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

February 2003

BUDGET ACTIVITY
1 - Basic research

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	71699	83310	84816	79750	78817	82389	84355	86227
H50	COMMS & NETWORKS COLLAB TECH ALLIANCE (CTA)	7371	7608	8205	8321	9132	9903	10144	10376
H53	ADV DIS INTR SIM RSCH	2408	2472	2563	2535	2723	2769	2836	2901
H54	ADVANCED SENSORS COLLAB TECH ALLIANCE (CTA)	5661	5891	6429	6566	7401	8192	8392	8583
H56	ADV DECISION ARCH COLLAB TECH ALLIANCE (CTA)	5616	5759	6217	6274	6766	7233	7409	7579
H59	UNIV CENTERS OF EXCEL	18525	11414	20268	16846	17100	17320	17702	18054
H62	ELECTROMECH/HYPER PHYS	7410	6716	5869	5743	6027	6251	6356	6458
H64	MATERIALS CENTER	1919	2757	2357	2449	2564	2718	2785	2847
H65	MICROELECTRONICS CTR	820	939	972	961	984	1073	1099	1124
H73	NAT AUTO CENTER	2853	5359	3038	3064	3153	3212	3289	3363
HA1	GLOBAL INFORMATION PORTAL	963	0	0	0	0	0	0	0
HA2	THERMAL FLUID DESIGN TOOL	942	0	0	0	0	0	0	0
HA3	VIRTUAL PARTS ENGINEERING RESEARCH CENTER	958	0	0	0	0	0	0	0
HA5	CENTER FOR OPTICS MANUFACTURING	1439	0	0	0	0	0	0	0
HA6	ARMOR MATERIALS DESIGN - LASER-BASED MATERIAL PROC	0	1191	0	0	0	0	0	0
HA7	DENDRIMER NANOTECHNOLOGY RESEARCH	0	3337	0	0	0	0	0	0
HA8	FERROELECTRIC MATERIALS NANOFABRICATION	0	953	0	0	0	0	0	0
HA9	JIDOKA PROJECT	0	1431	0	0	0	0	0	0
J08	INSTITUTE FOR CREATIVE TECHNOLOGY	9284	12236	12101	11345	7383	7373	7599	7816
J09	POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	5530	5739	5952	5894	5874	5857	6001	6138
J12	NANOTECHNOLOGY	0	9508	10845	9752	9710	10488	10743	10988

A. Mission Description and Budget Item Justification: This program element leverages research in the private sector through Collaborative Technology Alliances (CTA), Centers of Excellence, and the University Affiliated Research Centers. A significant portion of the work performed within this program directly supports Objective Force requirements by providing the enabling technologies which will make development of Objective Force equipment possible. CTAs are innovative alliances among government, industry and academic organizations to exploit scientific and technological breakthroughs and to transition these breakthroughs to exploratory development and applied research. CTAs have been competitively established in the areas of Advanced Sensors, Advanced Decision Architecture, Communications and Networks, Power and Energy and Robotics. This program element includes the Army's Centers of Excellence, which couple state-of-the-art research programs at academic institutions with broad-based graduate education programs to increase the supply of scientists and engineers in materials science, electronics and rotary wing technology. Also included is eCYBERMISSION, the Army national web-based competition to stimulate interest in science, math and technology in middle school students. This program element also includes the Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute of Technology. The ISN will emphasize revolutionary materials research for advanced soldier protection and survivability. A Biotechnology Center of Excellence will be established in FY03. The Army's Institute of Creative Technologies (ICT) is also included in this program element. The ICT is a partnership with academia and the entertainment industry to leverage innovative research and concepts for training and design. Examples of specific research of mutual interest to the entertainment industry and the Army are technologies for realistic immersion in synthetic environments, networked simulation, standards for interoperability, and tools for creating simulated environments. Historically Black Colleges and Universities and Minority Institution (HBCU/MI) Centers of Excellence address critical research areas for Army Transformation. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds have been provided to this program/project.

B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	73054	74855	70487	71211
Current Budget (FY 2004/2005 PB)	71699	83310	84816	79750
Total Adjustments	-1355	8455	14329	8539
Congressional program reductions		-1800		
Congressional rescissions		-1248		
Congressional increases		14376		
Reprogrammings	601	-479		
SBIR/STTR Transfer	-1956	-2394		
Adjustments to Budget Years			14329	8539

Change Summary Explanation: Funding - FY2004/ FY 2005: Funds increased to support the Robotics CTA, Biotech Center, eCYBERMISSION, and the Institute for Creative Technologies.

FY03 Congressional Adds:
Armor Materials Design – Laser-based material processing, Project HA6 ($1250); Composite Materials Center of Excellence, Project H64 ($826); Dendrimer Nanotechnology Research, Project HA7 ($3500); Institute for Creative Technologies, Project J08 ($1500); NAC University Automotive Research Coalitions, Project H73 ($2800); Ferroelectric materials nonfabrication, Project HA8 ($1000); Jidoka Project, Project HA9 ($1500).

Project with no R-2A:
Project H65 ($944)- Microelectronics Center of Excellence: This program allows the Army to leverage extensive scientific manpower and knowledge of the universities to conduct innovative research and exploit new concepts in solid state physics, electrical engineering, photonics, microelectromechanical systems (MEMS) and the use of chemical/electrochemical engineering to produce microelectronic devices to support specific Army needs.

Project HA6 ($1198)- Laser-based Material Processing. The purpose of this one year congressional add is to develop novel material and processing technologies such as friction stir welding, laser materials design and fabrication, free form rapid prototyping, and computer based simulations materials design in support of the Army's mis sile and helicopter programs. Implemented by the University of Missouri at Rolla. No additional funding is required to complete this project.

Project HA7 ($3356)- Dendrimer Nanotechnology Research. The objective of this one year Congressional Add is to focus on novel synthesis and scale-up of dendritic polymers for Army applications. No additional funding is required to complete this project.

Project HA8 ($958): Ferroelectric materials Nonfabrication. The objective of this one year Congressional Add is to explore advanced approaches for ferroelectric materials systhesis and development. No additional funding is required to complete this project.

Project HA9 ($1439): Jidoka Project. The objective of this one year Congressional Add is to research ways to maximize autonomation to improve the quality of automotive production. No additional funding is required to complete this project.

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H50**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H50	COMMS & NETWORKS COLLAB TECH ALLIANCE (CTA)	7371	7608	8205	8321	9132	9903	10144	10376

A. Mission Description and Budget Item Justification: This project supports a competitively selected university/industry consortium, the Collaborative Technology Alliance (CTA) that was formed to provide solutions for the Army's requirements for robust, survivable, and highly mobile wireless communications networks. The Objective Force has a requirement for state-of-the-art wireless mobile communications networks for command-on-the-move. The objectives include designing communications systems for survivable wireless mobile networks; providing signal processing for communications-on-the-move; secure jam-resistant communications; tactical information protection. The results of this work will significantly affect Objective Force communications/networking development efforts. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective transition path of the Transformation Campaign Plan (TCP).

No Defense Emergency Response Funds (DERF) have been provided to this program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Survivable Wireless Mobile Networks: perform research in dynamically self-configuring wireless network technologies that enables secure, scaleable, energy-efficient, and reliable communications for command-on-the move. In FY 02, investigated energy-efficient routing, transmission scheduling, and neighbor discovery protocols for directive antennas. Established formal models for routing protocols to systematize performance evaluation. In FY 03, investigate and assess routing, media access control, and auto configuration algorithms to enable energy-efficient communications for mobile networks. In FY 04, integrate self-organizing and auto configuring subnet protocols that enable persistent on-the-move communication sessions in highly mobile conditions. In FY 05, validate self-organizing and auto configuring subnet protocols that enable persistent on-the-move communication sessions in highly mobile conditions.	2583	2665	2828	2860
- Signal Processing for Communication-on-the-Move: perform research in signal processing techniques to enable reliable low-power multimedia communications among highly mobile users under adverse wireless conditions. In FY 02, investigated and assessed Multi-Input Multi-Output broadband non line of sight communications that showed major improvement in performance in noisy environment. In FY 03, investigate and assess multiple access and advanced modulation schemes that enables communications under dynamic wireless conditions. In FY 04, conduct analytical and experimental studies investigating high performance multiple access techniques and high spectral efficiency modulation schemes for communications on the move. In FY 05, conduct analytical and experimental studies validating high performance multiple access techniques and high spectral efficiency modulation schemes for communications on the move.	1842	1882	2070	2100
- Secure Jam-Resistant Communication: perform research in secure, jam-resistant, multi-user communications effective in noisy/cluttered and hostile wireless environments enabling low probability of detection/intercept. In FY 02, investigated robust coding schemes that mitigate interference and jamming that shows improved processing gain with reduced transceiver complexity. In FY 03, investigate and assess low probability of detection waveforms and interference mitigation techniques. In FY 04, conduct analytical and experimental studies investigating low probability of detection waveforms, interference mitigation techniques, and anti-jam modulation to enable survivable communications and spectrum reuse. In FY 05, conduct analytical and experimental studies validating low probability of detection waveforms, interference mitigation techniques, and anti-jam modulation to enable survivable communications and spectrum reuse.	1473	1560	1656	1675

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Tactical Information Protection: perform research in scaleable, efficient, adaptive, and secure information protection for very resource-constrained and highly mobile ad hoc networks. In FY 02, investigated novel approaches to autonomously distribute trust credentials without reliance on central authority and for self-authenticating key management where significant reductions in bandwidth and latency were shown. In FY 03, investigate and assess trust establishment, key management, and intrusion detection techniques for very resource-constrained and highly mobile ad hoc networks. In FY 04, conduct analytical and experimental studies investigating a highly efficient and noise robust security suite with distributed trust, distributed key management, and intrusion detection. In FY 05, conduct analytical and experimental studies validating a highly efficient and noise robust security suite with distributed trust, distributed key management, and intrusion detection.	1473	1501	1651	1686
Totals	7371	7608	8205	8321

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H53**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H53	ADV DIS INTR SIM RSCH	2408	2472	2563	2535	2723	2769	2836	2901

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

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Perform research into information exchange and retrieval systems that enhance information fusion on the battlefield to improve knowledge management for mobile command and control. In FY 02, designed laboratory experiments on battlefield data exchange and performed user experiments on intelligent retrieval. In FY03, evolve analytical database techniques to query different databases for pertinent information. In FY04, perform experiments on distributed databases using intelligent agent technologies; and in FY05, test information retrieval agent techniques on databases used in battlefield situations.	729	751	835	866

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Perform research, at the Army High Performance Computing Research Center (AHPCRC), that requires computationally intensive algorithms in the areas of projectile target interaction, signature modeling, and enabling technologies to include scientific visualization that supports the Objective Force transition path. In FY02, applied intelligent processing techniques in composite manufacturing, improved portability of portioning algorithms for use in the design of Army combat platforms, and analyzed principles of simulation based design to effect reductions in cost & time of fielding the Objective Force. In FY03, apply computational tools, such as data mining, to test data and extract patterns useful for the design of components and apply scalable, dynamic partitioning methods in the design of lightweight structures for the Objective Force. By FY 2004-2005, mature computational tools to influence the use of novel materials and ultra-lightweight structures in system designs for the Objective Force.	1679	1721	1728	1669
Totals	2408	2472	2563	2535

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H54**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H54	ADVANCED SENSORS COLLAB TECH ALLIANCE (CTA)	5661	5891	6429	6566	7401	8192	8392	8583

A. Mission Description and Budget Item Justification: This project supports a competitively selected industry/university consortium, the Collaborative Technology Alliance (CTA), for the purpose of leveraging world-class research relevant to the needs of the Objective Force and Army Transformation needs. This CTA links a broad range of government technology agencies and industry/academia partners with ARL. The CTA conducts innovative research focusing on three main technical areas: micro sensors, electro-optic smart sensors, and advanced radar concepts to support the Objective Force's requirement for advanced sensing technologies. The technical areas addressed under this project include overcoming technical barriers associated with: autonomous calibration and management of micro sensor networks; multidomain smart sensors (includes multispectral infrared focal plane arrays); a novel concept for ladar; multifunction radar sensors; and sensor modeling and algorithms for automatic target recognition (ATR) involving fusion of data from multiple sensors and signal processing. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective transition path of the Transformation Campaign Plan (TCP).

No Defense Emergency Response Funds (DERF) have been provided to this program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- In FY02, completed a novel algorithm for automatically detecting and tracking multiple objects in a video image. In FY03, perform microsensor research focused on sensors, algorithms, low-power signal processing, and autonomous sensor/network management for the unattended sensor network component of FCS. In FY04, evaluate 100x reduction of sensor network power budget. In FY05, complete self-calibrating sensor fields.	2258	2313	2576	2622
- Perform electro-optics research focused on infrared sensors, ladar, hyperspectral imaging, and automatic target recognition algorithms for improved situational awareness and targeting by FCS platforms. In FY02, transitioned custom-designed two-color infrared sensor array to CECOM/NVESD for the mine detection program. In FY03, quantify new material for high-performance infrared hyperspectral imager. In FY04, demonstrate and characterize separate passive infrared imager and active ladar imager. In FY05, demonstrate prototype integrated active/passive imager	1988	2075	2251	2288

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Perform radar research focused on low-cost electronically scanned antennas, integration of analog and digital components, advanced materials and device designs, and system studies to increase radar performance and reduce the detection of FCS platforms. In FY02, completed and evaluated production of prototype low-cost phase control modules for electronically scanned antennas planned for FCS platforms. In FY03, fabricate and demonstrate a prototype lens/filter array for radar beam steering. In FY04, complete electronically scanned antenna subsystem comprised of low-cost phase control modules. In FY05, prove out low-power MEMS phase shifters for electronically-scanned antennas.	1415	1503	1602	1656
Totals	5661	5891	6429	6566

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H56**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H56	ADV DECISION ARCH COLLAB TECH ALLIANCE (CTA)	5616	5759	6217	6274	6766	7233	7409	7579

A. Mission Description and Budget Item Justification: This project supports a new consortium, a competitively awarded Collaborative Technology Alliance (CTA) which began in FY2002. This CTA, which links a broad range of government technology agencies and industry/academia partners with ARL, conducts innovative research to support the Objective Force's requirement for state-of-the-art information technology applications for responsive situational awareness, distributed commander-staff-subordinate collaboration, and planning and execution monitoring in a high tempo, high stress environment. The objective of the CTA is human-centered, automated support of individual and distributed team information processing and decision-making to achieve information dominance and decision supremacy. Research is conducted in four areas: cognitive process modeling and measurement, analytical tools for collaborative planning and execution, user adaptable interfaces, and auto-adaptive information presentation. The technical barriers associated with this project are: human-computer interface in an information rich environment; display configuration; real time visualization; architecture; information presentation; and control coupling. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective transition path of the Transformation Campaign Plan (TCP). No Defense Emergency Response Funds (DERF) have been provided to this program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Modeling and measurements of cognitive processes of Army commanders and staffs (decision makers). In FY02, matured an architecture for integrating diagrammatic representation with conceptual representations to support a CDR's reasoning about events on the battlefield and enhanced a Java-based Multi-Criterial Viewer for examining trade-offs among alternative courses of action (COAs). In FY03, identify key effects on the military decision process of transitioning from plan-centric to intent-centric command and control. In FY04, devise basic architecture for allowing the actions of intelligent agents to be influenced by commander's critical information requirements and OPTEMPO. In FY05, establish guidelines for Command and Control (C2) of intelligent agents to allow the Army to perform C2 functions better and faster than our opponents in conflicts of any intensity under any conditions.	2042	2061	2281	2305
- Analytical tools for collaborative planning and execution: create tools that effectively support teams in coordinating and collaborating to achieve mission success across the spectrum of operations. In FY02 investigated Cognitive Task Analysis for Brigade and Battalion command and control. Conducted studies to understand why operators inaccurately perceive area in maps to design displays that improve decision-making. In FY03, create guidelines and tools to support collaboration and decision making in co-located and distributed teams. In FY04, evaluate cognitively based methods and procedures for improved situation awareness and team collaboration and decision making in a distributed environment. In FY05, extend this evaluation to include effective collaborations among human team members and between these teams and intelligent system aids designed to support Objective Force command and control.	1120	1186	1233	1240
- User-adaptive interfaces: explore ideas, frameworks, and technologies which assist the soldier in understanding, problem solving, planning and decision-making. In FY02, completed a new architecture to support sharing and distributing visual data across multiple displays adapting to each display's capabilities. In FY03, improve methods of displaying relevant information in different modalities. In FY04, evaluate prototype display architecture for enhancing situation awareness among co-located and distributed teams. In FY05, provide solutions for identification and fusion of information necessary to make and control decisions from generally distributed and disparate databases with varied data uncertainties.	1527	1540	1682	1692

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Auto-adaptive information presentation: investigate how to make autonomous machines team players with their human partners or supervisors in war fighting operations. In FY02, identified modifications in UAV command and control tasks so that research on team cognition provides relevant solutions to army unmanned aerial vehicles, Hunter and Shadow. In FY03, determine new forms of feedback. In FY04, evaluate cross adaptation architecture in which all agents contribute to, test and repair a common ground about intentions and assessments and future activities. In FY05, validate baseline system for improving the flexibility of FCS through dynamically reconfigurable software agent systems.	927	972	1021	1037
Totals	5616	5759	6217	6274

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H59**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H59	UNIV CENTERS OF EXCEL	18525	11414	20268	16846	17100	17320	17702	18054

A. Mission Description and Budget Item Justification: Army Centers of Excellence couple state-of-the-art research programs with broad-based graduate education programs at academic institutions with the goal of increasing the supply of scientists and engineers in Army Transformational areas. Army Centers supported within this project are the Rotorcraft Center of Excellence, a Collaborative Technology Alliance in Robotics,a Biotechnology Center of Excellence to be established in FY03, and HBCU/MI Centers of Excellence in areas of critical research for Army Transformation. This program element funds eCYBERMISSION, a web-based science, math and engineering (SME) competition designed to stimulate interest and encourage advanced education in these areas among middle school students nationwide. This project supports Army Transformation by providing research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles; by advancing perception and intelligent control research for robotics, and by raising the visiblity of the Army's commitment to America's youth and their pursuit of science and mathematics. In FY02, the Institute for Soldier Nanotechnologies at Massachusetts Institute for Technology was established, emphasizing revolutionary materials research toward advanced soldier protection and survivability capabilities. In FY03 and beyond, the nanotechnology program is funded in 61104/J12. The project also supports Army Transformation through the sponsorship of a nation-wide education competition that encourages the nation's youth to pursue advanced education and careers in Science Mathematics, and Engineering thereby providing a pool of technologically trained soldiers and civilians for the Army workforce of tomorrow. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective transition path of the Transformation Campaign Plan (TCP).

No Defense Emergency Response Funds (DERF) have been provided to this program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- eCybermission national competition to stimulate interest in SME in middle schools. In FY02 completed concept development and conducted regional Beta Test for seventh and eighth grade students. In FY03, launch eCYBERMISSION for seventh and eighth grade students nationwide. In FY04, conduct full-scale launch of competition to all middle school students across the country. In FY 05, sustain eCYBERMISSION and implement enhancements as necessary based on previous years' lessons learned.	6077	4325	4955	4915
In FY04, establish an HBCU/MI center of excellence in a transformational research area such as optimizing cognitive readiness under combat conditions, biowarfare ountermeasures, and others. Intent is to leverage as much as possible research carried out at the Army's Institute for Creative Technologies (modeling and simulation), at the Institute for Soldier Nanotechnologies (protective materials); and at the Army's biotechnology center (health and performance). In FY05, establish technology transition teams with industry, Army labs, and the Army user to rapidly transfer research results to application.	0	0	2477	2556
- Robotics Collaborative Technology Alliance: In FY02 Devised algorithms necessary to enable adaptive tactical behaviors in diverse, complex environments and accelerated image science research to develop algorithms for cluttered, highly dynamic scenes to improve real-time robotic perception. In FY04 conduct basic research in perception and control technology to permit future development of algorithms that enable unmanned systems to possess adaptable tactical behaviors. In FY05 prove initial perception and control technology and transition to semi and near autonomous robotic technology programs.	2279	0	2477	2556
- In FY03, establish an Army center for research in biotechnology to harness the enormous new opportunities that exist between the biological and non-biological sciences. In FY04 identify novel biocomputation approaches to information processing, using information content of macromolecules and their interactions, self-assembly processes for molecular manufacture of ultra-high density EMO materials. In FY05, identify photodynamic protein-based molecular memory for rapid and accurate information processing and storage, and biologically derived and biologically inspired synthesis and processing for enhanced performance materials properties.	0	4756	8423	4915

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Rotorcraft Centers of Excellence. In FY02, investigated vibration mechanisms and established reduction concepts in level and maneuvering flight. Investigated transmission design for robust diagnostics and prognostics. Established carefree maneuvering control laws for rotorcraft. Investigated deformable wake dynamics for maneuvering flight simulation. Investigated warping actuation of rotor blades by using active material. In FY03, establish semi-active damping control concepts for rotor systems. Develop innovative concepts for micro-rotorcraft or small UAV. Investigate aeromechanical stability and whirl flutter using blade-embedded elastomeric mass dampers. Conduct simulations of unsteady flow rotor interactions to predict dynamic loading in a turbulent environment. Develop passive noise reduction blade design concepts using Computational Fluid Dynamics. In FY04, investigate elastically tailored smart composite rotor blades. Investigate innovative design, and conduct fundamental analysis of micro-rotorcraft and UAVs. Develop a smart materials based actively conformable rotor airfoil. Investigate passive and semi-active reduction concepts of gearbox vibration and noise. Investigate active rotorcraft blade tip concepts for tip vortex core modifications using smart structures. In FY05, investigate limit detection and limit avoidance methods for carefree maneuvering. Develop experimental and computational analysis capabilities on rotor wakes and tip vortices.	1800	1879	1936	1904
- Established a University Affiliated Research Center to advance soldier survivability nanotechnology. Seven teams have been formed to research energy absorbing materials, mechanically active materials, devices and exoskeletons, sensors and chemical/biological agent protection, soldier medical technology, material processing and fabrication, modeling and simulation, and outreach and teaming. This program is now funded in Project J12.	8369	454	0	0
Totals	18525	11414	20268	16846

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H62**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H62	ELECTROMECH/HYPER PHYS	7410	6716	5869	5743	6027	6251	6356	6458

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

No Defense Emergency Response Funds (DERF) have been provided to this program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Research underpinning technologies for EM gun pulsed power. In FY02, conducted component trials for alternative EM pulsed power options; and investigated the utility of optically triggered switches. In FY03, validate alternative EM pulsed power options and validate advanced switch technology, including SiC and optical triggering for EM. In FY04, perform experiments to establish utility of inductive pulsed power systems and perform experiments to establish performance of high power switches. In FY05, experimentally validate improved high strength, high conductivity field coil material.	1700	1704	1710	1000

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Solve technical barriers associated with hypervelocity EM gun launch. In FY02, devised solutions for armature transition using the C-armature; evaluated candidate laboratory launcher and launch packages for further technology maturation; and proved advanced material and structural components of launcher and launch packages required for future field applications. In FY03, prove advanced integrated launch packages and muzzle shunt operation over the full range of velocities. In FY04, establish performance of non-transitioning EM launch package armatures and define improved materials to solve technical barriers to EM launch. In FY05, provide complete model of electromagnetic, structural, and thermal processes in EM launch.	2500	2165	1500	1000
- Research advanced technologies for hypervelocity target defeat. In FY02, proved robust EM gun penetration lethality against advanced targets. In FY03, prove robust EM gun novel kinetic energy penetration lethality against advanced targets. In FY04, launch a robust novel kinetic energy penetration from an EM gun. In FY05, numerically establish optimal EM novel kinetic energy penetration concept and transition to EM Gun Technology Program.	2500	2132	2109	2943
- Define integration approaches for EM gun technologies on future platforms. In FY02, devised an approach to power sharing architecture for EM guns on hybrid electric vehicles. In FY03, construct mobile power architecture experimental capability. In FY04, define key parameters relating to EM gun integration on a hybrid electric vehicle. In FY05, construct the methodology for end to end simulation of a virtual EM gun fighting vehicle.	710	715	550	800
Totals	7410	6716	5869	5743

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H64**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H64	MATERIALS CENTER	1919	2757	2357	2449	2564	2718	2785	2847

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

No Defense Emergency Response Funds (DERF) have been provided to this program/project.

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H64**

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
-In FY02, devised models of energy dissipation mechanisms in lightweight armors during ballistic impact; synthesized materials for ultra-light weight personnel extremities protection systems. Produced ceramic armor materials and devised computer techniques to model graded metal matrix composites in dynamic failure environments. In FY03, enable creation of lightweight structural and ballistic protective materials for Objective Force platforms. In FY04, devise techniques to exhibit improved electrical, optical, and power-generating properties to enable multi-functional capabilities for Objective Force platform survivability; devise theory and design criteria for generating hybrid materials and conduct experimental studies to verify models and show benefits for Objective Force Warrior applications; and devise processing of nano-scale metallics and ceramics envisioned for use in Objective Force. In FY05, devise electro-optical composite structural materials; explore practical strategies to scale-up synthesis and processing of hierarchical polymers and polymer-inorganic hybrid materials; and devise physics based models to predict the effects of microstructure on the behavior of metallic and ceramic material systems under dynamic loading conditions.	1919	1970	2357	2449
- The objective of this one year Congressional Add is to enhance the fundamental composite materials research ongoing at the University of Delaware. No additional funding is required to complete this project.	0	787	0	0
Totals	1919	2757	2357	2449

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H73**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H73	NAT AUTO CENTER	2853	5359	3038	3064	3153	3212	3289	3363

A. Mission Description and Budget Item Justification: The Center of Excellence for Automotive Research is a key element of the basic research component of the National Automotive Center (NAC), located at the U.S. Army Tank-Automotive Research, Development, and Engineering Center (TARDEC). The center is an innovative university/industry/government consortium leveraging commercial technology for potential application in Army vehicle systems through on-going and new programs in automotive research, resulting in significant cost savings while maximizing technological achievement. The goal of this PE is to significantly enhance the Army's transformation to the Objective Force by the application of advanced vehicle technologies. This goal will be accomplished through the insertion of leap ahead technologies in phased improvements over the next several decades. The research performed in this PE will contribute to formulating these leap ahead technologies. The selected university partners include: University of Michigan, University of Wisconsin, Wayne State University, University of Alaska, University of Tennessee, and Clemson University, while key industry partners include the major U.S. automotive manufacturers and suppliers.. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance.. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).
No Defense Emergency Response Funds (DERF) were provided to the program/project.

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H73**

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Automotive Research Center (ARC) - The goal of this effort is to advance state-of-the-art simulation and modeling of future Army automotive technologies, with strong emphasis on targeting the Army's FCS program. The ARC will also formulate and evaluate future advanced automotive technologies relative to future FCS vehicular platforms. In FY02: Conducted significant fundamental formulation and validation of advanced ground vehicular modeling and simulation algorithms for potential use in FCS. In FY03: Complete final validation and implementation of future FCS mobility and propulsion predictive algorithms, and initiate optimization of the overall Army ground vehicle simulation network. In FY04: Complete final optimization of the Army's overall ground vehicle simulation network and implement a mathematical framework capable of accepting modular subroutines in all generic automotive areas. Evaluate and analyze systems for intelligent remote monitoring, guidance, and control to be used for unmanned autonomous and semi-autonomous FCS ground vehicles. Integrate newly developed advanced automotive technology algorithms within the overall simulation network. FY05: Evaluate and analyze models suitable for ground vehicle design decisions relative to collision avoidance warning systems, rollover warning, active yaw control, path departure, and wireless intelligence systems.	2853	2699	3038	3064
- The purpose of this one year Congressional Add is to conduct basic research in the area of military and commercial ground vehicle modeling and simulation. The eight university consortium consists of Michigan, Wayne State, Oakland, Alaska, Iowa, Wisconsin, Clemson and Tennessee. No additional funding is required to complete this project.	0	2660	0	0
Totals	2853	5359	3038	3064

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J08**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
J08	INSTITUTE FOR CREATIVE TECHNOLOGY	9284	12236	12101	11345	7383	7373	7599	7816

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 will actively engage industry (multimedia, location-based simulation, interactive gaming) to exploit dual-use technology and will serve as a means for the military to learn about, benefit from, and facilitate the transfer of applicable entertainment technologies into military systems. The ICT will also work with creative talent from the entertainment industry in order to adapt their concepts of story and character to increasing the degree of participant immersion in synthetic environments and to improve the realism and usefulness of these experiences. Creating a true synthesis of the creativity, technology and capabilities of the industry and the R&D community will revolutionize military training and mission rehearsal by making it more effective in terms of cost, time, the types of experiences that can be trained or rehearsed, and the quality of the result. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective transition path of the Transformation Campaign Plan (TCP).

No Defense Emergency Response Funds (DERF) have been provided to this program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Conduct basic research in immersive environments to achieve more efficient and affordable training and 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 and training of military operations. In FY02, created integration techniques for using several cues in immersive environments including virtual humans, 3D sound, and visual media, and specified the architectures for several proof of concept test beds. In FY03, design the constructs for the test beds and specify the possible content media including photo-realistic structures, primary and background sound cues, and odors, and test the integration techniques and media for proper synchronization and identify shortfalls. In FY04, complete the specification of algorithms and architecture constructs for the proof of concept test beds and address computational efficiency and stability issues, develop new techniques to enhance the immersiveness of the prototypes. In FY05, investigate hardware and software solutions to timing and processing of multimodal, synchronized, queued media in synthetic environments, including blending virtual and physical objects into the mixed reality aspects of the test beds.	6023	5367	5932	6000
- Conduct basic research in the two most significant aspects of immersive environments - graphics and sound. 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. In FY02, created and refined algorithms for attaching dynamic audio objects in synthetic environments (e.g., helicopter sounds). In FY03, improve fidelity of rendering techniques for compositing real objects into virtual environments and achieve matching lighting effects including shadows and bounced light, and extend audio processing algorithms to permit two participants in a given training setting to experience proper sound cues based on their positions relative to the sound sources. In FY04, develop computationally efficient techniques for applying global illumination to synthetic objects. Extend research into second order effects of natural lighting on real persons in synthetic environments. In FY05, extend the concept of virtual loudspeakers to address multiple participants in a given mixed reality setting. Examine sound cancellation techniques to improve auditory cues in noisy environments. Combine new lighting techniques and sound algorithms to make preliminary assessment of their combined impact on immersion.	1800	1666	2634	2633

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Conduct research on intelligent avatars for virtual environments to enhance realism of interactions with trainee(s) and increase training effectiveness. In FY02 , created a novel technique for permitting arbitrary animation of synthetic characters. This provides more realistic movement of computer-generated characters used in simulations and training applications. In FY03, 1) investigate the synchronization of speech and gesture in virtual characters to address non-verbal aspects of communications, and 2) advance speech understanding and text-to-speech processing to permit human to computer interactions in noisy environments. In FY04, complete draft specification of data elements and parameters to permit synchronized verbal communications techniques for virtual characters to interact with soldiers in education and training situations. Conduct research on the impact that modeling the emotional aspects of verbal and non-verbal communications for virtual humans will have on interaction with human participants. In FY05, complete draft specification of data elements and parameters for non-verbal communications techniques. Integrate emotional models and timing constraints into the draft specification.	1461	1867	3535	2712
- The objective of this one year Congressional Add is to conduct basic research in immersive environments to achieve efficient and affordable training and modeling simulation solutions at Fort Sill. No additional funding is required to complete this project.	0	3336	0	0
Totals	9284	12236	12101	11345

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J09**

	COST (In Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
J09	POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	5530	5739	5952	5894	5874	5857	6001	6138

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

No Defense Emergency Response Funds (DERF) have been provided to this program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Research, investigation and characterization of a micro electro mechanical system (MEMS) based micro-gas turbine generator for producing electricity for the dismounted soldier for the Objective Force Warrior and beyond. In FY02, high-speed turbo operation has been achieved and the 1st generation magnetic generator has been tested. In FY03, operate the micro gas turbine using hydrogen as fuel. In FY04, design 2nd generation non-magnetic generator, turbine film cooling and test hydrocarbon-fueled turbojet.In FY05, provide the first hydrocarbon fueled turbojet.	2143	2243	2308	2304
- Research, investigation and characterization of novel fuel cells/components and logistic fuel reformation techniques for producing electricity for the dismounted soldiers for the Objective Force Warrior as well as producing electricity for vehicle prime power and accessory power for the Future Combat System. In FY02, completed the design and initial prototype of a 1 W direct methanol fuel cell system. In FY03, complete and evaluate the design of a methanol fuel processor feeding a high-temperature fuel cell. In FY04, design and test 10W steam-reformed-methanol hydrogen generator for an elevated temperature fuel cell. In FY05, the direct methanol fuel cell design will be extended to 20W; in addition, optimized processes for the conversion of logistics fuel cells to hydrogen for fuel cell and other uses will be evaluated.	1780	1835	1912	1885
- Research in support of the FCS program by reducing the size and weight of the electronic components and increasing their efficiency by replacing silicon semiconductor devices in the electronic systems and subsystems with those made from silicon carbide. In FY02 identified the breakdown voltages and currents that will have to be achieved to meet the demands in various converter circuits. In FY03 determine the benefits of replacing silicon diodes with silicon carbide diodes in DC - DC converter circuits used for electromagnetic armor and electro-thermal chemical guns, and in matrix converters for on-vehicle power conversion and conditioning. In FY04, determine the benefits of replacing silicon switches with silicon carbide switches in DC-DC converter circuits used for electromagnetic armor and electro-thermal chemical guns, and in matrix converters for on-vehicle power conversion and conditioning. In FY05, determine the benefits of replacing silicon diodes and switches with those made from silicon carbide and demonstrate this in various converter circuits.	1607	1661	1732	1705
Totals	5530	5739	5952	5894

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J12**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
J12	NANOTECHNOLOGY	0	9508	10845	9752	9710	10488	10743	10988

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

No Defense Emergency Response Funds (DERF) have been provided to this program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- In FY03, initiate research to develop mechanical behavior models of high performance fabrics to provide fundamental understanding of energy absorbing materials. - In FY04, conduct research on nano-based materials and membranes for individual climate control. - In FY05, develop innovative processes and techniques to construct high performance fabrics and multi-layered composite materials.	0	1882	2000	2000
- In FY03, devise high power, high force nanostructures polymer actuators utilizing promising properties exhibited by carbon nanotube technology. - In FY04, integrate actuators with sensors with the goal of improving upon force achieved by human muscle. - In FY05, investigate biomimetic muscle behavior with potential to provide new approaches to outperform natural systems.	0	3706	3845	4000

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- In FY03, research semi-permeable membranes for chemical and biological protection capable of being integrated into a multi-functional fabric system. - In FY04, investigate techniques and membranes for water purification/filtration. - In FY05, develop variable stiffness materials with goal of 100-fold change in stiffness for use in physiological protection (e.g. field applied splints).	0	3920	4000	3752
- In FY04, establish a media link. Transition research results of initial nanostructured materials to Army and industrial partners. - In FY05, Develop fiber fabrication techniques for materials that provide ballistic, climate, physiological, stealth and chemical biological agent protection for the individual soldier. Develop manufacturing processes for integrating multi-functional properties into textiles and materials.	0	0	1000	0
Totals	0	9508	10845	9752