP FOR THE SOLDIER*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will investigate the aerodynamics and structural behavior of permeable structures under dynamic loads; will explore the cognitive behavior of non-spatial influences on navigation through complex environments; and will do fundamental biomechanical research on exoskeleton design and human sciences towards optimization of user performance.			
Accomplishments/Planned Programs Subtotals	1.026	1.078	1.105

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H57: *Single Investigator Basic Research*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H57: *Single Investigator Basic Research*	62.870	73.075	78.257	-	78.257	79.027	80.262	79.933	82.453	Continuing	Continuing

Note

Not applicable

A. Mission Description and Budget Item Justification

This extramural research project discovers and exploits new scientific opportunities and technology breakthroughs, primarily from universities, that will improve the Army's Transformational Capabilities. Current technologies are unable to meet the operational requirements of the future force. The Army Research Office of the Army Research Laboratory (ARL) maintains a strong peer-reviewed scientific research program through which leap-ahead technological solutions may be discovered, matured, and transitioned to overcome the technological barriers associated with next generation capabilities. Included are research efforts for increasing knowledge and understanding in fields related to long-term future force needs in the physical sciences (physics, chemistry and biology), the engineering sciences (mechanical sciences, electronics, materials science and environmental science (atmospheric and terrestrial sciences), and mathematical and information sciences (mathematics, computer, and information sciences), and network science. Targeted research programs in nanotechnology, smart structures, multifunctional and microminiature sensors, intelligent systems, countermine, compact power, and other mission-driven areas will lead to a Future Force that is more strategically deployable, more agile, more lethal, and more survivable. The breadth of this basic research program covers approximately 900 active, ongoing research grants and contracts with leading academic researchers and approximately 1,600 graduate students yearly, supporting research at nearly 250 institutions in 50 states.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed extramurally by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Basic research in molecular, physiological, and systems biology	5.729	6.351	6.899
Description: Pursues fundamental discoveries with the ultimate goal of facilitating the development of novel biomaterials to greatly enhance Soldier protection and performance. More specifically, i) molecular genetics research pursues fundamental studies in molecular and systems biology, and genetics, ii) neurosciences research investigates the physiology underlying perception, neuro-motor output, and potential methods of monitoring cognitive states during activity, iii) biochemistry research focuses on studies in structural and cell biology, metabolic processes, and biophysics; iv) research in microbiology pursues studies in microbial physiology, ecology, and evolution, and v) social science research aims to elucidate the social, cultural, and other influences to human actions.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H57: *Single Investigator Basic Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Basic research efforts were aimed at the design of bioinspired nanodevices, the use of biomimetics to create new protective materials, the discovery and characterization of microbial species for potential bioremediation (e.g., degradation of toxic pollutants), and the discovery of potential animal metabolic pathways that could ultimately allow the modulation of oxidative stress as applied to Soldier health and performance; pursued concurrent transition and focus towards field use in these research areas; began new initiatives in non-invasive modulation of neural systems with the goals of bridging the living/nonliving interface in peripheral nerves and sensing of brain signals; expanded biofuel development studies; improved methods to convert operating base biological waste to energy; and investigated development of methodologies to convert sunlight 'directly' to biofuels. ***FY 2011 Plans:*** These research efforts are continuing to further advance their applicability and ultimately enable and facilitate development of new biotechnologies and bio-nano engineering applications for new Army capabilities and material. Research is also continuing to compare the potential for various non-invasive methods to reproducibly interpret brain signals. ***FY 2012 Plans:*** Efforts will continue to improve Soldier protection; will investigate potential mechanisms to improve Soldier cognitive and physical performance; and will explore methods to harness biological mechanisms for energy and fuel production.			
Title: Basic research in environmental science ***Description:*** Basic research in environmental science possesses three areas: atmospheric science research to measure, model, and theoretically understand the nighttime atmospheric boundary layer; terrestrial science research to enable the Army to operate effectively in all military operating environments by understanding fundamental terrain and land-based phenomena; and military habitation science, basic research to allow military power projection that meets operational needs in a sustainable manner. ***FY 2010 Accomplishments:*** Addressed Army-unique atmospheric operational needs and investigated automated terrain navigation by autonomous vehicles and used geographic information systems (GIS)-based approaches for cognitive understanding and utilization of geospatial information, analysis, representation, and modeling of multiple types of geospatial data. ***FY 2011 Plans:*** Examine small-scale processes of the diurnal continental atmospheric boundary layer, investigate the overlapping topics of network science and geographic information science research as related to social networks, and improve operational sustainment through basic research in military habitation science. ***FY 2012 Plans:***	2.030	2.474	3.679

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Environmental sciences will address the knowledge and capability gap between current operational weather prediction models and local atmospheric conditions affecting soldiers and systems through basic research in atmospheric dynamics and observational capability; research will further examine the evolution of the nocturnal boundary layer structure using up to three Tethered Lift Systems with multiple, redesigned, sensor packages trailing from each; the focus will be on quantifying the turbulent processes as a function of separation scales; both experimental and modeling work will continue to be performed that investigates the effects of both soil heterogeneity plus water and heat flux conditions at the soil surface on subsurface moisture distribution at different spatial scales in the unsaturated zone.			
Title: Basic research in chemical sciences	6.920	8.373	9.970
Description: Focuses on the ultimate goals of achieving advanced energy control, improved threat detection, and novel responsive materials for Soldier protection. Research efforts in advanced energy control involve the study of electrochemistry and electrocatalysis, and physical and theoretical chemistry, which can lead to light-weight, reliable, compact power sources for the Soldier and more effective, lower vulnerability propellants and explosives for tailored precision strikes with minimum collateral damage. Research in protective materials involves discoveries in polymer, inorganic, and organic chemistry, which can provide new approaches for shielding the Soldier and Army platforms from ballistic, chemical, and biological threats, and reducing signatures for identification by the enemy. Threat detection research involves studies in the fields of physical, theoretical, and inorganic chemistry, which can lead to advances that provide advance warning of explosive, chemical, and biological weapons and dangerous industrial chemicals. ***FY 2010 Accomplishments:*** Research was focused on functionalized morphology, novel reactive monomers, environmentally stable self-assembled materials, and reactions in extreme media. ***FY 2011 Plans:*** Research efforts continue on functionalized morphology, novel reactive monomers, environmentally stable self-assembled materials, and reactions in extreme media; discovering and designing mechanophores (mechanically active molecules): never-before-created molecules that provide automatic conversions between mechanical, thermal and chemical energy, and synthesizing and incorporating these compounds into polymers and polymeric materials. ***FY 2012 Plans:*** Will investigate how material and morphology can effect electron transfer and electrocatalysis; will investigate novel approaches and designs for functionalized morphology, novel reactive monomers, and environmentally stable self-assembled materials; novel			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
mechanophores previously integrated into composites will be evaluated for responses to mechanical damage; and will initiate modeling and experimental studies to begin to uncover the physical properties that control chemical reactivity.			
Title: Basic research in physics ***Description:*** Focuses on superior optics, signature management properties, ultra-sensitive sensors, precision guidance, quantum computing, and secure communications. Research efforts in superior optics, signature management properties, and ultra-sensitive sensors are made possible through discoveries in many subfields of physics, including optical physics and imaging science, and atomic and molecular physics. Research efforts in precision guidance involve the study of atomic and molecular physics, while the pursuit of the quantum computing and secure communications research topics is made possible from specific studies in the fields of quantum information sciences and condensed matter physics. ***FY 2010 Accomplishments:*** Research demonstrated ultra-light negative-index optical components; simulated intractable condensed matter theories with optical lattices; devised ultra-cold chemistry concepts heralding novel chemical synthesis routes; engineered artificial oxides to stimulate a second electronics revolution; and explored cross-platform qubit entanglement. ***FY 2011 Plans:*** Efforts continue on transformation optics for cloaking and omni-directional light collection; devising models and guiding materials development for next generation electronics using optical lattices; engineering artificially layered oxides to enable disruptive electronic technology; studying quantum entanglement-enhanced metrology and stealth imaging; studying techniques to exploit quantum entanglement and controllable quantum physics effects for imaging; researching new spin-based electronics technology (spintronics) and 'cold atom' spintronics. ***FY 2012 Plans:*** Research will continue advancing transformation optics toward eventual uses in cloaking applications and omni-directional light collection; will develop new ultra-cold chemistry concepts heralding novel chemical synthesis routes; will explore cross-platform qubit entanglement and evaluate potential applications in quantum entanglement-enhanced metrology and stealth imaging; will assess and improve theories to better understand and control defects in complex oxides, especially at interfaces.	9.325	12.457	10.788
Title: Basic research in electronics and photonics for situational awareness, communications, information processing, electro-magnetic warfare, and power efficiency. ***Description:*** Focuses on situational awareness, communications, information processing, electro-magnetic warfare, and power efficiency. ***FY 2010 Accomplishments:***	12.242	14.474	11.554

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Generated small avalanche photodiode arrays of the (Ga,In)(As,Sb) family providing low noise/high gain for night vision applications in mid infrared spectral region; showed feasibility of electrically-injected room temperature continuous-wave mid-infrared semiconductor lasers based on group IV-VI lead salt materials for optical communications; validated optical subwavelength sensing on biomolecules for Chem/Bio analysis; and showed proof of concept for a single-chip 2.4GHz transceiver on silicon with integrated antenna for improved radio communications. ***FY 2011 Plans:*** Determine feasibility of quantum cascade superlattice IR detector; create wide-bandgap ZincOxide(ZnO)/GaN based semiconductor lasers; tunable composition nanowire visible lasers with improved efficiencies/scalable power for low cost applications; and determine effects of polarization field upon ferromagnetic and optical properties of magnetically doped GaN for sensing/information processing. Study theory, materials growth and characterization of complex oxides that exhibit strong electron correlations leading to emergent phenomena not possible with semiconductors. Research non-invasive techniques to interface electronics with the brain. ***FY 2012 Plans:*** Will determine the effect of antidote lattices (a novel material structure) on the bandgap in graphene; will evaluate vertical lasing based on photonic crystal Fano resonances using nanomembrane broadband reflectors; will investigate photonic bandgap structures for use in multifunctional radio, radar, and sensor systems; will explore controlled nanogaps in nanowire waveguides to form the basis of a nanoscale spectrometer.			
Title: Basic research in mechanical and material sciences ***Description:*** Covers survivable armor, more lethal anti-armor, improved mobility, and flexible displays for Soldier systems. ***FY 2010 Accomplishments:*** Investigated topological optimization strategies to devise tools to optimize structures based on damage tolerance; validated new vorticity-based computational methods for rotorcraft flows capable of convecting the wake without the deleterious effects of numerical diffusion for improved model accuracy; researched implementation of reduced hydrocarbon combustion kinetics codes into engine models for future fuel flexible engines and devised physical understanding of hypergolic ignition to enable gel-propellant rocket propulsion. ***FY 2011 Plans:*** Devise a comprehensive understanding of the propagation of intense stress-waves in adaptive media with random, locally varying, and discontinuous properties for unprecedented armor material designs. Investigate novel/emerging composite materials system that mimics biological adaptive and self-healing characteristics for novel structural materials. ***FY 2012 Plans:***	12.187	12.385	14.254

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H57: *Single Investigator Basic Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will develop understanding at the microscopic level (single layer) for reaction processes and kinetics of reactive materials undergoing high speed impact; will develop materials with stress-activated molecules that enhance macroscopic properties of interest when elastic force is applied; will investigate a predictive theoretical framework to identify promising 2D free -standing crystalline oxides/ nitrides and nanocomposites; will characterize how the instantaneous 3-D structure of a turbulent boundary changes in the presence of an adverse pressure gradient for the understanding of dynamic stall processes.			
Title: Basic research in mathematical and computer sciences ***Description:*** Provides the backbone for performing complex, multi-system analysis, modeling and simulation for understanding information systems. Advancements in mathematical and computer sciences have a direct impact on enhancing the warfighters' decision-making, situation awareness, command and control, as well as on the overall performance of weapon, intelligence, transportation and logistics systems. ***FY 2010 Accomplishments:*** Experimentally validated the effectiveness of the devised products and tools on swarming and sensor fusion in laboratory test-beds; new methods helped to identify attacks against information systems, protecting information systems from attacks; devised techniques for inherently hardened software; the new understanding and knowledge gained from these efforts contributed to the development of robust and resilient information systems that addressed the processing and delivery of authentic, secure, reliable, and timely information to the warfighters, regardless of threat conditions. ***FY 2011 Plans:*** Use the results of the evaluation and validation efforts from FY10 to refine and improve tools and an enhance theory. Improved tools and enhanced theory developed in FY10 on cyber situation awareness is being investigated leveraging advances in cognitive science, adversarial reasoning, and decision sciences to establish new capabilities in effectively predicting, preventing, and detecting cyber intrusions, in sustaining mission critical functions and services, and in rapid recovering from damage. Studies are underway for creating then assessing efficient (optimal and nearly optimal) changepoint detection procedures and spatiotemporal image processing techniques for clutter rejection, and nonlinear filtering methods for tracking dim targets in IR/ video data. ***FY 2012 Plans:*** Will investigate trusted computing that is adaptive to both social and culture influences, and develop new capabilities for warfighters deployed in areas of different social and culture interactions; will investigate adaptive change detection procedures for composite hypotheses in cyber security for comparison of several changepoint detection methods; will develop computer network security and surveillance, clutter rejection and nonlinear filtering algorithms.	12.279	11.273	11.298
Title: Basic research in network science	2.158	3.623	3.224

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H57: *Single Investigator Basic Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: Focuses on gaining an understanding of the fundamental aspects of how networks develop, function, and adapt to the environmental and the rate of information flow in manmade and naturally occurring networks. This understanding will have a direct impact on net-centric force operations, such as better communication system design and operations, and more efficient logistics or communications support. ***FY 2010 Accomplishments:*** Defined and conducted first order laboratory experiments and simulations that refined network representations. ***FY 2011 Plans:*** Develop the theory to understand the non-stationary, non-ergodic statistics of complex biological, social and cognitive networks observed in the experiments of FY10; understand the limitations of traditional statistical theory on which predictions have been historically based and how it impacts the capabilities of the net-centric force; specifically, the influence of intermittent uncertainty on situation awareness and decision-making in a networked environment is being determined. ***FY 2012 Plans:*** Emphasis will be on understanding human networks and, in particular, how information mathematically spreads through a network; the impact of the proposed work will be a better understanding of how decisions are made in groups, and network effects of hard-line members of a group; will investigate the commonalities between communication and human networks, and how they can be analyzed in tandem.			
Title: Basic Research in bioforensics and microscale manipulation with bacteria ***Description:*** Covers the understanding of microbe adaptations, and micro-scale locomotion and controls for micro-bio-robots. The long term goal of this research is to improve the scientific understanding of how microbes adapt to an environment, enabling the ability to determine where microbes originated, how closely related they are, and their recent growth environment, which could ultimately reveal the identity and feasibility of bacterial signatures that could be used to trace the history of an organism to provide a means of tracking the cause, potential danger, and source of a biological event, whether naturally occurring or nefarious; and understand how micro-scale locomotion and manipulation is possible, with potential applications in bacteria propelled micro-structures for engineering of micro-manipulators and micro-robotics. ***FY 2011 Plans:*** Efforts are underway for investigating the detection limits of bacterial poles (i.e., cell structures acting as 'age markers' within bacteria); and studying micro-scale locomotion and manipulation using flagellated bacteria for actuation; and extending theory to address the use of attractants for controlling the trajectory of bacteria-propelled barge. ***FY 2012 Plans:***	-	1.665	1.997

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Efforts will determine the locations and compositions of palindromic repeats (i.e., structures acting as bacterial 'gene memory'); and will investigate methods to control of individual bacteria with external stimuli (chemical, optical or electrical) with appropriate spatial and temporal resolution; will create stochastic mathematical models for various control modalities and model abstraction techniques will be created to reduce the model complexity in order to achieve accurate automatic steering for the position and orientation of the micro-bio-robots.			
Title: Basic research in oxide electronics and brain-electronic interfaces ***Description:*** Focuses on advancing the theory, materials growth, and characterization of artificially-layered complex oxides with the ultimate goal of discovering emergent phenomena in this material system that may ultimately provide far-reaching opportunities for new technological capabilities, and deciphering the coding of neural systems with the long-term goal of discovering and developing methods for the non-invasive decoding and modulation of neural systems, the sensing and decoding the complex brain signals responsible for specific muscle movements, and ultimately the bridging of the living/nonliving interface in peripheral nerves that may lead to future applications in silent communication and mental control of equipment such as the natural and full control of prosthetic limbs. This research effort is an enhancement of the activities conducted under Electronics and Photonics and emerges as a new research area starting FY12. ***FY 2012 Plans:*** Research will expand predictive theories to accurately model materials and then verify accuracy; will continue to expand heteroepitaxial capabilities; will explore solutions to eliminating or mitigating dominant defects; will pursue luminescence diagnostic studies of material defects; will develop and examine experimental methods for potential to 'decode' brain signals to determine how particular thoughts can be used as control inputs for engineered systems; and will investigate potential methods for interfacing electronics with the brain.	-	-	1.997
Title: Basic research in quantum imaging and defect state enabled spintronics ***Description:*** Research aimed at advancing foundational theory and experiments to utilize quantum resources such as superposition and entanglement for beyond-classical capabilities in imaging that could ultimately enable sub-wavelength imaging, single-photon and low-power illumination, and improved covert detection using entanglement, and pursuing breakthroughs demonstrating that defect states contribute to long-range order in wide band-gap semiconductor systems, which could ultimately be exploited to develop magnetic semiconductors as the basis for the long-sought-after new spin-based electronics technology. This research effort is an enhancement of the activities conducted under physics and emerges as a new research area starting FY12. ***FY 2012 Plans:***	-	-	2.597

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H57: *Single Investigator Basic Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Research efforts will conduct additional experiments that build on the foundational theory and early experiments, which will enable the exploration of the advantages of entanglement in ghost imaging, two color ghost imaging, aberration cancellation in quantum interferometry, and optical materials to implement quantum lithography; will incorporate previously developed results of bright entangled sources in experiments; and will evaluate new techniques for directly manipulating with electrical fields the spins states associated with individual defect centers in diamond materials using quantum manipulation techniques.			
Accomplishments/Planned Programs Subtotals	62.870	73.075	78.257

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H66: *ADV STRUCTURES RSCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H66: *ADV STRUCTURES RSCH*	1.805	1.889	1.942	-	1.942	1.996	2.040	2.089	2.125	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project funds basic research for improved tools and methods to enable the structural health monitoring capabilities and condition-based maintenance for rotorcraft and ground vehicles. This research also enables the design and use of composite structures that can better address the cost, weight, performance, and dynamic interaction requirements of future platforms identified by the Army Modernization Strategy. Ultimately, these technologies result in safer, more affordable vehicles with a greatly reduced logistics footprint. This project is a joint Army/NASA effort that includes structures technology research into: structural integrity analyses; failure criteria; inspection methods which address fundamental technology deficiencies in both metallic and composite Army rotorcraft structures; use of composite materials in the design and control of structures through structural tailoring techniques; rotorcraft aeroelastic modeling and simulation; 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 on: advanced fatigue methodologies for metallic structures, improved composites technology throughout the vehicle, long-term investigation of integrated stress-strength-inspection, advanced methods for rotor system vehicle vibratory loads prediction, improved methods to predict vehicle stability, and improved analyses to address Army Aviation requirements. These advancements will extend service life, reduce maintenance costs, enhance durability, and reduce the logistics footprint of existing and future Army vehicles. As agreed under Project Reliance, this is the only project for rotorcraft and ground vehicle structures basic research within DoD.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), located in facilities at the NASA Langley Research Center, Hampton, VA, and at Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Structural Analysis and Vibration Methods	1.805	1.889	1.942

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H66: *ADV STRUCTURES RSCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: This research devises new structural analysis and validation methods to more accurately predict durability and damage tolerance of composite and metallic rotorcraft structures and evaluates structural dynamics modeling methods to address critical reliability issues in the rotating and fixed system components of future aircraft. ***FY 2010 Accomplishments:*** Completed characterization evaluation for materials used in finite element models for delamination fatigue life prediction and validated life prediction tools for dynamic rotorcraft sub-components. ***FY 2011 Plans:*** Develop predictive tools for residual strength after impact for thin-skin structural concepts; develop damage resistant and damage tolerant core and skin concepts; and validate residual strength prediction tools for stiffened skin components. ***FY 2012 Plans:*** Will use enhanced and selected Fatigue Crack Growth algorithms to validate damage tolerance (DT) methods through analytical redesign of a full-scaled rotorcraft component to meet DT requirements for Joint Future Theater Lift; will investigate Prognostics & Diagnostics (P&D) framework(s) for remaining useful life computations using flight evaluation data; will validate emerging P&D methods to establish probability of damage/flaw detection, develop usage credits, and establish fracture mechanics-based P&D technology.			
Accomplishments/Planned Programs Subtotals	1.805	1.889	1.942

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H67: *ENVIRONMENTAL RESEARCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H67: *ENVIRONMENTAL RESEARCH*	0.886	0.967	0.997	-	0.997	1.018	1.039	1.072	1.090	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this project is to focus basic research on innovative technologies for both industrial pollution prevention (P2) that directly supports the Army production base and weapon systems as well as non-stockpile chemical warfare (CW) site remediation. The pollution prevention work invests in next generation manufacturing, maintenance, and disposal methods that will result in significantly reducing the usage of hazardous and toxic substances and their associated costs. The goal is to decrease the overall life-cycle costs of Army systems by 15-30% through the application of advanced pollution prevention technologies. The CW remediation efforts concentrate on the application of biotechnology in the characterization and physical clean up of agent contaminated soils and groundwater and reduced corrosive and more environmentally benign decontamination of biological warfare (BW) agents on field equipment and weapon systems. The goal is to reduce the cost of remediating a site by at least 50% versus the use of conventional methods. CW thrusts include establishing the ecotoxicity of CW compounds, environmental fate and effect of CW compounds in soils and biodegradation of CW compounds. Pollution prevention thrusts include: environmentally acceptable, advanced, non-toxic processes to manufacture lightweight alternative structural materials to enhance weapon system survivability; clean synthesis of more powerful and improved energetic compounds to eliminate the use of hazardous materials and minimize the generation of wastes; and surface protection alternatives to hazardous paints, cadmium, chromium, and chromate conversion metal and composite surfaces.

This project is linked to the Army Environmental Requirements Technology Assessment (AERTA) requirements. The program element contains no duplication with any effort within the Military Departments.

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the defense Technology Area Plan (DTAP).

Work is under the direction of the U.S. Army Armament, Research, Development and Engineering Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Industrial Pollution Prevention	0.886	0.967	0.997
Description: This effort conducts research on innovative environmentally- friendly technologies that support the warfighter (focusing on pollution prevention technologies).			
FY 2010 Accomplishments: Developed environmentally benign approaches to nitration reaction in microreactors (ARDEC); synthesized environmental and human safe polysiloxane:nanoclay composites with enhanced thermal stability and gained an understanding of siloxane:clay interactions (NSRDEC); investigated new plasma enhanced magnetron technologies for ordnance coatings (Benet Labs);			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT H67: *ENVIRONMENTAL RESEARCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
developed polysiloxane nanocomposites for environmental and human safe flame-retardant materials (NSRDEC);conducted research on anaerobic hydrogen production from a variant of clostridium phytofermentans (ECBC); completed experimental work to patent chemistry of novel bio-based monomers for replacement of unsaturated polyesters (ARL); and continued joint synthetic/ theoretical efforts in identifying, synthesizing, characterizing new, stable dense energetic materials as potential ammonium perchlorate replacements (AMRDEC/ARL). ***FY 2011 Plans:*** Continue research efforts in FY10 that were reviewed by the Peer Panel during the Gate Reviews in September 2010. ***FY 2012 Plans:*** Will begin a new three year cycle of projects with a full call for proposals sent to the RDECOM laboratories.			
Accomplishments/Planned Programs Subtotals	0.886	0.967	0.997

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S13: *SCI BS/MED RSH INF DIS*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
S13: *SCI BS/MED RSH INF DIS*	10.296	10.652	10.900	-	10.900	11.121	11.348	11.447	11.445	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports basic research that provides for healthy, medically protected Soldiers. This project funds basic research leading to medical countermeasures for naturally occurring diseases impacting military operations. Basic research contained in this project provides understanding of the mechanisms that make organisms infectious and the effective human body response, which prevents disease. Understanding the biological characteristics of infectious organisms also enables the development of point-of-care and laboratory-based diagnostic tools. Understanding of disease transmission by insects and other organisms helps in developing new interventions to prevent disease. Infectious disease threats from malaria, diarrhea, and dengue (a severe debilitating disease transmitted by mosquitoes), which are common in Africa, Central, European, Southern, and/or Pacific Commands, are the highest priorities for basic research.

Research conducted in this project focuses on the following four areas:

(1) Prevention/Treatment of Parasitic (symbiotic relationship between two organisms) Diseases
(2) Bacterial Threats
(3) Viral Threats
(4) Diagnostics and Disease Transmission Control

Work is managed by the US Army Medical Research and Materiel Command in coordination with the Naval Medical Research Center (NMRC). The Army is responsible for programming and funding all DoD naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the co-located Walter Reed Army Institute of Research (WRAIR) and Naval Medical Research Center (NMRC), Silver Spring, MD, and their overseas laboratories.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Prevention/Treatment of Parasitic (symbiotic relationship between two organisms) Diseases	5.745	5.829	3.709
Description: This effort conducts basic research to better understand the biology of malaria and leishmaniasis (a skin-based disease transmitted by sand flies) parasites, and to gain the necessary foundation for discovering medical countermeasures to protect military personnel from infection. Malaria, which can cause fatal and chronic disease, is the most significant military			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S13: *SCI BS/MED RSH INF DIS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
infectious disease threat. Since the malaria parasite becomes resistant to drugs over time, it is necessary to continually search for parasite weaknesses that can be exploited with new, effective, user-friendly drugs and vaccines. ***FY 2010 Accomplishments:*** Applied new tools for discovery of promising compounds as potential leads to new classes of antimalarial drugs and for potential vaccine components. ***FY 2011 Plans:*** Continue iterative approaches for the discovery, design and synthesis of promising new antimalarial drug compounds and potential vaccine components. ***FY 2012 Plans:*** Will identify compounds to down-select for advance screening studies and evaluate their potential for future development as anti-parasitic drugs.			
Title: Vaccines for Prevention of Malaria ***Description:*** This effort conducts basic research to better understand and identify new proteins in the design of candidate vaccines for various types of malaria including the severe form of malaria (Plasmodium falciparum) and the less severe but relapsing form (Plasmodium vivax). A highly effective vaccine could reduce/eliminate the use of antimalarial drugs and the development of drug resistance to current/future drugs. ***FY 2012 Plans:*** Will identify new protein molecules as vaccine candidates against malaria to down-select for advance screening studies and evaluate their potential for future development; will study the mechanism of developing antibodies against these new molecules in animal models; will conduct research to develop methods of formulating new vaccine candidates for effective delivery inside the human body by using cutting-edge technologies.	-	-	2.244
Title: Bacterial Threats ***Description:*** This effort conducts research to better understand the biology of bacterial organisms and their effects on humans, as well as how to prevent wound infections, diarrhea (a significant threat during initial deployments) and scrub typhus (a debilitating mite-borne disease that is developing resistance to currently available antibiotics). ***FY 2010 Accomplishments:***	1.468	1.724	1.476

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S13: *SCI BS/MED RSH INF DIS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Assessed and improved selected proteins and other components identified from diarrheal-causing bacteria as potential components of candidate vaccines; conducted exploratory studies to evaluate methods to prevent wound infection from combat injuries. ***FY 2011 Plans:*** Develop further knowledge of the epidemiology (study of factors affecting the health and illness of populations) of diarrhea and wound infections in military personnel; assess basic wound management measures (concentrated oxygen, nutritional supplements and wound cleansing) to minimize the need for antimicrobials (a substance that kills or inhibits the growth of microbes such as bacteria, fungi, or viruses) and reduce antimicrobial resistance. ***FY 2012 Plans:*** Will assess results of epidemiologic studies (studies of factors affecting the health and illness of populations) of bacterial diarrhea and wound infections to ensure formulation of the best vaccine candidates for diarrhea and the best prevention practices to mitigate wound infections; will transition best basic wound management measures to preclinical (animal model) testing.			
Title: Viral Threats Research ***Description:*** This effort conducts research to better understand highly lethal or incapacitating viruses, including those that cause hemorrhagic diseases (severe viral infection that causes internal bleeding), such as dengue hemorrhagic fever and hantaviruses (severe viral infection that causes internal bleeding and is contracted from close contact with rodents). Basic research includes understanding risk of disease prevalence to the Warfighter, viral biology (including structure, function, lifecycle, and interactions with the environment), the disease process, and disease interaction with the human body. ***FY 2010 Accomplishments:*** Conducted basic research to better understand the biological basis of disease and protection in humans from naturally occurring viruses of military importance; developed a better understanding of which parts of the immune system are needed to provide a protective response in humans. ***FY 2011 Plans:*** Continue to study and evaluate the basis of disease and how the immune system reacts to diseases of interest. ***FY 2012 Plans:*** Will continue to study and evaluate the basis of the dengue disease and how the immune system reacts to it; will conduct research on defining factors that contribute to causing dengue hemorrhagic fever that occurs in a subset of infected individuals	1.757	1.764	1.736

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S13: *SCI BS/MED RSH INF DIS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
only; will also develop methods of distinguishing between protective and non-protective antibodies that will be used as surrogate markers of protection when evaluating vaccines against dengue infection.			
Title: Diagnostics and Disease Transmission Control ***Description:*** This effort conducts research to investigate the biology of biting insects (including mosquitoes and leishmaniasis-infected sand flies) and other organisms that transmit disease (disease vectors) and their control. Expand medical diagnostic and disease surveillance capabilities in the field. This research will help to direct new interventions into preventing disease transmission. ***FY 2010 Accomplishments:*** Conducted studies on the diversity, description and classification of medically-important insects (including mosquitoes, ticks and sand flies) as the scientific foundation for a web-based guide to identification. Explored new designs for devices to collect insects, and assessed medical threats from disease-carrying insects in deployed areas. ***FY 2011 Plans:*** Conduct mosquito identification within US Northern Command region using DNA markers to identify specimens. Conduct research leading to a new generation of detection assays for diagnosis of Rickettsial disease (carried by ticks, fleas, and lice) and lethal virus infectious agents within insect vectors (carriers of disease). ***FY 2012 Plans:*** Will develop new trapping methods to improve sand fly surveillance; will develop tools to identify mosquito species that transmit malaria parasites; will develop a detection method for scrub typhus (a debilitating mite-borne disease that is developing resistance to currently available antibiotics) in the Pacific Command?s area of operation.	1.326	1.335	1.735
Accomplishments/Planned Programs Subtotals	10.296	10.652	10.900

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S14: *SCI BS/CBT CAS CARE RS*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
S14: *SCI BS/CBT CAS CARE RS*	6.352	6.818	9.709	-	9.709	9.853	9.211	9.481	9.833	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds basic research to understand the basic mechanisms of severe trauma to advance treatment and surgical procedures to save lives and improve medical outcomes for the Soldier. Experimental models are developed to support in-depth trauma research studies. This project includes studies of predictive indicators and decision aids for life-support systems, studies to heal and repair burned or traumatically injured tissue, Traumatic Brain Injury (TBI), sight and face trauma, and transplant technology. Such efforts will minimize lost duty time from and provide military medical capabilities for far-forward medical/surgical care of injuries, as well as post-evacuation restorative and rehabilitative care.

Research conducted in this project focuses on the following five areas:

(1) Damage Control Resuscitation
(2) Combat Trauma Therapies
(3) Combat Critical Care Engineering
(4) Clinical and Rehabilitative Medicine
(5) Traumatic Brain Injury (TBI)

Starting in FY10, S19 (T-Medical/Soldier Status) funding is merged into project S14.
Promising results identified in this project are further matured under PE 0602787A, project 874.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; the US Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Damage Control Resuscitation	1.017	0.962	1.345
Description: This effort conducts studies of genetic pathways and metabolic mechanisms associated with blood clotting to understand the relationships between the human immune processes and bleeding in trauma.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S14: *SCI BS/CBT CAS CARE RS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Extended survival studies to determine the biochemical and genetic relationships between blood clotting and inflammation, which are factors causing death following severe bleeding. ***FY 2011 Plans:*** Investigate genetic components of the response to hemorrhage (bleeding) in specific strains of rats. ***FY 2012 Plans:*** Will conduct studies of immune system interaction with the coagulation (blood clotting) system and the effect of trauma on fibrinogen (a blood clot component) formation.			
Title: Combat Trauma Therapies ***Description:*** This effort conducts studies of trauma to tissues and organs, and ways to mitigate and/or repair this damage. Research addresses cellular repair/growth mechanisms to treat TBI, dental injuries, extremity wounds and fractures, and burns. ***FY 2010 Accomplishments:*** Realigned vision restoration efforts to the Clinical and Rehabilitative Medicine program area; conducted penetrating ballistic-like brain injury (PBBI) protein and gene regulation, as well as neuroprotection mechanism studies; investigated PBBI biomarkers as surrogate markers to show effectiveness of neuroprotection drugs; refocused dental disease research to repair of maxillofacial ((head, neck, face and jaw) bone and soft tissue injury repair; began research in eye trauma to understand the cellular and neuronal mechanisms of eye injuries. ***FY 2011 Plans:*** Continue gene regulation and neuroprotection mechanism studies including studies to understand cellular mechanisms of cell death; characterization of a poly-trauma (multiple injuries) model; discovery of novel pharmaceuticals to mitigate TBI brain hypothermia (drop in temperature); investigate new therapies based upon dentally-derived stem cells for traumatic dental wound healing and repair; explore causes of low vision from head trauma. ***FY 2012 Plans:*** Will realign neuroprotection research to the TBI program area, and regenerative efforts in craniomaxillofacial trauma (soft tissue and skeletal injuries to the face, head and neck) to the Clinical and Rehabilitative Medicine Research Program; will research potential bone defect models to find one that is clinically relevant to combat trauma.	1.347	2.038	0.956
Title: Combat Critical Care Engineering ***Description:*** This effort conducts basic science studies of vital sign responses to trauma as predictors of medical outcomes and as a basis for developing life-saving interventions. This research area starts in FY12.	-	-	0.769

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S14: *SCI BS/CBT CAS CARE RS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2012 Plans: Will begin basic research studies to investigate differences in physiological responses between individuals with high- and low-tolerance to blood loss.			
Title: Traumatic Brain Injury ***Description:*** This effort conducts basic research in poly-trauma (multiple injuries)/TBI model, cellular mechanisms of cell death and the discovery of novel drugs to mitigate TBI. ***FY 2012 Plans:*** Will realign neuroprotection research from the Combat Trauma Therapies task area to the TBI task area; will continue basic research in poly-trauma (multiple injuries)/TBI model, cellular mechanisms of cell death and discovery of novel drugs to mitigate TBI.	-	-	0.986
Title: Clinical and Rehabilitative Medicine ***Description:*** This effort conducts basic studies of mechanisms of tissue growth and traumatic injury to gain an understanding that will assist or facilitate the healing or transplantation process. The focus is placed on severe blast trauma to the limbs, head, and face (including eye), as well as burns. ***FY 2010 Accomplishments:*** Began research in eye trauma to understand the cellular and neuronal mechanisms of eye injuries; explored different innovative regenerative tissue strategies to include scaffold-like tissue mats containing blood vessels, cell-based therapies to augment regenerative tissue approaches that yield a pool of responding cells that can be biologically queued to specific cell types, and biomaterials that direct cell growth. ***FY 2011 Plans:*** Continue the iterative process of exploring innovative regenerative tissue strategies and advancing promising approaches to the applied research phase. ***FY 2012 Plans:*** Will continue research in eye trauma to understand the cellular and neuronal mechanisms of eye injury; will continue the process of exploring innovative regenerative tissue strategies and advancing promising approaches to the applied research phase.	3.988	3.818	5.653
Accomplishments/Planned Programs Subtotals	6.352	6.818	9.709

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S14: *SCI BS/CBT CAS CARE RS*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S15: *SCI BS/ARMY OP MED RSH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
S15: *SCI BS/ARMY OP MED RSH*	7.003	8.839	6.320	-	6.320	6.687	7.628	7.655	7.592	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds basic research on physiological and psychological factors limiting Soldier effectiveness and on the characterization of health hazards generated by military systems and resulting as a consequence of military operations. This includes research on the neurobehavioral aspects of post traumatic stress and suicide, and developing concepts for medical countermeasures to prevent or mitigate the effects of muscle and bone injury as well as to reduce the effects of sleep loss and other stressors on Warfighter performance. The hazards of exposure to directed energy, repetitive use, fatigue, heat, cold, and altitude are also investigated under this project.

Research conducted in this project focuses on the following six areas:

(1) Injury Prevention and Reduction
(2) Physiological Health
(3) Environmental Health and Protection
(4) Computational Biology
(5) Psychological Health and Resilience

Promising results identified in this project are further matured under PE 0602787A, project 869.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; the US Army Institute of Surgical Research (USAISR), San Antonio TX; and the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Injury Prevention and Reduction	1.300	1.392	1.428
Description: This effort conducts research on the body's effects from non-ionizing radiation and directed energy (laser), as well as the physiological mechanisms of musculoskeletal injury.			
FY 2010 Accomplishments: Investigated hormone and cell-level adaptations in skeletal muscle in response to military-relevant training and injury to include mechanisms of skeletal muscle repair, regeneration, and adaptation; explore how bone components are associated with stress			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S15: *SCI BS/ARMY OP MED RSH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
fracture risk; identified laser eye injury thresholds in an animal model for single short-duration pulses and repetitive pulse exposures for small and large retinal spot sizes to enhance risk-assessment tools for eye protection. ***FY 2011 Plans:*** Identify specificity of hormonal fatigue markers in Soldiers during states of physical exertion and energy status; investigate responses to physical fatigue to prevent musculoskeletal injury; examine dose-response relationships to blood and tissue changes, and model results for visible and infrared wavelengths as a risk assessment tool for laser eye injury. ***FY 2012 Plans:*** Will examine effectiveness of topical applications of drugs to prevent further nerve degeneration from eye trauma and high-risk military environmental exposures. For example, an intervention could be applied through an eye dropper as a treatment against laser eye injury.			
Title: Physiological Health ***Description:*** This effort conducts research on the physiological mechanisms of sleep, fatigue, and nutrition on Soldier performance and well-being. ***FY 2010 Accomplishments:*** Investigated the extent individual resilience generalizes across various types of sleep loss; explored the relative effects of countermeasures for reversing deficits caused by fatigue; investigated and modeled optimal recovery sleep and recycle rate following missions; identified healthy weight-management strategies to improve Soldier health and retention. ***FY 2011 Plans:*** Investigate the extent to which the recuperative value of recovery sleep and the rate of recuperation can be enhanced through use of medication; identify the nutritional strategies required to sustain health in the modern training environment; explore the impact of micronutrient (nutrients essential in small quantities to orchestrate a whole range of physiological functions) status on performance and immune function during military training. ***FY 2012 Plans:*** Will identify menus, food service practices, labeling and educational materials to promote healthy eating behavior in military dining facilities; will identify the hormonal and metabolic responses of human fat tissue during periods of underfeeding, followed by overfeeding.	2.364	2.237	2.190
Title: Environmental Health and Protection ***Description:*** This effort conducts research on the physiological mechanisms of exposure to extreme heat, cold, altitude and other environmental stressors.	1.263	1.239	1.378

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S15: *SCI BS/ARMY OP MED RSH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Explored rodent models of heat stroke to evaluate and enhance long-term recovery and return-to-duty; investigated dose-response of medication countermeasures for the effectiveness of preventing altitude illness compared to the probability and severity of adverse side-effects. ***FY 2011 Plans:*** Explore molecular mediators of tissue, organ and skeletal muscle injury associated with exertional heat injury and/or heat stroke in the rodent model; expand the investigation of dose-response of medication countermeasures for the effectiveness of preventing altitude illness at moderate altitude (3,000 meters). ***FY 2012 Plans:*** Will identify clinical measures (blood and molecular changes within tissue) of heat stroke.			
Title: Computational Biology ***Description:*** This effort conducts research, using tools that combine biology, computer sciences and mathematics to solve biological problems that would be difficult or impossible to solve solely through testing in traditional laboratory experiments, animal models or human trials. Research in this area starts in FY11. ***FY 2011 Plans:*** Conduct computational biology modeling to advance the development of protein-protein interaction models for the prediction of host-pathogen interaction networks.	-	0.923	-
Title: Psychological Health and Resilience ***Description:*** This effort conducts research into the basic mechanisms of psychological resilience (i.e., mental toughness and the ability to overcome traumatic events) and post-concussion related mental and physical challenges. Studies also include determination of suicide risk, as well as protective factors and treatment for Post-Traumatic Stress Disorder (PTSD). ***FY 2010 Accomplishments:*** Investigated a behavioral screening tool to induce and evaluate PTSD-like symptoms in rodents; investigated potential correlations between anti-depressant medication use and suicidal behaviors; investigated neuropsychological performance evaluations/batteries as a diagnostic for concussion in Soldiers; identified factors that predict or correlate severity of post-concussion symptoms. ***FY 2011 Plans:*** Induce and evaluate PTSD-like symptoms in rodents for potential drug and behavioral intervention to treat combat-related PTSD; further explore associations of completed and attempted suicides with the use of anti-depression medication; investigate the	2.076	3.048	1.324

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT S15: *SCI BS/ARMY OP MED RSH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
predictive value of neuropsychological and neurological measures for prediction of likelihood and/or severity of subsequent post-concussion symptoms. ***FY 2012 Plans:*** Will identify deployment-related measures to assess intervention effectiveness (e.g., mitigating functional impairment, transition, risky behaviors) for the treatment of PTSD.			
Accomplishments/Planned Programs Subtotals	7.003	8.839	6.320

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T14: *BASIC RESEARCH INITIATIVES - AMC (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
T14: *BASIC RESEARCH INITIATIVES - AMC (CA)*	26.860	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Defense Research Sciences.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Perpetually Assailable and Secure Information System (PASIS) ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed technologies that directly impact the Army's and DoD's capabilities, including secure information processing, transmission and storage; Educated and trained scientists and engineers in the areas of information assurance, reliable software engineering, and network science.	3.182	-	-
Title: Cyber Threat Analytics ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Conducted research to accelerate the ability of organizations to defend against large scale network threats by creating the underlying technologies to enable next-generation privacy-preserving digital threat analysis centers.	2.388	-	-
Title: Integrated Flexible Electronics ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed flexible electronics materials enabling improved organic light emitting diode and thin film transistor performance. The devices were integrated with flexible active matrix backplanes from the Flexible Display Center.	1.592	-	-
Title: Organic Semiconductor Modeling and Simulation ***Description:*** This is a Congressional Interest Item.	0.875	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T14: *BASIC RESEARCH INITIATIVES - AMC (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Developed modeling and simulation for organic electronics. The modeling results were used to design and advance electronic devices fabricated at University of Texas Dallas and the Flexible Display Center.			
Title: Nanocrystal Source Display ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed novel quantum dot (QD) light emitting devices. The QD devices were advanced for improved efficiency and stability. The device will be integrated with active matrix backplanes from the Flexible Display Center.	0.756	-	-
Title: Sustainable Alternative Energy for DoD ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed methods for generating JP-8 Diesel fuel from bio waste, including tree pulp and other vegetation materials.	1.990	-	-
Title: High Frequency Devices and Circuits for Nanotubes and Nanowires ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed carbon nanotube- and silicon nanowire-based high frequency components. Research supports fully organic (plastic) electric and electronic circuits, which are lightweight, low loss, durable, easy to carry and bend, and provide more battery life.	1.433	-	-
Title: Lightweight Polymer Designs for Soldier Combat Optics ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed a sturdy polymer based material that can be used for low-cost, lightweight eyewear and day optics that can withstand the rigors of difficult climate.	0.796	-	-
Title: Secure Open Systems Initiative ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:***	2.388	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T14: *BASIC RESEARCH INITIATIVES - AMC (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Established a national Secure Open Systems Institute (SOSI) that will be a global center for Open Source security research and development.			
Title: Bioactive Polymers and Coating Systems for Protection Against Bio-Threats ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed a family of novel antimicrobial coatings that can be embedded on fabrics to block toxins, kill bacteria and control pathogenic biological agents. The fabrics will be used in the manufacture of items such as tents and chem-bio shelters.	3.581	-	-
Title: Understanding Blast Induced Brain Injury ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Researched blast induced brain injuries.	2.387	-	-
Title: Security Protection Using Ballistic CORE Technology ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Researched technology to provide enhanced protection against blast fragmentation.	3.900	-	-
Title: Maine Center for Toxicology and Environmental Health, Toxic Particles Research and Equipment ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed data to inform risk assessments of the toxicity of depleted uranium, chromates and nanoparticles.	1.592	-	-
Accomplishments/Planned Programs Subtotals	26.860	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601102A: *DEFENSE RESEARCH SCIENCES*	**PROJECT** T14: *BASIC RESEARCH INITIATIVES - AMC (CA)*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T22: *SOIL & ROCK MECH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
T22: *SOIL & ROCK MECH*	2.284	2.358	4.926	-	4.926	4.531	4.631	5.281	5.525	Continuing	Continuing

A. Mission Description and Budget Item Justification

This basic research project correlates the effects of the nano- and micro-scale behavior on the macro-scale performance of geological and structural materials to provide a foundation for the creation of future revolutionary materials and to revolutionize the understanding the sensor data within a heterogeneous geological systems. This research encompasses geologic and structural material behavior, structural systems, and the interaction with dynamic and static loadings. Research includes: underlying physics and chemistry that controls the mechanics and electromagnetic behavior of geological and structural materials, new techniques that provide measurements at the fundamental scale, and fundamental theories for relating nano- and micro-scale phenomena to macro-scale performance. This research provides the basis for applied research in PE 0602784A (Military Engineering Technology), project T40 (Mobility/Weapons Effects Technology), that supports the civil engineering technologies for adaptive protection, scalable weapons effects, near surface computational evaluation platform, and austere entry and maneuver for the future force.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Military Engineering Basic Research	2.284	2.358	2.438
Description: Funding is provided for the following effort			
FY 2010 Accomplishments: Developed a model for ultra high strength fiber reinforced concrete (FRC) subjected to highly dynamic loading conditions (e.g., blast, impact, and penetration events); gained an understanding of the rate effects in high performance concrete to determine if mesoscale models under development inherently generate the strain rate effects seen in macroscopic concrete response.			
FY 2011 Plans: Develop a mathematical technique to create continuum models for engineering-level analysis at coarser scales using discrete variables from nanoscale models.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T22: *SOIL & ROCK MECH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will complete a particle scale model to study the effects of two naturally occurring bonding agents on the suspension of particulates from naturally occurring soils.			
Title: Materials Modeling for Force Protection ***Description:*** This effort moves from PE 0601102 Project T23 in FY 11 to this Project T22 in FY 12. ***FY 2012 Plans:*** Will continue to perform fundamental research to explore characteristics of natural materials with exceptional mechanical properties in order to develop the foundational understanding that will lead to advances in blast and ballistic protection through engineered material models. This work moves from PE0601102A-T23 Facilities Research in FY12.	-	-	2.488
Accomplishments/Planned Programs Subtotals	2.284	2.358	4.926

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T23: *BASIC RES MIL CONST*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
T23: *BASIC RES MIL CONST*	1.727	3.839	1.901	-	1.901	1.970	2.005	2.042	2.077	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This basic research project supports facilities research initiatives. The project is focused on forming an explicit and mathematically robust set of algorithms for geometrical reasoning; assessing the conceptual feasibility of applying nanoparticle technology to real-time sensors, thermal conductivity, and high strength materials; and developing novel and advanced concepts for mitigating the effect of chemical and biological agents in built structures. These efforts provide basic research leading to improved design in a range of facilities to optimize facility mission performance, enhance facility security, reduce design and construction errors and omissions, reduce resource requirements, and reduce the environmental burdens over the facility's life. This project provides leap-ahead technologies to solve military-unique problems in the planning, programming, design, construction, and sustainment of deployed facilities, and energy and utility infrastructure. This project supports exploratory development efforts in PE 0602784A (Military Engineering Technology), projects T41 (Military Facilities Engineering Technology) and project T45 (Energy Technology Applied to Military Facilities).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Facilities Research	1.727	3.839	1.901
Description: Funding is provided for the following effort.			
FY 2010 Accomplishments: Investigated mechanisms for on-demand release of biocides and free radicals to determine photolytic degradation phenomena; developed a fundamental understanding of the use of electrophoresis in producing new composite materials for present and future military applications.			
FY 2011 Plans: Continue to establish a basic understanding of physical, chemical, and biological phenomena specific to the next generation nanotechnology research initiatives of military interest. Also, complete investigation of electric field effects on chemical reactions in confined nanoporous geometries. Conduct basic research to explore characteristics of natural materials with exceptional			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T23: *BASIC RES MIL CONST*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
mechanical properties in order to develop the foundational understanding that will lead to advances in blast and ballistic protection, base sustainment, and readiness through engineered material models. In FY12, this work moves to 0601102A T22, Materials Modeling for Force Protection; explore atomistic- and poly-crystalline-level mechanical properties of materials such as graphene or carbon nanotube (CNT) - ceramic composites for use in optimal performance designs that scale to macro-system levels. The goal is to discover the properties and relationships that lead to a means to create new bio-inspired composite materials that are lighter and better performing. ***FY 2012 Plans:*** Will explore the controlled dissociation of either methane or ammonia in order to produce pure hydrogen gas; will determine the effects of temperature on the quantum dot output spectrum in order to increase understanding for improved sensor development.			
Accomplishments/Planned Programs Subtotals	1.727	3.839	1.901

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T24: *Signature Physics and Terrain State Basic Research*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
T24: *Signature Physics and Terrain State Basic Research*	1.508	1.573	1.616	-	1.616	1.660	1.693	1.727	1.756	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This basic research project increases knowledge in the areas of terrain state and signature physics. It investigates the knowledge base for understanding and assessing environmental impacts critical to battlespace awareness. Projects include fundamental material characterization, investigation of physical and chemical processes, and examination of energy/mass transfer applicable to predicting state of the terrain, which control the effects of the environment on targets and target background signatures and mobility in support of the materiel development community. The terrain state area of terrestrial sciences investigates weather-driven terrain material changes and sensing/inferring subsurface properties. The signature physics area of terrestrial sciences focuses on understanding the dynamic changes to electromagnetic, acoustic and seismic signatures, and energy propagation in response to changing terrain state and near surface atmosphere. This project supports exploratory development efforts in PE 0602784A (Military Engineering Technology), Project 855 (Topographical, Image Intel and Space) and T42 (Terrestrial Science Applied Research).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Terrain State and Signature Physics	1.508	1.573	1.616
Description: Funding is provided for the following effort.			
FY 2010 Accomplishments: Observed, characterized, and modeled the variation of forward scattering at near to grazing angles for both vertical and horizontal polarization to determine if significant geometric roughness will deteriorate, rather than not affect, the forward scattering of RF energy; investigated the controlling influences of radio signal energy loss in deserts and thus poor depth penetration into low clay soils through examination of gypsum and carbonates by determining the complex permittivity spectra and attenuation rates at clay			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T24: *Signature Physics and Terrain State Basic Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
through sand size; evaluated hypothesis that urban ambient sound and vibration signals can be characterized as a baseline for actionable warnings for future sensor arrays. ***FY 2011 Plans:*** Investigate the topography and morphology of a high relief mountain basin as a major factor driving the spatial distribution of snow melt onset as measured by passive microwave sensors. Devise a calculation method for sound wave propagation and coherence over random spatial variations in terrain surface elevation and ground properties (such as permeability, porosity, grain size, and water content) and identify the characteristics and significance of random terrain effects on wave scattering. ***FY 2012 Plans:*** Will determine if radars can better detect subsurface disturbances through improved coherent waveform detection, and understanding of volume scatter loss rates; will formulate methods for near real-time calculation of sound fields in complex environments; also will construct a 3D numerical model of gas transport in soil that incorporates convection and diffusion and will determine the role of soil microstructure in gas movement through porous media in the near-surface ground, which will support emerging methods of subsurface target detection; will investigate a novel approach to represent terrain state spatial and temporal patterns and relationships to significantly reduce computational complexity and intensity required to model soil moisture and surface temperature.			
Accomplishments/Planned Programs Subtotals	1.508	1.573	1.616

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T25: *Environmental Science Basic Research*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
T25: *Environmental Science Basic Research*	7.690	8.106	8.234	-	8.234	8.562	8.719	8.870	9.021	Continuing	Continuing

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This basic research project investigates fundamental scientific principles and phenomena necessary to ensure efficient development of the technologies needed to address Army sustainment issues in the restoration, compliance, conservation, and non-industrial pollution prevention areas. These efforts include: investigating and monitoring contaminated sites, including chemical contamination and unexploded ordnance (UXO) detection/discrimination; better characterization of contaminants through improved risk-based assessment; destruction, containment, or neutralization of organics in water, soil, and sediments resulting from military activities; adhering to applicable federal, state, and local environmental laws and regulations; monitoring and controlling noise generation and transport; protecting and enhancing natural and cultural resources; reducing pollution associated with military activities; and the study of ecosystem genomics and proteomics in support of the Army's new Network Science initiative. The project supports applied research under PE 0602720A (Environmental Quality Technology), project 048 (Industrial Operations Pollution Control Technology), project 835 (Military Medical Environmental Criteria), and project 896 (Base Facilities Environmental Quality).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Environmental and Ecological Fate of Explosives, Energetics, and Other Contaminants	3.661	3.923	3.985
Description: Funding is provided for the following effort. ***FY 2010 Accomplishments:*** Completed new computational chemistry equations to predict solubility and other physical characteristics of munitions constituents (MC); established biological models of soil invertebrate neurotransmission networks as affected by less-than-lethal doses of RDX; constructed computational biology models of the physiological reaction of bacteria to explosives contaminants; investigated the use of engineered proteins as cell-based toxicology sensors of MCs; explored the use of endophytes (microorganisms living inside plants) as biosensors of MC contamination. ***FY 2011 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T25: *Environmental Science Basic Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Continue to establish a basic understanding of physical, chemical, and biological phenomena specific to the environmental and ecological fate of contaminants of military interest. Continued investigations of degradation and transformation mechanisms of insensitive munitions and emerging contaminants. ***FY 2012 Plans:*** Will investigate bioassay response to climate and contaminant stress on a standard laboratory organism (Daphnia) to elucidate impacts on other species of concern to Military installations; will characterize metals-rich granules (MRG) produced by lead (Pb) exposed soil invertebrates to determine bioavailability and potential for bacteria to release the Pb back into the environment in a biologically available form; will construct a neuro-endocrine feedback mechanism ex vivo to replicate the neuroendocrine system in environmental monitoring species (fish) for advancement of high throughput screening and analyses, and computation modeling of contaminates; also, will investigate the linkage of oxidative stress to behavior and animal survival impacts using real time-time imaging of gene expression and behavioral tracking.			
Title: Remediation of Explosives, Energetics, and UXO ***Description:*** Funding is provided for the following effort. ***FY 2010 Accomplishments:*** Completed investigations of degradation of and by nanomaterials. Investigated the chemical composition of metal-rich granules (MRG) produced by soil invertebrates when exposed to MC to reduce uncertainty factors in environmental risk assessment; determined the potential for abiotic and biotic degradation of new insensitive explosives to determine their potential for transport in soils and environmental affects. ***FY 2011 Plans:*** Continue to establish a base of understanding of the physical, chemical, and biological phenomena specific to the remediation of explosives and energetics on training ranges. ***FY 2012 Plans:*** Will determine the potential for abiotic and biotic degradation of insensitive explosives, NTO and FOX-7, potential insensitive replacements for RDX; will investigate non-traditional concentration response relationships for prediction of environmental risks supporting development of novel energetics.	2.302	2.360	2.395
Title: Training Land Natural Resources ***Description:*** Funding is provided for the following effort. ***FY 2010 Accomplishments:***	0.721	0.735	0.750

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T25: *Environmental Science Basic Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Defined the fundamental properties of pollination networks on Army ranges; investigated environmentally benign bioadhesion resistant coatings (modification of surface microstructure) as a means to reduce transport of invasive species. ***FY 2011 Plans:*** Continue to establish a basic understanding of physical, chemical, and biological phenomena specific to ecosystem maintenance, mitigations, and rehabilitation. Investigate the mechanisms of accumulated oxidative stress affects on altered animal behavior and survival to provide a model of linking animal responses across large spatial and temporal scales for landscape, river, coastal and climate management. ***FY 2012 Plans:*** Will define multiple-stressor assessment techniques to identify and evaluate the relative contribution of interacting stressors that impact military lands and critical natural resources; will investigate how geographical fragmentation affects the pollination dynamics and gene flow within species populations to advance the fundamental knowledge for management of rare and endemic plant and pollinator species on Army ranges; also, through dermal and dietary exposure in plant and animal tissue will determine the magnitude of tungsten bioavailability impacting firing range sustainability as well as to advance ecological assessment capabilities.			
Title: Network Science ***Description:*** Funding is provided for the following effort. ***FY 2010 Accomplishments:*** Identified metabolic network control structures that govern the degradation / transformation of RDX; determine the relationship of complex biological network architecture to fragility in hormone production. ***FY 2011 Plans:*** Continue to establish a basic understanding of physical, chemical, and biological phenomena specific to network science applications. Evaluate alternative compositions of heterogeneity in population vigilance affording resilient/adaptive behavior at reduced cost. Develop cognitive elements to dynamically elicit the emergence of desired composition in heterogeneity. Define the network structure involving steroidogenesis genes using time series analysis. Develop approaches using genetic tools to perturb network dynamics by gene silencing or over expression. ***FY 2012 Plans:*** Will investigate first principle phenomenology describing spontaneous formation of highly regular biological networks by bacteria to determine spatial pattern relationships in bacteria colonies; will determine cognitive elements associated with attention	1.006	1.088	1.104

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T25: *Environmental Science Basic Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
and memory allowing heterogeneity in vigilance across a population to emerge naturally in a form conducive to social network resilience and adaptive behavior under predatory threat.			
Accomplishments/Planned Programs Subtotals	7.690	8.106	8.234

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T61: *Basic Research Initiatives - MRMC (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
T61: *Basic Research Initiatives - MRMC (CA)*	1.592	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Medical Basic Research Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Combat Mental Health Initiative	1.592	-	-
Description: This is a Congressional Special Interest Item			
FY 2010 Accomplishments: This Congressional Interest Item collected data from a random sampling of Ohio National Guard members for a study to better understand why some people develop Post Traumatic Stress Disorder (PTSD) and others do not.			
Accomplishments/Planned Programs Subtotals	1.592	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T63: *ROBOTICS AUTONOMY, MANIPULATION, & PORTABILITY RSH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
T63: *ROBOTICS AUTONOMY, MANIPULATION, & PORTABILITY RSH*	1.181	1.463	1.857	-	1.857	1.935	1.969	2.001	2.035	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project funds basic research in technical areas that will expand the autonomous capabilities, utility, and portability of small robotic systems for military applications, with a focus on enhanced intelligence, biomimetic functionality, and robust mobility, to permit these systems to serve as productive tools for dismounted Soldiers. The ability of the Warfighter to command a suite of small unmanned systems (air, ground, and hybrid vehicles) will reduce exposure of the Soldier to harm and will improve the efficiency by which a dismounted unit achieves tactical objectives such as securing a targeted zone. Example missions requiring enhanced autonomy, manipulation, and man-portability include rapid room clearing and interior structure mapping; detection of human presence, chemical/biological/nuclear/radiological/explosive (CBNRE), and booby-traps; surveillance; and subterranean passage detection and exploration. Because of their relatively small size, light weight, and service in dismounted environments, small unmanned systems have unique challenges in perception, autonomous processing, mobility mechanics, propulsive power, and multi-functional packaging that transcend similar challenges associated with large unmanned systems. The Army Research Lab will conduct research in related disciplines, including machine perception, intelligent control, biomimetic robotics, manipulator mechanics, and propulsive power and drives to foster the development of technologies for lightweight, small-volume, environmentally-harsh robotics applications. Machine perception research includes the exploration of lightweight ultra-compact sensor phenomenology and the maturation of basic machine vision algorithms that enable small unmanned systems to more fully understand their local environment. Intelligent control research includes the maturation of autonomous processing capabilities and the advancement of artificial intelligence techniques that lead to reliable autonomous behavior in a large-displacement, highly-dynamic environment and permit unmonitored task performance. Research in biomimetic robotics and manipulator mechanics includes the advancement of mechatronic and biomimetic appendages to enable agile high-speed locomotion, dexterous task-performance, and environmental-manipulation; and the maturing of nonlinear control algorithms to support robust, stable mobility. Propulsion power and drives research includes investigations of engine cycles and alternative hybrid energy conversion techniques to provide compact, lightweight, quiet, low-emission, high-density power sources that support highly-portable unmanned systems capable of performing long-endurance missions.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Defense of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed internally by the Army Research Laboratory (ARL) at the Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Robotics autonomy and human robotic interface research	1.181	1.463	1.857

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601102A: *DEFENSE RESEARCH SCIENCES*	**PROJECT** T63: *ROBOTICS AUTONOMY, MANIPULATION, & PORTABILITY RSH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: In-house research with a focus on enabling robust autonomous mobility for small robotic systems, including autonomous operations in Global Positioning System (GPS) denied areas, planning, behaviors, intelligent control, and the interface of perception technologies to accomplish Army missions in the area of unmanned systems. These efforts will include research activities in micromechanics conducted in association with the Micro Autonomous Systems and Technology Collaborative Technology Alliance. ***FY 2010 Accomplishments:*** Developed dexterous manipulation systems with high density sensors and intelligent control algorithms to support complex task performance such as opening doors and moving objects or impediments. These manipulation systems were studied statically and in combination with highly mobile robots. ***FY 2011 Plans:*** New combinations of advanced sensor data are being fused in real time to provide enhanced dynamic situation awareness for small robotic systems, increasing the speed and agility of operation. ***FY 2012 Plans:*** Will evaluate novel modes of air and ground mobility for micro-mechanical systems.			
Accomplishments/Planned Programs Subtotals	1.181	1.463	1.857

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T64: *SCI BS/SYSTEM BIOLOGY AND NETWORK SCIENCE*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
T64: *SCI BS/SYSTEM BIOLOGY AND NETWORK SCIENCE*	1.234	1.278	2.198	-	2.198	2.794	2.846	2.895	2.937	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds research to conduct studies through a modernized systematic approach that uses iterative computer simulation with mathematical modeling and biological information to analyze and refine biological studies. The information gained from these studies provides a better understanding of the overall biological system and its molecular network of interactions, which leads to improved early strategic decision-making in the development of preventive and treatment solutions to diseases. This approach establishes a model for application of systems biology processes and knowledge of biological networks to discover medical products that prevent and/or treat diseases or medical conditions. This more complex, yet integrated approach, to studying biological systems could potentially reduce both the time and expense of medical product development for the Army.

Funding for this research is in project S15 prior to FY10.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the US Army Medical Research and Material Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Network Sciences Initiative	1.234	1.278	2.198
Description: This effort supports research to conduct studies through a modernized systematic approach that uses iterative computer simulation with mathematical modeling and biological information to analyze and refine biological studies.			
FY 2010 Accomplishments: Completed development of mathematical models that predict host-pathogen (infectious agent or germ) networks. These mathematical models can be used to predict environmentally-produced observable responses induced by external stimuli at the molecular level: genomic (DNA-based) and proteomic (protein-based). Established and evaluated mathematical and computational models that address identified gaps in network biology.			
FY 2011 Plans: Validate these models animals.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT T64: *SCI BS/SYSTEM BIOLOGY AND NETWORK SCIENCE*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will validate the accuracy of the models and apply the models to identify markers for traumatic brain injury.			
Accomplishments/Planned Programs Subtotals	1.234	1.278	2.198

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT VR9: *SURFACE SCIENCE RESEARCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
VR9: *SURFACE SCIENCE RESEARCH*	-	-	2.250	-	2.250	2.000	2.100	2.300	2.600	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project begins in FY12 and benefits the Army by establishing and maintaining a core research capability to enable a molecular level understanding of properties and behaviors of materials relevant to the Army; by developing understanding and ability to manipulate nanostructured materials as a means to tune properties which meet desired performance requirements; by advancing the scientific understanding of surface properties and interfacial dynamics of complex materials; and by providing scalable processes grounded in a molecular understanding of materials. This project funds basic research in the characterization of chemical and biochemical phenomena occurring at or near solid surfaces and interfaces; the interactions between chemical reactions and transport processes on surfaces; theory and modeling of processes at complex surfaces; and the synthesis and characterization of catalysts that function at the nanoscale. Investment in basic research centered on the surface science disciplines will enable growth of a knowledge base that will result in improved understanding of the interactions of complex materials in real world environments.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Edgewood Chemical and Biological Center (ECBC), Research, Development and Engineering Command, in Aberdeen, Maryland.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Surface Science Research	-	-	2.250
Description: The activities in this program are related to performing basic and early applied research in chemistry, biology and physics on fundamental problems related to surfaces, interfacial dynamics, thin film materials, chemical-biological catalysis and opto-electronic/sensory technologies.			
FY 2012 Plans: Base FY 2012 Description: Will investigate the complex behavior of mass transport in microporous systems; will design rational molecular and nano-system functional abiotic structures; will conduct fundamental studies and modeling of the interfacial			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601102A: *DEFENSE RESEARCH SCIENCES*	PROJECT VR9: *SURFACE SCIENCE RESEARCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
phenomena of particulate matter (solid/liquid) with surfaces and the interaction of matter and mechanisms of transfer of energy at the nanoscale and at biological interfaces.			
Accomplishments/Planned Programs Subtotals	-	-	2.250

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*				R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	96.409	91.161	80.977	-	80.977	82.107	87.764	91.907	94.707	Continuing	Continuing
D55: *University Research Initiative*	75.344	75.911	77.639	-	77.639	78.881	84.547	88.702	91.406	Continuing	Continuing
D58: *URI ACTIVITIES (CA)*	13.728	-	-	-	-	-	-	-	-	Continuing	Continuing
D66: *MEDICAL UNIVERSITY RESEARCH INITIATIVES (CA)*	4.935	-	-	-	-	-	-	-	-	Continuing	Continuing
V72: *MINERVA*	2.402	15.250	3.338	-	3.338	3.226	3.217	3.205	3.301	Continuing	Continuing

Note

FY12 funding decrease is the transfer out of MINERVA.

A. Mission Description and Budget Item Justification

The objective of this program element (PE) is to support Army basic research efforts in the Multidisciplinary University Research Initiative (MURI) program, the Defense University Research Instrumentation Program (DURIP) and the Presidential Early Career Awards for Scientists and Engineers (PECASE) program by funding basic research in a wide range of scientific and engineering disciplines pertinent to maintaining the U.S. land combat technology superiority. Army MURI program efforts involve teams of researchers investigating high-priority, transformational topics that intersect more than one traditional technical discipline (e.g., Intelligent Luminescence for Communication, Display, and Identification). For many complex problems, this multidisciplinary approach serves to accelerate research progress and expedite transition of results to application. The DURIP provides funds to acquire major research equipment to augment current, or devise new, research capabilities in support of Army transformational research. The PECASE program funds single-investigator research efforts performed by outstanding academic scientists and engineers early in their independent research careers.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Basic Research Plan, the Army Science and Technology Master Plan, and the Army Modernization Strategy.

Work on this project is performed extramurally by the Army Research Laboratory (ARL), Research Triangle Park, NC.

Projects D58 and D66 fund Congressional interest items.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army					DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*		R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*			
B. Program Change Summary ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**
Previous President's Budget	99.400	91.161	96.143	-	96.143
Current President's Budget	96.409	91.161	80.977	-	80.977
Total Adjustments	-2.991	-	-15.166	-	-15.166
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.238	-			
• SBIR/STTR Transfer	-2.753	-			
• Adjustments to Budget Years	-	-	-15.166	-	-15.166

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT D55: *University Research Initiative*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
D55: *University Research Initiative*	75.344	75.911	77.639	-	77.639	78.881	84.547	88.702	91.406	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

The objective of this project is to support the Multidisciplinary University Research Initiative (MURI), the Defense University Research Instrumentation Program (DURIP) and the Presidential Early Career Awards for Scientists and Engineers (PECASE) program. The MURI program funds university basic research in a wide range of scientific and engineering disciplines pertinent to maintaining US land combat technology superiority. Army MURI efforts involve teams of researchers investigating high-priority, transformational topics that intersect more than one traditional technical discipline (e.g. Intelligent Luminescence for Communication, Display, and Identification). For many complex problems, this multidisciplinary approach serves to accelerate research progress and expedite transition of results to application. The DURIP provides funds to acquire major research equipment to augment current, or devise new, research capabilities in support of Army transformational research. The PECASE program funds single-investigator research efforts performed by outstanding academic scientists and engineers early in their independent research careers.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work on this project is performed by the Army Research Laboratory (ARL) located in Research Triangle Park, NC.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Multidisciplinary University Research Initiative (MURI)	56.781	58.453	59.783
Description: MURI programs are typically 5 years in length at a cost of $1.25M/yr.			
FY 2010 Accomplishments: The program supported MURI, with 10 new awards that are critical to the Army's future operating capabilities. MURI topics were Neuronal Behavior in Primary Blast; Identifying and Extracting the Mathematical Signatures of Prokaryotic Activity in DNA; Developing a Theoretical Foundation for Predicting DNA Stability; Tomography of Social Networks of Asymmetric Adversaries; Adaptive Perception and Agile Autonomy in Severe Environments; Structured Modeling for Low-Density Languages; Directed Self-Assembly of Reconfigurable Materials; Atomtronics: A generalized electronics; Bio-Electronic Templates for Interfacing to the Nanoscale; Ion Transport In Complex Heterogeneous Organic Materials; and Defect Reduction in Superlattice Materials.			
FY 2011 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT D55: *University Research Initiative*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
The program supports ongoing MURI awards made in prior years, with 8 new awards that are critical to the Army's future operating capabilities are planned. ***FY 2012 Plans:*** Support for MURI awards made in prior years will continue and 8 new MURI awards critical to future operating capabilities will be initiated. Effective transition mechanisms include collaboration among principal investigators, participation by 6.2/6.3 program managers in MURI program reviews, and communication of the MURI research results to the Army Research Laboratory, the Research, Development, and Engineering Centers including Engineer Research and Development Center, U.S. Army Medical Research and Materiel Command, U.S. Army Research Institute, and industry.			
Title: Presidential Early Career Awards for Scientists and Engineers (PECASE) ***Description:*** Supports PECASE investigators started in prior years. ***FY 2010 Accomplishments:*** Continued support for prior year awardees and selected five new awards. ***FY 2011 Plans:*** Continue selecting five new awards and support prior years awardees. ***FY 2012 Plans:*** Will continue support for prior year PECASE awards and select five additional PECASE awardees.	2.837	4.291	4.389
Title: Defense University Research Instrumentation Program (DURIP) ***Description:*** Supports basic research through competitive grants for research instrumentation. ***FY 2010 Accomplishments:*** DURIP funded competitive grants for research instrumentation. ***FY 2011 Plans:*** Fund competitive grants for research instrumentation to enhance universities' capabilities to conduct world class research critical to Army transformation. ***FY 2012 Plans:*** Will continue funding competitive grants for research instrumentation to enhance universities' capabilities to conduct world class research critical to Army transformation.	12.574	13.167	13.467
Title: The Minerva Research Initiative (MRI)	3.152	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT D55: *University Research Initiative*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: The MRI is a university-based social science research program initiated by the Secretary of Defense. It focuses on areas in the social sciences of strategic importance to U.S. national security policy. It seeks to increase the Department's intellectual capital in the social sciences and improve its ability to address future challenges and build bridges between the Department and the social science community. Minerva will bring together universities, research institutions, and individual scholars and support multidisciplinary and cross-institutional projects addressing specific topic areas determined by the Department. Proposals have been solicited that address the following topics: Chinese Military and Technology Research and Archive Programs; Studies of the Strategic Impact of Religious and Cultural Changes within the Islamic World; Iraqi Perspectives Project; Studies of Terrorist Organization and Ideologies; New Approaches to Understanding Dimensions of National Security, Conflict, and Cooperation. ***FY 2010 Accomplishments:*** Within the Army there were four awards initiated in FY09 which were continued in FY10. In FY11 this effort is consolidated under PE 61103, Project V72.			
Accomplishments/Planned Programs Subtotals	75.344	75.911	77.639

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT D58: *URI ACTIVITIES (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
D58: *URI ACTIVITIES (CA)*	13.728	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for University Research Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Hi-tech Eyes for the Battlefield. ***Description:*** This is a Congressional Special Interest Item ***FY 2010 Accomplishments:*** Developed a novel, lightweight and adaptive image sensor architecture that derives its performance not from the size of the optical elements but from the power of the signal processing and the adaptability of its parts. The program investigated independent control of the instantaneous fields of view from an array of micro-imagers using signal processing and a two-dimensional array of micro-mirrors.	1.591	-	-
Title: Columbia College Chicago Construct Program. ***Description:*** This is a Congressional Special Interest Item ***FY 2010 Accomplishments:*** Began the multi-phase CONSTRUCT project to teach machines to analyze the interactions among humans as they collaborate to complete a task. This was done by merging video gaming with behavioral and computer science to quantify the ways in which individuals communicate, such as speech, body language, and facial movements, in order to facilitate more constructive interactions.	1.592	-	-
Title: Open Source Intelligence for Force Protection and Intelligence. ***Description:*** This is a Congressional Special Interest Item ***FY 2010 Accomplishments:***	0.796	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT D58: *URI ACTIVITIES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
This effort supported the collection, data mining, and data distribution of open source information that can be used to achieve a tactical advantage.			
Title: Antennas for Unmanned Aerial Vehicles. ***Description:*** This is a Congressional Special Interest Item ***FY 2010 Accomplishments:*** Developed an affordable and miniature antenna structure to be used on Unmanned Aerial Vehicles (UAVs) that are capable of supporting the advanced communication needs of the military. Project addressed the unstable imaging problem that exists with current UAV cameras and investigated antenna structures that are capable of supporting proficient UAVs communication needs in order to recognize their full potential in wartime.	0.995	-	-
Title: Laboratory for Engineered Human Protection (LEHP). ***Description:*** This is a Congressional Special Interest Item ***FY 2010 Accomplishments:*** Conducted research in innovative solutions for personnel protection.	1.591	-	-
Title: Collaboration Skills for Time Critical Teams, Squads and Workgroups. ***Description:*** This is a Congressional Special Interest Item ***FY 2010 Accomplishments:*** Developed a crisis communications research center to focus academic and professional expertise on the role of communications in major crises. The ultimate aim is to create opportunities for research which will lead to the development of improved training procedures and the deployment of communications strategies and infrastructure that would help prepare for and mitigate future crises.	1.591	-	-
Title: Cooperative Developmental Energy Program. ***Description:*** This is a Congressional Special Interest Item ***FY 2010 Accomplishments:*** The program provided funding for a partnership with the Museum of Aviation Foundation that will investigate new energy investment strategies and best management practices for energy and water conservation.	1.592	-	-
Title: Manufacturing Lab for Next Generation Engineers.	1.592	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT D58: *URI ACTIVITIES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: This is a Congressional Special Interest Item ***FY 2010 Accomplishments:*** Investigated energy investment strategies for motivating and attracting scientists and engineers to pursue careers in the energy industry.			
Title: Molecular Electronics for Flash Memory Protection. ***Description:*** This is a Congressional Special Interest Item ***FY 2010 Accomplishments:*** Established an accelerated research program focusing on the development and use of ultra-high-density, three-dimensional memory chips for the fabrication of flash memory devices, to be deployed for surveillance activities and communication in the battlefield.	2.388	-	-
Accomplishments/Planned Programs Subtotals	13.728	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT D66: *MEDICAL UNIVERSITY RESEARCH INITIATIVES (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
D66: *MEDICAL UNIVERSITY RESEARCH INITIATIVES (CA)*	4.935	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Medical University Research Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Burn and Shock Trauma Institute. ***Description:*** Funding is provided for the following effort ***FY 2010 Accomplishments:*** This is a Congressional Interest Item.	1.592	-	-
Title: International Diabetes Research Initiative ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This effort conducted research on new treatment and prevention strategies for diabetes.	2.547	-	-
Title: Science, Technology, Engineering, Mathematics (STEM) at Coppin State University ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This effort provided opportunities for enhancement of student achievement via the Science, Technology, Engineering, mathematics (STEM) efforts at Coppin State University.	0.796	-	-
Accomplishments/Planned Programs Subtotals	4.935	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT D66: *MEDICAL UNIVERSITY RESEARCH INITIATIVES (CA)*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT V72: *MINERVA*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
V72: *MINERVA*	2.402	15.250	3.338	-	3.338	3.226	3.217	3.205	3.301	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

The objective of this project is to support the Minerva Research Initiative (MRI), a university-based social science research program initiated by the Secretary of Defense in FY09. It focuses on areas in the social sciences that are of strategic importance to U.S. national security policy which have not been substantially pursued in the past. The Minerva research effort will be performed to understand the internal military-political dynamics of repressive regimes, the vulnerabilities of regimes and institutions to various kinds of influence and instability, the nature of crowd dynamics, the potential to influence public opinions and attitudes in diverse cultures, cultural effects on network security and military operations, the influence of technology on military capabilities of potential adversaries and allies, and other intersections of social-cultural issues with military activities. Predictive models and other analysis tools will be developed. Leveraging the expertise in the social sciences within the academic community is needed to provide understanding of the roots of terrorist organizations and the challenges and opportunities for military operations in a culturally diverse environment. Better understanding at a fundamental level and new computational tools will provide a beneficial impact on war fighting capabilities at the national policy, military strategy, operational, and tactical levels, and will enhance the capabilities of intelligence activities at all levels. All research results will be open source.

In FY11, this project consolidated efforts that were initiated under PE 0601103A, Project D55. Existing grants on the studies of the strategic impact of religious and cultural change in the Muslim world; Iraqi perspectives; and studies of terrorist organizations and ideologies; and new approaches to understanding dimensions of national security, conflict and cooperation from that project will be continued in FY12.

Also in FY12, new research activities related to Minerva Outreach and In-House capability will be funded though the Office of the Secretary of Defense.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan, as well as the requirements of the Army Culture and Foreign Language Strategy.

Work in this project will be executed extramurally by the Army Research Office and National Science Foundation.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Minerva Outreach and In-house Capability	2.402	12.000	0.038
Description: Supports Minerva basic research projects and establishment of a Chairs program at principally military educational institutions.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601103A: *University Research Initiatives*	PROJECT V72: *MINERVA*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Solicited topics focusing on social science and cultural issues affecting US military warfighting capabilities, the relationship of foreign military and technology capabilities, national and military implications of foreign religious and cultural changes, foreign perspectives of US policy and strategy, terrorist organizations and ideologies, and other issues related to the national security conflict and cooperation. ***FY 2011 Plans:*** Extend research areas to new topics, such as new theories of deterrence and the national security implications of energy and climate change. Develop in-house social science capabilities necessary to integrate results from the extramural program into the planning, programming and management processes of the DoD as well as to tap university-based expertise in cutting edge social scientific research areas. ***FY 2012 Plans:*** This effort will be funded through the Office of the Secretary of Defense.			
Title: Minerva University Consortia ***Description:*** Focuses on studies of the strategic impact of religious and cultural change in the Muslim world. ***FY 2011 Plans:*** Continue research initiated in PE 0601103, Project D55 to conduct studies of the relationship of technology and national security in China, the stability vulnerabilities of African states and institutions to environmental stress, and the internal dynamics of the Baathist regime from the Iraqi perspective. ***FY 2012 Plans:*** Will further efforts on the three (3) existing projects focusing on social science and cultural issues affecting US military warfighting capabilities: the relationship of foreign military and technology capabilities; national and military implications of foreign religious and cultural changes; foreign perspectives of US policy and strategy; terrorist organizations and ideologies; as well as other issues related to the national security implications of conflict and cooperation.	-	3.250	3.300
Accomplishments/Planned Programs Subtotals	2.402	15.250	3.338

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601103A: *University Research Initiatives*	**PROJECT** V72: *MINERVA*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*				R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	107.582	98.087	120.937	-	120.937	118.577	123.282	127.163	131.926	Continuing	Continuing
F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*	4.785	5.030	5.161	-	5.161	5.195	5.321	5.347	5.438	Continuing	Continuing
H04: *HBCU/MI CENTERS - TRADOC BATTLELABS*	2.638	2.776	18.071	-	18.071	18.308	18.643	18.981	19.479	Continuing	Continuing
H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*	8.251	9.672	12.214	-	12.214	12.494	12.812	13.218	13.638	Continuing	Continuing
H09: *ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)*	4.364	5.077	5.284	-	5.284	5.490	5.586	5.677	5.773	Continuing	Continuing
H50: *Network Sciences CTA*	2.554	3.289	12.908	-	12.908	12.979	15.283	15.567	15.831	Continuing	Continuing
H53: *Army High Performance Computing Research Center*	3.311	3.706	4.355	-	4.355	4.467	4.847	6.119	6.909	Continuing	Continuing
H54: *Micro-Autonomous Systems Technology (MAST) CTA*	7.739	8.050	7.945	-	7.945	8.290	8.434	8.570	8.716	Continuing	Continuing
H59: *UNIV CENTERS OF EXCEL*	5.345	5.580	6.356	-	6.356	7.431	7.543	7.647	7.777	Continuing	Continuing
H62: *Institude for Advanced Technology (IAT)*	6.184	5.506	1.423	-	1.423	-	-	-	-	Continuing	Continuing
H64: *MATERIALS CENTER*	2.726	2.869	2.920	-	2.920	2.971	3.023	3.072	3.829	Continuing	Continuing
H73: *Automotive Research Center (ARC)*	2.831	2.947	3.994	-	3.994	4.049	4.102	4.153	4.207	Continuing	Continuing
J08: *INSTITUTE FOR CREATIVE TECHNOLOGY*	7.486	7.878	8.022	-	8.022	8.167	8.310	8.944	9.838	Continuing	Continuing
J12: *Institute for Soldier Nanotechnology (ISN)*	9.862	10.487	10.787	-	10.787	10.891	11.181	11.261	11.452	Continuing	Continuing
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	21.924	-	-	-	-	-	-	-	-	Continuing	Continuing

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army									DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*				R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*							
J14: *ECYBERMISSION*	4.086	5.330	5.426	-	5.426	-	-	-	-	Continuing	Continuing
J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*	7.828	8.072	8.217	-	8.217	8.363	8.510	8.647	8.794	Continuing	Continuing
J17: *VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE*	1.963	2.066	2.654	-	2.654	2.741	2.828	2.990	3.151	Continuing	Continuing
J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*	3.705	9.752	-	-	-	-	-	-	-	Continuing	Continuing
VS2: *CENTER FOR ADVANCED RESEARCH*	-	-	5.200	-	5.200	6.741	6.859	6.970	7.094	Continuing	Continuing

Note

FY12 funding increase includes the transfer in for Historical Black Colleges and Universities (HBCU) Science.

A. Mission Description and Budget Item Justification

This program element (PE) investigates research that supports enabling technologies for future force capabilities. Broadly, the work in this project falls into three categories: Collaborative Technology Alliances (CTAs), University Centers of Excellence (COE), and University-Affiliated Research Centers (UARCs). The Army formed CTAs to leverage large investments by the commercial sector in basic research areas that are of great interest to the Army. CTAs involve partnerships between industry, academia, and the Army Research Laboratory (ARL) to incorporate the practicality of industry, the expansion of the boundaries of knowledge from universities, and Army scientists to shape, mature, and transition technology. CTAs have been competitively established in the areas of Micro Autonomous Systems Technology (MAST), Network Sciences, Robotics and Cognition and Neuroergonomics. This PE includes the Army's COE, which focus on expanding the frontiers of knowledge in research areas where the Army has enduring needs, such as rotorcraft, automotive, microelectronics, materials, and information sciences. COEs 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 information sciences, materials science, electronics, automotive, and rotary wing technology. Also included is eCYBERMISSION, the Army's national web-based competition to stimulate interest in science, math, and technology among middle and high school students. This PE includes the four Army UARCs, which have been created to exploit opportunities to advance new capabilities through a sustained long-term multidisciplinary effort. The Institute of Advanced Technology (IAT) funds basic research in electromagnetic and hypervelocity physics. In January 2012 the UARC contract with IAT will end with all remaining funds moved to project VS2. These funds will be used to competitively establish a new external center to address the extreme challenges associated with understanding and modeling materials subject to high impact rates. The Institute for Soldier Nanotechnologies focuses on Soldier protection by emphasizing revolutionary materials research for advanced Soldier protection and survivability. The Institute for Collaborative Biotechnologies focuses on enabling network centric-technologies, and broadening the Army's use of biotechnology for the development of bio-inspired materials, sensors, and information processing. The Institute for Creative Technologies is a partnership with academia and the entertainment and gaming industries to leverage innovative research and concepts for training and simulation. 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

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*

interoperability, and tools for creating simulated environments. This PE also includes the Historically Black Colleges and Universities and Minority Institution (HBCU/MI) Centers of Excellence that address critical research areas for Army Transformation.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this PE is managed by: the Army Research Lab (ARL) in Adelphi, MD; the US Army Tank-Automotive Research, Development, and Engineering Center (TARDEC) in Warren, MI; the Simulation and Training Technology Center (STTC) in Orlando, FL; and the US Army Research Institute for the Behavioral and Social Sciences (ARI) in Arlington, VA.

Project J13 funds Congressional interest items.

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	115.338	98.087	99.355	-	99.355
Current President's Budget	107.582	98.087	120.937	-	120.937
Total Adjustments	-7.756	-	21.582	-	21.582
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-4.721	-			
• SBIR/STTR Transfer	-3.035	-			
• Adjustments to Budget Years	-	-	21.582	-	21.582

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*	4.785	5.030	5.161	-	5.161	5.195	5.321	5.347	5.438	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports the Neuroergonomics Collaborative Technology Alliance (CTA), a competitively selected industry and university consortium, to leverage world-class research in support of future force and Army transformation needs. Escalating levels of complexity and uncertainty on the current and future battlefield present conditions which have never existed before now. Solution strategies and approaches must be developed or tailored. The emerging field of neuroergonomics, which seeks to understand the brain at work and to leverage that understanding to optimize system design, offers tremendous potential for providing the solutions needed to meet the needs of Army forces in the future. This CTA addresses the solution strategies and approaches needed to design systems to fully exploit investments in revolutionary technological advances in areas such as robotics, microelectronics, and computer and network information systems. These technologies present significant opportunities to enhance Army mission capabilities, but impose significant burdens on the human brain, which will ultimately limit Soldier-system effectiveness, sustainability, and survivability. The technical barriers associated with this project include: immature knowledge base to guide the neuroergonomic approach to human-system integration; inadequate capabilities to sense and extract information about brain activity in dynamic, operational environments; lack of valid measures to robustly and uniquely characterize operationally-relevant cognitive performance; lack of techniques for integrating advanced understandings of brain activity into systems designs, including real-time use of measures of cognitive behavior as system inputs and the capability to account for individual differences in maximizing Soldier-system performance. This CTA conducts an intensive and accelerated program to formulate, validate, and transition basic research findings through multi-dimensional approaches focused in three areas: understanding fundamental principles underlying Soldier neurocognitive performance in operational environments, advancing computational approaches for the analysis and interpretation of neural functioning, fundamental advancement in neurotechnologies that enhance Soldier-system interactions and performance. This Cognition and Neuroergonomics CTA began in FY10.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL) in Adelphi, MD.

Funding was restructured from the Advanced Decision Architecture Collaborative Technology Alliance in PE 0601104A, project H56.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Neurocognitive performance in operational environments	1.391	1.540	1.950

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: This effort is intended to understand fundamental principles underlying Soldier neurocognitive performance in operational environments. ***FY 2010 Accomplishments:*** Combined multiple levels of performance and physiological assessment (electroencephalogram (EEG), eye tracking, and behavioral observations) to investigate multiple sensory modality perceptual-motor interactions; included assessment of interactions between basic elements of cognition, sensory-perceptual channel inputs, and motor systems; explored multisensory interactions that support attention allocation and decision-making across a distributed and complex environment and under the influence of performance stressors. ***FY 2011 Plans:*** Explore formal models of information presentation, including multi-modal and adaptive displays as well as multisensory attentional cueing; examine interactions between information systems and physical-cognitive performance. ***FY 2012 Plans:*** Will transition lessons learned to the design and creation of simulation experiments to capture neurocognitive performance while embedded in military-relevant operational contexts; will utilize simulation environments to evaluate predictions made from formal models; will elaborate and refine models of neurocognitive function developed based on results generated during simulation experiments.			
Title: Computational neural analysis ***Description:*** This effort advances computational approaches for the analysis and interpretation of neural functioning. ***FY 2010 Accomplishments:*** Focused on methodological exploration and model development; collected and analyzed data sets needed to facilitate the exploration and elaboration of data analytic, data fusion, visualization and modeling techniques and establish computational infrastructure to be applied to future years; investigated methods for sparse and mixed data-type modeling for insertion into analysis of physiological and performance observations in other program areas. ***FY 2011 Plans:*** Examine how the nervous system filters large-scale, multi-dimensional data sets for decision making; identify individual differences in neural processing underlying successful and unsuccessful decision making. ***FY 2012 Plans:***	1.431	1.540	1.550

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will analyze data sets generated during large-scale simulation experiments; will use simulation data sets for further expansion and elaboration of models and methods for assessing predictive features involving inter- and intra-subject variability; and will refine models according to assessments of the adequacy of overlap and agreement between data and observations.			
Title: Neurotechnologies ***Description:*** This effort provides a fundamental advancement in neurotechnologies that enhance Soldier-system interactions and performance. ***FY 2010 Accomplishments:*** Established a science of neuroergonomic interaction to guide the development of multi-touch screen interfacing for Soldier-system interaction; evaluated physiological (EEG) signals acquired from newly-developed wireless micro-electrode technologies; and began the investigation and evaluation of novel online signal processing methods for brain-signal extraction from complex data. ***FY 2011 Plans:*** Explore methods for state detection and signal processing techniques for signal integration; develop static algorithms that account for the variability in individual differences and/or environmental stressors on performance. Implement modeling of human visual attention for insertion into computer vision algorithm for automated scene processing and alerting of events of interest in the visual field. ***FY 2012 Plans:*** Will refine online signal processing methods as well as expand methods for analysis of EEG data; will identify key biomechanical measures based on the inertial fatigue-monitoring sensors and will investigate remote monitoring of Soldier fatigue; will design algorithms for a neuro-computer vision system for automated environmental appraisal; and will develop methods for integration of user feedback into a system for alerting the Soldier to important environmental events involving saliency and attention modeling, object detection, object tracking and crowd modeling.	1.963	1.950	1.661
Accomplishments/Planned Programs Subtotals	4.785	5.030	5.161

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H04: *HBCU/MI CENTERS - TRADOC BATTLELABS*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H04: *HBCU/MI CENTERS - TRADOC BATTLELABS*	2.638	2.776	18.071	-	18.071	18.308	18.643	18.981	19.479	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Historically Black Colleges and Universities and Minority Institutions (HBCU/MI) program provides support for research and collaboration with DoD facilities and personnel. Centers of Excellence have proven effective in harnessing a critical mass of university research expertise and focusing their intellectual capabilities on Army unique science and technology problems. The focus of this effort is to enhance programs and capabilities of a select number of high-interest scientific and engineering disciplines through innovative research at Centers of Excellence established at Historically Black Colleges and Universities (HBCU). These COEs work with Army, industrial, and other academic partners to accelerate the transition from the research phase to technology demonstration. In addition, these Centers of Excellence recruit, educate, and train outstanding students and post-doctoral researchers in science and technology areas relevant to Army Transformation. This project was previously funded in PE 0601104A, project H59 (University Centers of Excellence) and is being transferred into a distinct project for visibility and management. The National Defense Authorization Act for Fiscal Year 2010 established new program authority (enacted in 10 U.S.C. 2362, Section 252) and a delegation of authority memo from the Under Secretary of Defense (Acquisition, Technology and Logistics) to the Secretary of the Army cleared the way for the next iteration of the Centers of Excellence, called the Partnership in Research Transition (PIRT) Program. Up to five new PIRT Centers will be established focusing on Army-relevant, topic focused, near-transition-ready innovative research that support Army Warfighter Outcomes.

The increase in the PE is the result of the Office of the Secretary of Defense increase of funding.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work on this project is performed extramurally by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Centers of Excellence for Battlefield Capability Enhancements (BCE)	2.638	2.776	2.826
Description: Through FY10 centers were located at: Tuskegee Univ. (Flexible Extremities Protection); NCA&T State Univ. (Environmentally-stable Flexible Displays, and Human-centric Command and Control Decision Making: predictive modeling of group situational awareness); Tennessee State Univ. (Sensor Fusion); and Prairie View A&M Univ. (Beyond-Line-of-Sight Lethality). Collaborations with TRADOC Battle Labs have helped accelerate technology transitions to the battlefield.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H04: *HBCU/MI CENTERS - TRADOC BATTLELABS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Established a new PIRT Program to enhance programs and capabilities of a select number of high-interest scientific and engineering disciplines through Army-relevant, topic-focused, near-transition-ready innovative research. ***FY 2011 Plans:*** Completing awards for up to five centers. ***FY 2012 Plans:*** Will continue initial FY11 research efforts based upon new Centers.			
Title: Historically Black Colleges and Universities and Minority Institutions (HBCU/MI) ***Description:*** The Historically Black Colleges and Universities and Minority Institutions (HBCU/MI) program provides support for research and collaboration with DoD facilities and personnel; the research grants further knowledge in the basic physical scientific and engineering disciplines through theoretical and empirical activities; collaborative research allows university professors to work directly with military laboratories or other universities. ***FY 2012 Plans:*** This effort is devolved from the Office of the Secretary of Defense, PE 0602228D8Z; as executive agent, the Army will conduct Broad Agency Announcement and solicitations to execute funding for grants and awards following legislative and executive policy and guidance when Congress directs.	-	-	15.245
Accomplishments/Planned Programs Subtotals	2.638	2.776	18.071

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*	8.251	9.672	12.214	-	12.214	12.494	12.812	13.218	13.638	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports the Army's Institute for Collaborative Biotechnologies (ICB), a University Affiliated Research Center led by the University of California-Santa Barbara, and two major supporting partners, the California Institute of Technology and the Massachusetts Institute of Technology. The ICB is the Army's primary conduit for leveraging biotechnology for: advanced sensors; new electronic, magnetic, and optical materials; and information processing and bioinspired network analysis. The objective is to perform sustained multidisciplinary basic research supporting technology to provide the Army with biomolecular sensor platforms with unprecedented sensitivity, reliability, and durability; higher-order arrays of functional electronic and optoelectronic components capable of self-assembly and with multi-functions; and new biological means to process, integrate, and network information. These sensor platforms will incorporate proteomics (large scale study of proteins) technology, DNA sequence identification and detection tools, and the capability for recognition of viral pathogens. A second ICB objective is to educate and train outstanding students and post doctoral researchers in revolutionary areas of science to support Army Transformation. The ICB has many industrial partners, such as IBM and SAIC, and has strong collaborations with Argonne, Lawrence Berkley, Lawrence Livermore, Los Alamos, Oak Ridge, and Sandia National Laboratories, the Army's Institute for Soldier Nanotechnologies, the Institute for Creative Technologies, and Army Medical Research and Materiel Command (MRMC) laboratories.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed extramurally by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Institute for Collaborative Biotechnologies	7.069	8.453	11.000
Description: Perform sustained multidisciplinary basic research supporting technology to provide the Army with biomolecular sensor platforms.			
FY 2010 Accomplishments: Translated discoveries of the mechanisms by which lightweight biological composites dissipate energy and resist fracture into new approaches for blast-resistant materials and structures; and developed nanofluidic platform to analyze mechanisms underlying nanoscale fluidic biomeolcule separations.			
FY 2011 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Devise a platform that integrates surface enhanced Raman spectroscopy technologies into free surface fluidic explosives detection system with an open surface microchannel system featuring controlled flow velocities; develop optimized materials as implantable, biodegradable tissue scaffolds for eventual application to battlefield trauma; and conduct force measurements to verify a gecko-inspired reversible adhesive system. ***FY 2012 Plans:*** Research will be conducted toward development of mass-based assays for detecting molecular, viral and cell-based pathogens relevant to the Army; will develop shell and bone-inspired passive actuators aimed toward dissipating energy targeted against buildings, barracks and bunkers; will expand use of synthetic biology for engineering novel materials and fuels; and will develop first-principles molecular design rules to create honeycomb micro-trusses for fabrication into composite blast-resistant materials.			
Title: Neuroscience ***Description:*** Perform multidisciplinary basic research in the area of neuroscience. ***FY 2010 Accomplishments:*** Extended brain mapping to evaluate Army personnel with field experience for decision making, executive function and memory performance; partnered with the Institute for Creative Technologies (ICT) to begin to design, develop and implement standard virtual human-agent interaction contexts and scenarios in order to create standard test-bed scenarios for determining the human interactional efficacy of virtual human agents. ***FY 2011 Plans:*** Research electroencephalogram (EEG) and functional magnetic resonance imaging (fMRI) methods to understand the neural underpinnings leading to successful perceptual discrimination; and improve the characterization of neural data developed in this research effort using methodologies in network dynamics, optimal control and complex systems. ***FY 2012 Plans:*** Efforts will continue the study of spatial and temporal dynamics of brain function via simultaneous fMRI-EEG neuroimaging; will integrate cognitive theory and biologically constrained computational models with multimodel imaging to further develop enabling technologies that support improved methods for Soldier training; will continue investigation of genetic markers that can be linked to abilities in classification learning; and will investigate the shared neural substrates for action simulation and intention understanding.	1.182	1.219	1.214
Accomplishments/Planned Programs Subtotals	8.251	9.672	12.214

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H09: *ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H09: *ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)*	4.364	5.077	5.284	-	5.284	5.490	5.586	5.677	5.773	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports a collaborative effort between the competitively selected industry and university consortium, the Robotics Collaborative Technology Alliance (CTA), and the Army Research Laboratory (ARL) for the purpose of leveraging world-class research in support of the future force and Army transformation needs. This project conducts basic research in areas that will expand the capabilities of intelligent mobile robotic systems for military applications with a focus on enhanced, innate intelligence, ultimately approaching that of a dog or other intelligent animal, to permit unmanned systems to function as productive members of a military team. Research is conducted in machine perception, including the exploration of sensor phenomenology, and the investigation of basic machine vision algorithms enabling future unmanned systems to more fully understand their local environment for enhanced mobility and tactical performance; intelligent control, including the advancement of artificial intelligence techniques for robot behaviors permitting future systems to autonomously adapt, and alter their behavior to dynamic tactical situations; understanding the interaction of humans with machines focusing upon intuitive control by Soldiers to minimize cognitive burden; dexterous manipulation of the environment by unmanned systems; and unique modes of mobility to enable unmanned systems to seamlessly navigate complex or highly constrained three dimensional environments. The program will conduct both analytic and validation studies. Research products will be transitioned to the companion applied technology program, PE 0602618A, project H03, for integration and evaluation in test bed platforms and will form the scientific basis for new technology that will migrate into Army and Joint advanced and system development programs to provide highly capable unmanned systems for the future force.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL) at the Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Autonomous systems	4.364	5.077	5.284
Description: Explore opportunities enabling revolutionary, autonomous, highly mobile systems for the future force. Research focuses on unmanned systems operating as a team with human supervisors and displaying a high degree of adaptability to dynamic environmental and tactical situations.			
FY 2010 Accomplishments: Expanded research to include a more complete understanding of control and interaction between humans and robots through non-verbal cues and natural language; autonomous understanding and retention of salient features and activities to promote			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H09: *ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
learning and adaptation to dynamic, unknown environments; and novel structural and control techniques to enable more dexterous manipulation. ***FY 2011 Plans:*** Research expanded abilities to perceive and understand activities, consistent with complex urban environments and investigate concepts underlying the planning and coordinated response by multiple heterogeneous robots. ***FY 2012 Plans:*** Will focus upon exploration of principles for constructing and managing a hierarchical world model combining cognitive higher level representations with lower level planning to enable formation of effective human robot teams; will evaluate the learned recognition of terrain and objects with placement into context; will assess situational awareness within human-robot teams; and will explore methodologies for coordinated manipulation.			
Accomplishments/Planned Programs Subtotals	4.364	5.077	5.284

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H50: *Network Sciences CTA*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H50: *Network Sciences CTA*	2.554	3.289	12.908	-	12.908	12.979	15.283	15.567	15.831	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports a competitively selected university and industry consortium, the Communication and Networks Collaborative Technology Alliance (CTA) that was formed to leverage commercial research investments to provide solutions for the Army's requirements for robust, survivable, and highly mobile wireless communications networks. The future force has a requirement for state-of-the-art wireless mobile communications networks for command-on-the-move. The objectives include designing communications systems for survivable wireless mobile networks; providing signal processing for communications-on-the-move; secure jam-resistant communications; and tactical information protection. The CTA facilitates the exchange of people among the collaborating organizations to provide cross-organizational perspectives on basic research challenges, as well as the use of state-of -the-art facilities and equipment at the participating organizations. This CTA accelerates the transition of communications and networks technology to PE 0602783A (Computer and Software Technology). The results of this work will significantly affect future force communications and networking formulation efforts.

The Communications and Networks CTA ended in FY09. In FY10, a portion of this program shifts to in-house efforts in PE 0601102A/project H48. The remainder of the program is refocused in FY10 on the Network Sciences CTA to more strongly emphasize Information Assurance and Network Science as defined by the December 2005 National Research Council Board on Army Science and Technology study. Since the International Technology Alliance on Network and Information Sciences (PE 0601104A/project J15) was established in 2006, joint planning of the research programs prevents redundancies and leverages accomplishments from both programs. Beginning in FY12, all funds from PE 61104/project J22 will be realigned to this project.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Network Sciences Collaborative Technology Alliance (NS CTA)	2.554	3.289	12.908
Description: The Network Sciences CTA began in FY10 and focuses on two major research areas: Information Networks and Social/Cognitive Networks; and builds upon successes of the Communications & Networks CTA for Communications Networks and Integration. The vision for the NS CTA is to develop a fundamental understanding of the ways that information, social/cognitive, and communications networks can be designed, composed, and controlled to dramatically increase mission effectiveness and ultimately enable humans to effectively exploit information for timely decision-making. Information Networks research develops the fundamental understanding of autonomous network activities and its linkage to the physical and human domains as related to human decision making within the networked command and control (C2) structure. Social/Cognitive			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H50: *Network Sciences CTA*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Networks research is developing the fundamental understanding of the interplay of the various aspects of the social and cognitive networks with information and communications. Communications Networks research is developing the foundational techniques to model, analyze, predict, and control the behavior of secure tactical communication networks as an enabler for information and C2 networks. Integration is focused on achieving an integrated Information Networks, Social/Cognitive Networks, Communications Networks research program that significantly enhances the fundamental understanding of the underlying science of networks. ***FY 2010 Accomplishments:*** Established the Network Sciences CTA in support of the Network Science & Technology Research Center (PE 0601104A/project J22). Research included modeling to understand network centric organizations and developing mobile ad hoc network simulation and emulation technologies to evaluate networks in organizations. ***FY 2011 Plans:*** Design an evaluation scheme for the verification and validation of models of trust in network supported decision making. ***FY 2012 Plans:*** Will develop models of network performance that capture the complex interactions between social, cognitive, information and communication networks; will extend the initial trust model that will improve network fidelity and reliability in the tactical mobile ad hoc network (MANET) environment; will develop theoretically grounded empirical models of emergence and propagation of trust and beliefs in insurgent-civilian populations and in battle command decision-making; will produce experimentally-confirmed results in dynamics and stability of large-scale, dynamic, distributed, human-centric networks of information; and will investigate the impacts of mobility and adversarial attacks on the dynamics of information quality delivered through mobile communication networks.			
Accomplishments/Planned Programs Subtotals	2.554	3.289	12.908

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H53: *Army High Performance Computing Research Center*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H53: *Army High Performance Computing Research Center*	3.311	3.706	4.355	-	4.355	4.467	4.847	6.119	6.909	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports critical research at the Army High Performance Computing Research Center (AHPCRC). Research at the AHPCRC is focused on the Lightweight Combat Systems Survivability, computational nano- and bio-sciences, computational battlefield network and information sciences including evaluating materials suitable for armor/anti-armor and sensor applications, defense from chemical and biological agents, and associated enabling technologies requiring computationally intensive algorithms in the areas of combat systems survivability, battlefield network sciences, chemical and biological defense, nanoscience and nanomechanics, and computational information sciences, scientific visualization enabling technologies that support the future force transition path. This project also supports the Robotics Collaborative Technology Alliance which explores new opportunities to enable revolutionary autonomous mobility of unmanned systems for the Future Force. This research is an integral part of the larger Army Robotics Program and feeds technology into Robotics Technology (PE 0602618A, project H03). The project will also address research focusing on unmanned systems operating as a team with human supervisors and displaying a high degree of adaptability to dynamic environmental and tactical situations.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed extramurally by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: AHPCRC	3.311	3.706	4.355
Description: The AHPCRC research mission is to advance computational science and its application to critical Army technologies through an Army-university-industry collaborative research program.			
FY 2010 Accomplishments: Enhanced lightweight fabric structure systems; enhanced innovative scalable algorithms to analyze very large-scale complex mobile network simulation applications; developed new scalable multi-scale computational approaches for micro-systems design; and implemented computational bio- and nano-science scalable algorithms.			
FY 2011 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H53: *Army High Performance Computing Research Center*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Validate lightweight fabric structure systems; implement and evaluate new and novel programming models on heterogeneous systems; implement computational approaches to analyze very large-scale mobile network simulation applications; implement new multi-scale computational approaches for micro-systems design; advance scalable algorithms for material sciences, computational bio- and nano-sciences; and stimulate innovations in algorithms for new multi-core hybrid computing architectures. ***FY 2012 Plans:*** Will develop: computational approaches for coupling light weight fabric structural mechanics with computational electromagnetics to study contact mechanics between electromagnetically charged fabrics and structures; scalable approaches for nano-fluidics for Army medical applications; quantum level approaches for an all electron battery; and programming models for emerging hybrid computing architectures for Army applications. Will investigate scalable algorithms for large-scale social networks and will validate multi-scale computational approach for micro-systems design.			
Accomplishments/Planned Programs Subtotals	3.311	3.706	4.355

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H54: *Micro-Autonomous Systems Technology (MAST) CTA*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H54: *Micro-Autonomous Systems Technology (MAST) CTA*	7.739	8.050	7.945	-	7.945	8.290	8.434	8.570	8.716	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports the Micro Autonomous Systems and Technology (MAST) Collaborative Technology Alliance (CTA), a competitively selected industry-university consortium which leverages world-class research necessary to address future force and Army Transformation needs. The CTA links a broad range of government technology agencies, as well as industrial and academic partners with the Army Research Laboratory (ARL). The MAST CTA focuses on innovative research in four main technical areas related to the coherent and collaborative operation of multiple micro autonomous platforms: microsystem mechanics, processing for autonomous operation, microelectronics, and platform integration. Payoff to the warfighter will be advanced technologies to support future force requirements in situational awareness. The CTA facilitates the exchange of people among the collaborating organizations to provide cross-organizational perspectives on basic research challenges, and to make available to the Alliance state-of-the-art facilities and equipment at the participating organizations.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Micro Autonomous Systems Technology CTA	7.739	8.050	7.945
Description: Funding is provided for the following effort			
FY 2010 Accomplishments: Developed limits on platform power and tradeoffs between power for propulsion, sensing, signal processing, and communication; implemented small group collaborative tactical behaviors and investigated tradeoffs in distributed processing and communications for perception and navigation; developed initial prototypes in microelectronics for navigation, communication, information processing, and sensing for micro-autonomous systems; proved the hover capability of a flapping wing platform; and investigated performance of small flying platforms under gusty wind conditions.			
FY 2011 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H54: *Micro-Autonomous Systems Technology (MAST) CTA*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Extramural partners are modeling multiple robotic platform architectures; exploring autonomous tactical behaviors in realistic 3-D environments, designing holistic sensing, processing, actuation architectures; and transitioning processing algorithms to the Army robotics community; and investigating contractor developed models and technologies for future implementation. Will investigate methods to optimize and implement microelectronics technology for navigation, communication, information processing, and sensing for micro-autonomous systems. ***FY 2012 Plans:*** Will experimentally validate the ability of small air and ground platforms to identify points of ingress into a structure and to navigate through them in a robust, stable manner and; will conduct experiments on the ability of small air and ground platforms to navigate to a waypoint based on sensor input.			
Accomplishments/Planned Programs Subtotals	7.739	8.050	7.945

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H59: *UNIV CENTERS OF EXCEL*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H59: *UNIV CENTERS OF EXCEL*	5.345	5.580	6.356	-	6.356	7.431	7.543	7.647	7.777	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project funds the International Technology Centers (ITCs), the Foreign Technology (and Science) Assessment Support (FTAS) program, and a Basic Research Center for Network Science located at the United States Military Academy.

The nine ITCs located in Australia, the United Kingdom, Canada, France, Germany, Japan, Chile, Argentina, and Singapore support the Army's goals of providing the best technology in the world to our Warfighters by leveraging the Science and Technology (S&T) investments of our international partners. The ITCs perform identification and evaluation of international technology programs to assess their potential impact on the Army's S&T investment strategy. ITC 'technology finds' are submitted as technology information papers (TIPs) to various Army S&T organizations for evaluation and consideration for further research and development. The ITC TIPs also serve as input into the international section of the Army S&T Master Plan. The FTAS program builds upon the TIPs submitted by the ITCs. In some cases the TIP is truly unique and may well meet an Army requirement or potentially support ongoing Army S&T investments. In such cases, the FTAS program can provide initial resources (seed money) to fund basic research in these technology areas identified by the TIPs as having potential relevance to the Army's S&T plan. The research will provide information useful in making early assessments of the technology's potential contributions to the Army's S&T strategy.

Beginning in FY09, this project funds a Basic Research Center in Network Science at the United States Military Academy (USMA) to further the theoretical understanding of engineering design principles on network sciences and how they operate. Work in this project is coordinated with and complementary to the work at the Network Science and Technology Research Center (NSTRC) funded under PE 0601104A/project J22 and PE 0601104/project H50.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed extramurally by Headquarters, Army Research, Development and Engineering Command (RDECOM) and the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: International Technology Centers (ITC)	4.387	4.593	5.371
Description: Funding is provided for the following effort.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H59: *UNIV CENTERS OF EXCEL*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
The ITCs made progress in several main areas of foreign technology identification and supported international collaboration including: Counter-Improvised Explosive Devices and Mines, Training, Power and Energy, Human Dimension, Sustainment, Battle Command, and Battle Space Awareness; five FTAS projects were completed with technology originating from the United Kingdom, Israel, Brazil and Belgium. These projects have shown to have successfully advanced technology programs for ARL, Armament Research, Development, and Engineering Center (RDEC), Communications-Electronics RDEC and Tank-Automotive RDEC. ***FY 2011 Plans:*** Continue to solicit projects and build on the success of the FTAS Program. Continue efforts to explore ITCs technology based on critical Army requirements. Eleven additional projects with technology originating from eight different countries are being worked on in FY11. These projects were initiated from TIPs received and submitted by AMRDEC, ARDEC, ARL, CERDEC and TARDEC. Twelve FTAS project proposals submitted during FY10 are currently awaiting decision. ***FY 2012 Plans:*** Will continue to solicit projects and build on the success of the FTAS Program; will continue to enhance and refine technology search capabilities using feedback from customers (RDECs, PMs and labs) to focus on near and long term capabilities.			
Title: Basic Research Center in Network Science at the United States Military Academy (USMA) ***Description:*** Network science research at USMA in support of the Network Science and Technology Research Center. ***FY 2010 Accomplishments:*** Contributed to and facilitated the Army transformation to network-centric operations (NCO), and promoted the professional development of the United States Military Academy (USMA) faculty in the physical, mathematical, engineering, biological, behavioral, and social sciences relevant to network science; as well as created tools that allowed the design and synthesis of networks to obtain desired properties and to increase the level of rigor and mathematical structure in network science. ***FY 2011 Plans:*** The Center is abstracting common concepts across fields, performing evaluations and measurements of network structure, to allow enhancement of the robustness and security of networks; advancing scientific and technological knowledge needed to support NCO and contributing to the tactics, techniques and procedures using the existing USMA knowledge of current and emerging Army doctrine, world geo-political circumstances, and the Army as an organization. ***FY 2012 Plans:***	0.958	0.987	0.985

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H59: *UNIV CENTERS OF EXCEL*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Greater emphasis will be placed on studying emerging markets and the role they play in the economic development of a country; will research biological networks to understand the impact of environmental contaminants on genetic and metabolomic circuits in the human body.			
Accomplishments/Planned Programs Subtotals	5.345	5.580	6.356

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H62: *Institude for Advanced Technology (IAT)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H62: *Institude for Advanced Technology (IAT)*	6.184	5.506	1.423	-	1.423	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds a University Affiliated Research Center (UARC), the Institute for Advanced Technology (IAT) at the University of Texas, to conduct basic research in electromechanics and hypervelocity physics in support of electromagnetic (EM) guns. Of particular interest are EM power, EM launchers, EM integrated launch packages, and hypervelocity terminal ballistics. Advanced computational models are devised and/or applied to solve complex problems in each of these areas. In keeping with the Army EM Armaments Program strategy, highest emphasis has been placed on advancing the state-of-the-art in pulsed power. The sponsored research provides the scientific underpinning for EM gun pulsed power including switching; addresses technical barriers associated with EM gun launcher life; and researches advanced technologies for hypervelocity target defeat. The sum of these focused efforts serves as a catalyst for technological innovation and provides crucial support to the Army technology base for advanced weapon systems development with applications for anti-armor, artillery, air defense, and the future force.

In January 2012, the UARC contract with IAT is scheduled to end. New efforts beginning in FY12 will be conducted via competitive solicitation and performed under PE 0601104/Project VS2, Center for Advanced Research.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is monitored and guided by the Army Research Laboratory (ARL) in Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Pulsed Power	2.832	2.683	-
Description: This effort investigates advanced pulsed power concepts. ***FY 2010 Accomplishments:*** Analyzed methods to increase energy density of pulsed alternators; and evaluated the design options for moderate-sized advanced pulsed power system assessments of new concepts, especially including battery-inductor arrangements, for Army Electromagnetic (EM) gun applications to define their operating system characteristics. ***FY 2011 Plans:*** Analyze advanced pulsed power concepts that are reduced in size and weight and identify gaps in understanding of pulsed power research.			
Title: Launch	1.649	1.391	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H62: *Institute for Advanced Technology (IAT)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: This effort investigates rail and armature design. ***FY 2010 Accomplishments:*** Investigated techniques to increase rail life and showed higher muzzle energy railgun operation with integrated launch packages that contain realistic flight bodies; and updated theories for elevated temperature railgun operation based on experiments and simulations. ***FY 2011 Plans:*** Will incorporate FY10 investigation results into advanced rail and armature design.			
Title: Electromagnetic Lethality ***Description:*** Funding is provided for the following effort ***FY 2010 Accomplishments:*** Studied target effects of novel penetrator concepts for precision fires and other high velocity impact conditions; and studied target effects of novel penetrator concepts for precision fires and other high velocity impact conditions. ***FY 2011 Plans:*** Conduct theory critical evaluations that determine the lethality potential of novel concepts. . ***FY 2012 Plans:*** Will complete theoretical investigations of novel lethal concepts and document findings; and will finalize contract obligations.	1.703	1.432	1.423
Accomplishments/Planned Programs Subtotals	6.184	5.506	1.423

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H64: *MATERIALS CENTER*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H64: *MATERIALS CENTER*	2.726	2.869	2.920	-	2.920	2.971	3.023	3.072	3.829	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project concentrates scientific resources on materials research for lightweight vehicle protection and is executed through Cooperative Research Agreements (CRAs). The effort funds collaborative research in three Materials Science and Engineering Research Areas (MSERAs): Composite Materials Research; Advanced Metals and Ceramics Research; and Polymer Materials Research. Each MSERA pursues thematic research thrusts that address topics pertinent to lightweight vehicle protection and that are aligned with the Army's strategic materials research vision enabling long-term synergistic collaboration between the Army Research Laboratory (ARL) scientists and university researchers. The Materials Cooperative Research Agreements provide for mutual exchange of personnel and sharing of research facilities with the University of Delaware, Johns Hopkins University, Rutgers University, Drexel University, and Virginia Polytechnic Institute and State University. Lightweight, multi-functional composites, advanced armor ceramics, dynamic response of metals, protective polymer, and hybrid systems are emphasized. This project is closely coordinated with ARL in-house materials research projects (PE 0601102A, project H42) to promote effective and efficient transfer of fundamental scientific research addressing lightweight protective material requirements for the future force. The center accelerates the transition of technology to PE 0602105A (Materials Technology).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL) in Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Materials Research for vehicle protection	2.726	2.869	2.920
Description: Materials Research for vehicle protection Performs research and exploits promising breakthroughs in multi-functional composites, advanced armor ceramics, dynamic response of metals, protective polymers, and hybrid systems to enable revolutionary vehicle protection.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H64: *MATERIALS CENTER*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Examined high rate deformation mechanisms for ceramics and other advanced materials; examined the role of defects; characterized materials using advanced microscopy methods; and developed microstructure-processing relationships for severely plastically deformed materials. ***FY 2011 Plans:*** Research the relationship between microstructures of nanoscale composites and observations of high rate deformation; and examine the dynamic response of multifunctional materials systems. ***FY 2012 Plans:*** Will research the role of non-traditional deformation mechanisms in the failure and flow of potential armor materials; and will model the twinning (local intermediate plastically) behavior of non-cubic metals and ceramic materials.			
Accomplishments/Planned Programs Subtotals	2.726	2.869	2.920

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H73: *Automotive Research Center (ARC)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H73: *Automotive Research Center (ARC)*	2.831	2.947	3.994	-	3.994	4.049	4.102	4.153	4.207	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project significantly enhances the Army's transformation to the future force by the application of novel, high payoff technologies that can be integrated into Army ground platforms. The Center of Excellence for Automotive Research is part of the basic research component of the National Automotive Center (NAC), a business group within the US Army Tank-Automotive Research, Development, and Engineering Center (TARDEC). The Center of Excellence for Automotive Research is an innovative university/industry/government consortium leveraging commercial technology for potential application in Army vehicle systems through ongoing and new programs in automotive research, resulting in significant cost savings and performance enhancing technological opportunities. The research performed in this project contributes to formulating and establishing the basic scientific and engineering principles for these technologies.

Efforts are fully coordinated and complementary to those performed by the NAC and TARDEC under PE 0602601A (Combat Vehicle and Automotive Technology). Selected university partners include: University of Michigan, Virginia Tech, Wayne State University, University of Alaska, Oakland University, and Clemson University. Key industry partners include all major US automotive manufacturers and suppliers. The Automotive Research Center (ARC) formulates and evaluates advanced automotive technologies and advances state-of-the-art modeling and simulation for the Army's future ground vehicle platforms.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by TARDEC, Warren, MI.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Automotive Research Center (ARC)	2.831	2.947	3.994
Description: Funding is provided for the following effort.			
FY 2010 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H73: *Automotive Research Center (ARC)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Explored and developed mobility and propulsion models for unmanned ground vehicles; developed more detailed vehicle thermal management models for hybrid electric tactical ground vehicles; and studied the feasibility of advanced materials for reducing Army ground vehicle weight while meeting survivability needs with a focus on improved fragmentation protection models. ***FY 2011 Plans:*** Exploring advanced automotive propulsion concepts that will potentially improve the fuel economy and mobility of military ground vehicles including novel hybrid electric architectures; investigating the feasibility of advanced materials for reducing Army ground vehicle weight while meeting survivability needs; and assessing the impact of alternative diesel and jet fuels on advanced automotive and heavy-duty diesel engines combustion characteristics. ***FY 2012 Plans:*** Will research fundamental challenges synthesizing and advancing ground vehicle technologies as well as power systems to improve mobility and reliability; effort will address novel electronic architectures, alternative fuels and advanced materials for weight reduction.			
Accomplishments/Planned Programs Subtotals	2.831	2.947	3.994

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J08: *INSTITUTE FOR CREATIVE TECHNOLOGY*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
J08: *INSTITUTE FOR CREATIVE TECHNOLOGY*	7.486	7.878	8.022	-	8.022	8.167	8.310	8.944	9.838	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports simulation and training technology research at the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. The ICT was established to support Army training and readiness through research into simulation and training technology for applications such as mission rehearsal, leadership development, and distance learning. The ICT actively engages industry (multimedia, location-based simulation, interactive gaming) to exploit dual-use technology and serves as a means for the military to learn about, benefit from, and facilitate the transfer of applicable entertainment technologies into military systems. The ICT also works with creative talent from the entertainment industry to adapt concepts of story and character to increase the degree of participant immersion in synthetic environments and to improve the realism and usefulness of these experiences. In developing a true synthesis of the creativity, technology, and capability of industry and the research and development community, it is revolutionizing military training and mission rehearsal by making it more effective in terms of cost, time, range of experiences that can be trained or rehearsed, and the quality of the result. This project accomplishes this by performing basic research in modeling and simulation in accordance with the core competencies for the ICT University Affiliated Research Center (UARC).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed extramurally by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Immersive Environments	2.832	3.050	3.098
Description: Conduct basic research in immersive environments, to include virtual humans, three dimensional (3D) sound and visual media, to achieve more efficient and affordable training, modeling, and simulation solutions. Research includes investigation of techniques and methods to address the rapid development of synthetic environments that can be used for mission rehearsal, assessment, and training of military operations.			
FY 2010 Accomplishments: Developed semi-automatic environment setup and alignment system that will allow rapid setup and configuration of immersive environments.			
FY 2011 Plans: Investigate methods of interaction between multiple real and virtual humans in virtual immersive environments.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J08: *INSTITUTE FOR CREATIVE TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will investigate use of large scale 3D displays for immersive simulation and learning environments; and will complete social perception as well as reactivity studies to improve virtual human responsiveness and rapport.			
Title: Graphics and Animations ***Description:*** Research will improve computational techniques in graphics for achieving real-time photo-realistic rendering of physical and synthetic environments for training and simulations. Research into auditory aspects of immersion will provide the sound stimulus for increasing the realism for military training and simulation devices. ***FY 2010 Accomplishments:*** Investigated technologies for near-photo real, life-like characters; and investigated methods for metadata tagging of historical art assets. ***FY 2011 Plans:*** Develop tools for rapidly creating virtual characters that can be animated based on real people. ***FY 2012 Plans:*** Will investigate novel approaches for using specialized light sources to facilitate 3D modeling; and will complete the development of algorithms that provide real-time reconstruction of geometric shapes using a single photographic view of an object.	1.719	1.732	1.780
Title: Techniques and Human-virtual Human Interaction ***Description:*** Conduct basic research to investigate methods and techniques for improving the perception, communication, understanding, and responsiveness of virtual humans when interacting with live humans. ***FY 2010 Accomplishments:*** Investigated technologies for enabling virtual humans to sense a person's gestures or facial expressions; and developed new virtual human cognitive architecture to model complex human mental processes within virtual humans. ***FY 2011 Plans:*** Investigate techniques for allowing multiple real people to interact with multiple virtual humans. ***FY 2012 Plans:*** Will enhance toolkits for virtual humans to accelerate the development of virtual humans via collaborations with external organizations; and will develop statistical models of culture-specific behaviors for conversations.	2.935	3.096	3.144
Accomplishments/Planned Programs Subtotals	7.486	7.878	8.022

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J08: *INSTITUTE FOR CREATIVE TECHNOLOGY*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J12: *Institute for Soldier Nanotechnology (ISN)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
J12: *Institute for Soldier Nanotechnology (ISN)*	9.862	10.487	10.787	-	10.787	10.891	11.181	11.261	11.452	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports sustained multidisciplinary research at the Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute of Technology. The ISN emphasizes revolutionary materials research for advanced Soldier protection and survivability. The ISN works in close collaboration with the Army Research Laboratory (ARL), the Army's Natick Soldier Research, Development and Engineering Center (NSRDEC), and other Army Research Development and Engineering Command (RDECOM) elements, as well as several major industrial partners, including Raytheon and DuPont, in pursuit of its goals. The institute is designated as a University Affiliated Research Center (UARC) to support research to devise nanotechnology-based solutions for the Soldier. This project emphasizes revolutionary materials research toward an advanced uniform concept. The future uniform will integrate a wide range of functionality, including ballistic protection, responsive passive cooling and insulating, screening of chemical and biological agents, biomedical monitoring, performance enhancement, and extremities protection. The objective is to lighten the Soldier's load through system integration and multifunctional devices while increasing survivability. The new technologies will be compatible with other Soldier requirements, including Soldier performance, limited power generation, integrated sensors, communication and display technologies, weapons systems, and expected extremes of temperature, humidity, storage lifetimes, damage, and spoilage.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed extramurally by the Army Research Lab (ARL) in Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Nanomaterials	2.482	2.651	2.751
Description: Nanomaterials research efforts focus on light-weight, multifunctional nanostructured fibers and materials. ***FY 2010 Accomplishments:*** Prepared nanostructures with unique, controlled sizes and shapes for sensing light; continued development of microfluidic reactors for the synthesis of complex, engineered nanostructured quantum dots; engineered and functionalized carbon nanotubes			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J12: *Institute for Soldier Nanotechnology (ISN)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
(CNTs) to enhance ability of CNTs to generate photocurrents following absorption in the infrared and visible spectra; began development of an acoustic fiber having acoustic wave detection and modulation capabilities. ***FY 2011 Plans:*** Characterize the absorption and emission properties of nanoparticles using models and experimental tests; toward the development of photodetector arrays, design rules for optimized incorporation of quantum dots into organic and inorganic thin film structures are being developed; begin development of technology for the controlled assembly of large-scale ordered CNT arrays and develop library of new responsive thermoplastic elastomers containing attached field responsive groups for the generation of electro-actuating, chemically responsive or temperature/light responsive contractile fibers or porous fabrics. ***FY 2012 Plans:*** Will design and fabricate photoconducting and photodiode fibers with bandwidth and noise equivalent power commensurate with communication system specifications; will investigate the electrical tunability of conductive electrospun fibers establishing a clear processing-structure-property relationship for these fibers; and will examine properties of nanoparticle-containing layer-by-layer films, including films designed to be self-cleaning and with decontamination properties.			
Title: Blast Effects on Soldier ***Description:*** Blast Effects on Soldier research involves the areas of Battle Suit Medicine and Blast and Ballistic Protection. ***FY 2010 Accomplishments:*** Developed models predicting transdermal transport in skin and investigate various transport pathways and mechanisms; designed nanosized micellar structures formed as a block copolymer thin film on surfaces and interfaces for non-invasive drug delivery; tethered amplified fluorescent polymers for pre-symptomatic biosensing system via polymeric nanocoatings deposited by chemical vapor deposition; designed portable electro-microfluidic devices for real-time medical monitoring, modeling and simulation of the next-generation of 'induced charge electro-osmosis' nanoscale fluid flow regimes; designed protective material prototypes based on graphene chainmail structures. ***FY 2011 Plans:*** Synthesize controlled release films using layer-by-layer technique; use transfer printing of grapheme-carbon nanotube multilayers to build stacked, alternate laminates of grapheme chainmail structures; evaluate mechanical properties of superelastic alloys as a function of their nano-scale dimensions and at blast application rates; conduct novel nanomechanical impact loading experiments to map hydrated-tissue mechanical properties and impact penetration resistance in the absence and presence of protective materials. ***FY 2012 Plans:***	4.910	5.185	5.285

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J12: *Institute for Soldier Nanotechnology (ISN)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will investigate and model shock propagation in new polymeric materials; will examine the underlying biomechanical motion mechanisms of the P. senegalus (dinosaur eel) exoskeleton as well as the effect of curvature on the exoskeleton mechanics of this fish; will examine properties of new aluminum nanoscale crystalline alloys and develop underpinning theory for stabilizing these alloys; and will continue development of nanostructured contractile polymers to serve as new actuator material technologies.			
Title: Soldier Protection ***Description:*** Soldier Protection research efforts focus on Soldier Survivability and Protection and Nanosystems Integration. ***FY 2010 Accomplishments:*** Developed the strategy for electrical contacts for optoelectronic fibers; and evaluated virucidal coatings for activity, toxicity, and elucidation of mechanism of virucidal action; as well as demonstrated amplifying, fluorescent, chemical sensing devices with plasmon-mediated electrical transduction to produce resistivity-based chemical sensing. ***FY 2011 Plans:*** Prepare optoelectronic fiber materials with electrical contacts; extend the optical resolution limits of current chemical microscopy methods providing chemically specific mapping of surfaces with a lateral resolution of 5 nm; initiate chemical vapor deposition (iCVD) films containing sensing functionalized groups;, fabricate into various geometries and optimize for sensing sensitivities; establish approaches to enable seamless integration of multiple detection functions on the single fiber level as well as the level of fiber assembly; continue long-term development of laser-to-uniform free-space optical communication system including development of multi-material optical detector fibers, the incorporation of these fibers into a larger fabric, and the hardware/ software needed for interfacing the receiver fabric to a data acquisition system. ***FY 2012 Plans:*** Will optimize quantum dot synthesis in pursuit of new schemes and collaborations with Army partners to improve the performance of quantum detector (QD) sensors in detecting biological warfare agents; will evaluate hemorrhagic shock device and continue to develop rapid reconstitution prototype to be integrated in a spring-loaded syringe; and will characterize novel nanoscale virucidal and bactericidal coatings for equipment surface protection.	2.470	2.651	2.751
Accomplishments/Planned Programs Subtotals	9.862	10.487	10.787

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601104A: *University and Industry Research Centers*	**PROJECT** J12: *Institute for Soldier Nanotechnology (ISN)*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	21.924	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for University and Industry Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Nanotubes Optimized for Lightweight Exceptional Strength (NOLES) ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Exploited novel properties and fabrication opportunities associated with nano-based Bucky-paper technology, which includes enhancing flame retardance of polymer composites, low energy displays, and novel, low energy bimorph actuator mechanism development.	3.182	-	-
Title: Visualization for Training and Simulation in Urban Terrains ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This effort focused on refining the visualization and simulation capabilities so that they become more realistic and can be used in war game scenarios and troop training simulations.	1.193	-	-
Title: Development of Enabling Chemical Technologies for Power from Green Sources ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Explored molecular structure, assembly, and physical properties, and their impact on performance. Specific research efforts included: 1) molecular design and synthesis, 2) physical characterization of molecules and macromolecules, 3) bulk materials characterization at soft-hard interfaces, 4) device fabrication and characterization, and 5) theoretical modeling.	1.194	-	-
Title: Manufacturing and Industrial Technology Center	0.398	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Provided manufacturing and technology training that combined effective uses of technology to prepare students for success in science and technology-based professions.			
Title: Center for Nanoscale Bio-Sensors as a Defense against Biological Threats ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Created newly discovered nanoscale materials and used visualization techniques to image and manipulate them at the scale of the individual atom using the unique nanoscale ferroelectric, magnetic and quantum dot material fabrication facilities.	2.984	-	-
Title: Micro Electro Mechanical Systems (MEMS) Antenna for Wireless Communications Supporting unmanned aerial vehicles (UAVs) in the Battlefield ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This effort developed micro electro mechanical systems (MEMS) based electronically steered antenna by leveraging radio frequency MEMS switch technology currently under development by industry and government.	2.387	-	-
Title: Academic Support and Research Compliance for Knowledge Gathering ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This program established a partnership between Kansas University and the Combined Arms Center (CAC) at Fort Leavenworth, Kansas through which Kansas University offers the Army a new Master's program for Special Forces Officers.	1.990	-	-
Title: Ink-Based Desktop Electronic Material Technology ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed specialized inks that are wholly capable of fabricating electronics that would be printed on desktop printers and then incorporated into electronics, significantly resulting in improved mobility and point-of-use printing capability.	1.592	-	-
Title: Army Material Degradation	0.637	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Performed modeling and formulation studies to better understand the degradation and failure of Army coating systems.			
Title: Center for Hetero-Functional Materials ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** As conventional semiconductor manufacturing technology matures, new materials to create single-chip-devices are needed for a wide range of applications to ensure our national security. The Center combined federal funds with state funds to acquire additional research scientists, equipment, infrastructure improvements, technicians, and technical staff in the physics, chemistry, engineering and biology departments.	0.796	-	-
Title: ARL-ONAMI Center for Nanoarchitectures for Enhanced Performance ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Created early-stage technology for future Army sensing, communications, portable energy storage and generation and thermal management requirements based on breakthroughs in nanomaterials, nanostructured films and surfaces, micro-scale reaction engineering and ultra-lower power mixed signal electronics.	0.796	-	-
Title: Intelligent Network-Centric Sensor Development Program ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed improved sensors, including network sensors that would integrate imagery and other sensor information from several platforms.	1.194	-	-
Title: Materials Processing and Applications Development Center of Excellence for Industry ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:***	1.194	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Focused on rapid development and applications insertion of emerging design, materials, and manufacturing technologies to provide solution options for many important military needs.			
Title: Advanced Polymer Systems for Defense Applications - Power Generation, Protection and Sensing ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Provided materials that will potentially lead to advances in the generation and storage of power for military devices.	2.387	-	-
Accomplishments/Planned Programs Subtotals	21.924	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J14: *ECYBERMISSION*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
J14: *ECYBERMISSION*	4.086	5.330	5.426	-	5.426	-	-	-	-	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports eCYBERMISSION, a nation-wide, web-based, science, technology, engineering and mathematics (STEM) competition designed to stimulate interest and encourage continued education in these areas among middle and high school students nationwide. The project supports Army Transformation by providing a pool of technologically literate citizenry that potentially grow to become future Soldiers and civilians for the Army workforce of tomorrow.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, the Army Science and Technology Master Plan, the Department of Defense Basic Research Plan, and the President's initiative for education.

Work in this project is executed by the U. S. Army Research, Development and Engineering Command (RDECOM).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: eCYBERMISSION	4.086	5.330	5.426
Description: This effort supports a web-based science, technology, engineering and math competition for students in grades 6 through 9. ***FY 2010 Accomplishments:*** Continued to seek increased participation from existing levels and to increase geographic diversity; sustained eCYBERMISSION and implemented enhancements based on lessons learned from previous years. ***FY 2011 Plans:*** Continue to seek increased participation from existing levels and to increase geographic diversity and sustain eCYBERMISSION and implement enhancements based on lessons learned from previous years. ***FY 2012 Plans:*** Will work to increase participation from existing levels and to increase geographic diversity; will sustain eCYBERMISSION and implement enhancements based on lessons learned from previous years.			
Accomplishments/Planned Programs Subtotals	4.086	5.330	5.426

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601104A: *University and Industry Research Centers*	**PROJECT** J14: *ECYBERMISSION*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*	7.828	8.072	8.217	-	8.217	8.363	8.510	8.647	8.794	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports a competitively selected United States (US)/United Kingdom (UK) government, university, and industry consortium established to perform fundamental network and information science research in the areas of network theory, system-of-systems security, sensor processing and delivery, and distributed coalition planning and decision making. The focus is on enhancing distributed, secure, and flexible decision-making to improve coalition operations, and developing the scientific foundations for complex and dynamic networked systems-of-systems to support the complex human, social, and technical interactions anticipated in future coalition operations. The US Army Research Laboratory (ARL) and the UK Ministry of Defense (MOD) established a jointly funded and managed US and UK consortium, to be known as an International Technology Alliance (ITA) on Network and Information Sciences in FY06. The goal is fundamental science breakthroughs to enable superior coalition operations. Emphasis is on integration of multiple technical disciplines in an international arena. This program supports the future force transition path of the Transformation Campaign Plan (TCP).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed extramurally by the Army Research Laboratory (ARL) at Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Network and information science basic research for US/UK coalition operations information.	7.828	8.072	8.217
Description: Funding is provided for the following effort. ***FY 2010 Accomplishments:*** Devised efficient robust resource usage algorithms for operations without centralized control, and with inaccurate knowledge of operating conditions for enhanced network capabilities; investigated trust models to ensure distributed sensor data fusion under uncertainty; devised agent reasoning models and agent interaction models as well as algorithms to allow for effective agent support for human ad hoc teams in time stressed environments. ***FY 2011 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Establish theoretical foundations for policy specification with formal representations at various levels of abstraction. Devise mathematical models to represent mappings between events, sensor monitored information, and end-uses; optimal compression of information flows based on human cognition metrics. Design reasoning algorithms to enable the creation of agents that promote trust among teammates and manage differing levels of trust. ***FY 2012 Plans:*** Will devise mathematical models to reason about network behaviors and composite security metrics to improve the security of heterogeneous coalition networks; and will investigate efficient and effective distributed federated database techniques to fuse and aggregate data from heterogeneous networks in support of dynamic coalition operations.			
Accomplishments/Planned Programs Subtotals	7.828	8.072	8.217

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J17: *VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
J17: *VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE*	1.963	2.066	2.654	-	2.654	2.741	2.828	2.990	3.151	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project is for Vertical Lift Research Center of Excellence to 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 who can contribute to Army Transformation. Work will provide 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 Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed extramurally by the Aeroflightdynamics Directorate of the Aviation and Missile Research, Development, and Engineering Center (AMRDEC) (located at the NASA Ames Research Center, Moffett Field, CA).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Vertical Lift Research Center of Excellence	1.963	2.066	2.654
Description: Funding is provided for the following effort			
FY 2010 Accomplishments: Designed and fabricated robust wind tunnel testing system for rotating icing environment evaluations; built and evaluated active trailing edge flaps rotor configurations for reducing rotor vibrations, power, and noise; investigated the performance improvements in the tip/casing region of ducted fan systems; and evaluated health monitoring capability of hybrid carbon-fiber/carbon-nanotube epoxy composites.			
FY 2011 Plans: Develop a method to describe nonlinear propagation path of rotor noise, develop a methodology for airfoil design that accounts for unsteady aerodynamics, use validated 3-D model to explore helical gear vibration, and compute induced power for typical rotor configurations and compare with measured data. The Vertical Lift Research Center of Excellence (VLRCOE) program will be re-competed in FY2011 and new agreements will be initiated in 4th quarter FY2011.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J17: *VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will fully implement multiple new VLRCOE agreements, with substantial participation of Navy and NASA that includes experimental and analytic work toward basic research applicable to future DoD rotorcraft fleet requirements.			
Accomplishments/Planned Programs Subtotals	1.963	2.066	2.654

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*	3.705	9.752	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds the establishment of the Network Science and Technology Research Center (NSTRC). The NSTRC will be competitively awarded and managed by the Army Research Laboratory (ARL). ARL researchers, with partners at other sites, will collaborate in a virtual center environment. There will be an effort undertaken to include additional partners such as universities, industry, and other government agencies. Network Science is the study of network representations of physical, biological, and social phenomena leading to predictive models of these phenomena. As such, network science may be seen as the cornerstone for future military operations and the conduct of network-centric warfare. The mission of this center will be to strengthen the theoretical underpinnings of network science; conduct basic research on how and why biological and social (non-physical) networks function and determine their applications to military networks; to manage the activities in network science research, technology development, and network experimentation for the Army; to focus science and technology investments to enable network-centric operations and warfare; to focus applied science and technology to enable social networks important to Army operations; and to enable the development of network science applications and facilitate their transition to Army and Joint operations. Network science, technology, and evaluations encompasses all information and information exchange, visualization, collaboration, manipulation, protection, restoration, transport, services, data storage, and application layers, including the knowledge that human use of networks is a critical component. Establishment of the center will require a phased approach cable of supporting development of fundamental network theory and network technologies, and carry out the assessment of impacts upon human performance; the integration of new technologies and social networks into capabilities; and experimentation as a means to evaluate and confirm fundamental theories and predictive models and/or characterize new technologies and operational concepts while also being capable of promoting training of personnel when applicable. Unlike the Training and Doctrine Commands on-going efforts within their centers, schools, and battle-labs, the focus of the NSTRC will be to develop the framework to perform research important to the Army in the areas of modeling, simulation and evaluation of very large networks, command and control of joint/combined networked forces, impact of network structure on organizational behavior, security and information assurance of networks, swarming behavior, and managing network complexity. It will also have a significant focus on and investment in the discovery and foundational aspects of the science of networks both human engineered and biologically evolved.

Work is this project is coordinated with and complementary to the work at the United States Military Academy (USMA) Basic Research Network Science Center funded under PE 0601104/project H59. Beginning in FY12 all funds in this project will be realigned to PE 61104/project H50.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project will be primarily preformed extramurally with a small intramural effort by the Army Research Laboratory (ARL) in Adelphi, MD.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601104A: *University and Industry Research Centers*	**PROJECT** *J22: NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Network Science and Technology Research Center (NSTRC)	3.705	9.752	-
Description: Research in the broad area of network sciences technology is performed at various government agencies, industries and universities across the country and is coordinated through the Network Sciences Collaborative Technology Alliance, PE 0601104A/project H50. The future Army will have to take advantage of a multitude of new technologies to network the force and create a decisive warfighting advantage. The challenges will be to select, on the basis of their technical merit and applicability, those technologies best able to resolve identified technology shortfalls. ***FY 2010 Accomplishments:*** Developed diagnostic models and methods to advance the science of social/cognitive networks; established a synergistic framework for physics-based and human-based information fusion; and developed models of mobile ad hoc networking to define interactions and behavior among information networks. ***FY 2011 Plans:*** Study cross-domain issues to develop trust models that will support networks of humans connected through wireless mobile ad hoc networks. Study mathematical models and human/metric-driven mobility modeling to develop a better understanding of the dynamic behaviors of composite networks; investigate the ability of network science to assess, understand, analyze, measure and predict the performance of combined social, cognitive, information and communication networks.			
Accomplishments/Planned Programs Subtotals	3.705	9.752	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT VS2: *CENTER FOR ADVANCED RESEARCH*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
VS2: *CENTER FOR ADVANCED RESEARCH*	-	-	5.200	-	5.200	6.741	6.859	6.970	7.094	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

In January 2012, the University Affiliated Research Center (UARC) contract with Institute for Advanced Technology (IAT) (PE 0601104A/Project H62) is scheduled to end. In FY12, a competitive external center will be awarded to provide the Army with next generation multi-functional materials for ballistic and electronic applications and to address the extreme challenges associated with understanding and modeling materials subject to Army operational environments. This center will address the modeling and experimental challenges associated with developing multidisciplinary physics simulations across multiple length scales for materials to include: A limited ability to relate materials chemistry, structure, and defects to materials response and failure under extreme conditions; An inadequate ability to predict the roles of materials structure, processing, and properties on performance in relevant extreme environments and designs; and The lack of experimental capabilities to quantify multiscale response and failure of materials under extreme conditions. It is envisioned that once this multi-scale modeling capability is in place, it will be applied across multiple disciplines to facilitate revolutionary advances in materials for coupled environments (electromagnetic, high rate, high pressure, etc).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is monitored and guided by the Army Research Laboratory (ARL) in Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Multi-Disciplinary, Multi-Scale Materials Behavior in Extreme Environments.	-	-	5.200
Description: Research will focus on the following areas: two-way multiscale modeling for predicting performance and designing materials, investigating analytical and theoretical analyses to effectively define the interface physics across length scales; advancing experimental capabilities for verification and validation of multiscale physics; and modeling and strategies for the synthesis of high loading rate tolerant materials so that all of the latter lead to the development of a comprehensive set of metrics that define high loading rate tolerant material systems. The multi-scale modeling capability will be applied across multiple disciplines to facilitate revolutionary advances in materials for coupled environments (electromagnetic, high rate, high pressure and other extreme environments).			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT VS2: *CENTER FOR ADVANCED RESEARCH*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
An external center will be competitively awarded to establish first- generation modeling and experimental techniques for multi-scale materials modeling.			
Accomplishments/Planned Programs Subtotals	-	-	5.200

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.