Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
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 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	93.101	140.715	123.045	-	123.045	128.947	136.085	141.558	146.194	Continuing	Continuing
F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*	4.852	5.153	5.251	-	5.251	5.381	5.462	5.659	5.595	Continuing	Continuing
H04: *HBCU/MI PROGRAMS*	2.678	18.043	18.507	-	18.507	18.855	19.209	19.711	20.044	Continuing	Continuing
H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*	9.327	12.195	12.326	-	12.326	12.958	13.377	13.801	14.034	Continuing	Continuing
H09: *ROBOTICS CTA*	4.897	5.276	5.550	-	5.550	5.649	5.695	5.842	5.940	Continuing	Continuing
H50: *Network Sciences CTA*	3.172	12.888	12.968	-	12.968	14.951	15.729	16.020	16.044	Continuing	Continuing
H53: *Army High Performance Computing Research Center*	3.574	4.348	4.516	-	4.516	4.902	6.193	6.991	7.109	Continuing	Continuing
H54: *Micro-Autonomous Systems Technology (MAST) CTA*	7.763	7.932	8.127	-	8.127	8.296	8.648	9.081	8.969	Continuing	Continuing
H59: *International Tech Centers*	5.396	6.346	7.503	-	7.503	7.609	7.708	7.832	7.964	Continuing	Continuing
H62: *Institude for Advanced Technology (IAT)*	5.310	1.421	-	-	-	-	-	-	-	Continuing	Continuing
H64: *MATERIALS CENTER*	2.766	2.915	0.758	-	0.758	-	-	-	-	Continuing	Continuing
H73: *Automotive Research Center (ARC)*	2.845	3.988	4.092	-	4.092	4.195	4.197	4.251	4.321	Continuing	Continuing
J08: *INSTITUTE FOR CREATIVE TECHNOLOGIES (ICT)*	7.598	8.009	8.003	-	8.003	8.404	9.051	9.955	10.123	Continuing	Continuing
J12: *Institute for Soldier Nanotechnology (ISN)*	10.113	10.770	10.706	-	10.706	11.308	11.396	11.589	11.784	Continuing	Continuing
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	-	19.968	-	-	-	-	-	-	-	Continuing	Continuing
J14: *Army Educational Outreach Program*	3.628	5.417	9.593	-	9.593	9.738	9.864	9.935	10.038	Continuing	Continuing

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army									DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*				R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*							
J15: *NETWORK SCIENCES ITA*	7.786	8.204	4.048	-	4.048	4.125	4.242	4.321	4.601	Continuing	Continuing
J17: *VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE*	1.992	2.650	2.771	-	2.771	3.062	3.026	3.189	3.243	Continuing	Continuing
J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*	9.404	-	-	-	-	-	-	-	-	Continuing	Continuing
VS1: *CENTER FOR FLEXIBLE ELECTRONICS*	-	-	-	-	-	-	-	-	2.058	Continuing	Continuing
VS2: *Multi-scale Materials Modeling Centers*	-	5.192	8.326	-	8.326	9.514	10.163	10.851	11.240	Continuing	Continuing
VS3: *CENTER FOR QUANTUM SCIENCE RESEARCH*	-	-	-	-	-	-	2.125	2.530	3.087	Continuing	Continuing

Note

FY12 increase is a congressional add.

A. Mission Description and Budget Item Justification

This program element (PE) fosters university and industry based research to provide a scientific foundation for 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 are industry-led 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 relevant to the Army mission. CTAs have been competitively established in the areas of Micro Autonomous Systems Technology (MAST), Network Sciences, Robotics and Cognition and Neuroergonomics. COEs 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 are Army Educational Outreach Program (AEOP) and activities to stimulate interest in science, math, and technology among middle and high school students. This PE includes support for basic research at 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 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

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army	DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*

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 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 Assistant Secretary of Defense, Research and Engineering science and technology focus areas and the Army Modernization Strategy.

Work in this PE is performed 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.

B. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	98.087	120.937	118.577	-	118.577
Current President's Budget	93.101	140.715	123.045	-	123.045
Total Adjustments	-4.986	19.778	4.468	-	4.468
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	20.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.889	-			
• Adjustments to Budget Years	-	-	4.468	-	4.468
• Other Adjustments 1	-2.097	-0.222	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*	4.852	5.153	5.251	-	5.251	5.381	5.462	5.659	5.595	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project fosters research through 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.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Neurocognitive performance in operational environments	1.700	1.915	1.965

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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 2011	FY 2012	FY 2013
Description: This effort is intended to understand fundamental principles underlying Soldier neurocognitive performance in operational environments. ***FY 2011 Accomplishments:*** Explored formal models of information presentation, including multi-modal and adaptive displays as well as multisensory attentional cueing; examined interactions between information systems and physical-cognitive performance. ***FY 2012 Plans:*** 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. ***FY 2013 Plans:*** Will complete execution of large scale simulation evaluations to generate data for addressing issues of individual differences in neurocognitive performance; will transition lessons learned from evaluation of formal models in simulation assessments to inform the development of a second phase of evaluation with increased military relevance/realism.			
Title: Computational neural analysis ***Description:*** This effort advances computational approaches for the analysis and interpretation of neural functioning. ***FY 2011 Accomplishments:*** Examined how the nervous system filters large-scale, multi-dimensional data sets for decision making; identified individual differences in neural processing underlying successful and unsuccessful decision making. ***FY 2012 Plans:*** Analyze data sets generated during large-scale simulation experiments; used simulation data sets for further expansion and elaboration of models and methods for assessing predictive features involving inter- and intra-subject variability; and refined models according to assessments of the adequacy of overlap and agreement between data and observations. ***FY 2013 Plans:*** Will complete the analysis of large-scale simulations including further elaboration of models and computational methods for assessing neurocognitive performance and identifying predictive features of inter- and intra-subject variability; will design extensions of databases to enable further analysis and modeling of individual differences in neurocognitive function.	1.550	1.563	1.586
Title: Neurotechnologies	1.602	1.675	1.700

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Description: This effort provides a fundamental advancement in neurotechnologies that enhance Soldier-system interactions and performance. ***FY 2011 Accomplishments:*** Explored methods for state detection and signal processing techniques for signal integration; developed static algorithms that account for the variability in individual differences and/or environmental stressors on performance. Implemented 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:*** Refined online signal processing methods as well as expand methods for analysis of electroencephalogram (EEG) data; identified key biomechanical measures based on the inertial fatigue-monitoring sensors and investigate remote monitoring of Soldier fatigue; designed algorithms for a neuro-computer vision system for automated environmental appraisal; and developed 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. ***FY 2013 Plans:*** Will further mature and assess online signal processing methods for analysis of EEG data; will validate methods and sensor performance for remote monitoring of Soldier fatigue; will implement and evaluate algorithms for a neuro-computer vision system for automated environmental appraisal; will implement and assess user feedback / alerting system relating to saliency and attention modeling, object detection, object tracking for automation and Soldier training technology design.			
Accomplishments/Planned Programs Subtotals	4.852	5.153	5.251

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 2013 Army			DATE: February 2012
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 PROGRAMS*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H04: *HBCU/MI PROGRAMS*	2.678	18.043	18.507	-	18.507	18.855	19.209	19.711	20.044	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports basic research through the Partnership in Research Transition (PIRT) program, the Army's research initiative focused on partnerships with Historically Black Colleges and Universities and Minority Institutions (HBCU/MI), and provides support Department of Defense Historically Black Colleges and Universities and Minority Institutions (HBCU/MI) program providing support for research and collaboration with DoD facilities and personnel for research and collaboration with DoD facilities and personnel. 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. 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 the Army.

Work in this project if fully coordinated with the Office of Secretary of Defense program manager for HBCU/MI programs.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Centers of Excellence for Battlefield Capability Enhancements (BCE)	2.678	2.826	2.908
Description: In FY11, five new PIRT Centers of Excellence were established at: Hampton Univ. (Lower Atmospheric Research Using Lidar Remote Sensing); NCA&T State Univ. (Nano to Continuum Multi-Scale Modeling Techniques and Analysis for Cementitious Materials Under Dynamic Loading); Delaware State Univ. (Center for Advanced Algorithms); Howard Univ (2) Bayesian Imaging and Advanced Signal Processing for Landmine and IED Detection Using GPR and Extracting Social Meaning From Linguistic Structures in African Languages). These Centers were selected to: enhance programs and capabilities through Army-relevant, topic-focused, near-transition-ready innovative research; strengthen the capacity of the HBCUs to provide excellence in education; and to conduct research critical to the national security functions of the DoD.			
FY 2011 Accomplishments: Completed awards for five centers.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 PROGRAMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Continuing the FY11 research efforts based upon the new Centers. ***FY 2013 Plans:*** Will continue research efforts at PIRT Centers of Excellence began in FY12.			
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 is conducting a Broad Agency Announcement and solicitations and is executing funding for grants and awards following legislative and executive policy and guidance when Congress directs. ***FY 2013 Plans:*** 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.	-	15.217	15.599
Accomplishments/Planned Programs Subtotals	2.678	18.043	18.507

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*	9.327	12.195	12.326	-	12.326	12.958	13.377	13.801	14.034	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports research at the Army's Institute for Collaborative Biotechnologies (ICB), 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 was established as a University Affiliated Research Center (UARC) to support 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 Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Institute for Collaborative Biotechnologies	8.151	10.981	10.908
Description: Perform sustained multidisciplinary basic research supporting technology to provide the Army with bio-inspired materials and biomolecular sensor platforms.			
FY 2011 Accomplishments: Began development and analysis of 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; began development of optimized materials as implantable, biodegradable tissue scaffolds for eventual application to battlefield trauma; and conducted force measurements to verify a gecko-inspired reversible adhesive system.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Research efforts pursue development of mass-based assays for detecting molecular, viral and cell-based pathogens relevant to the Army; developing shell and bone-inspired passive actuators aimed toward dissipating energy targeted against buildings, barracks and bunkers; expanding use of synthetic biology for engineering novel materials and fuels; and develop first-principles molecular design rules to create honeycomb micro-trusses for fabrication into composite blast-resistant materials. ***FY 2013 Plans:*** Will investigate engineering glucosidases (enzyme class responsible for catalyzing breakdown of plant and other biomaterials into nutrients) and will assess bio- mixtures with thermally-stable cellulases for potential future applications in biofuel production; will research concepts and designs for bio-inspired energy-dispersive composites.			
Title: Neuroscience ***Description:*** Perform multidisciplinary basic research in the area of neuroscience. ***FY 2011 Accomplishments:*** Researched electroencephalogram (EEG) and functional magnetic resonance imaging (fMRI) methods to understand the neural underpinnings leading to successful perceptual discrimination; improved the characterization of neural data previously obtained from this research effort using methodologies in network dynamics, optimal control and complex systems. ***FY 2012 Plans:*** Continue the study of spatial and temporal dynamics of brain function via simultaneous fMRI-EEG neuroimaging and integrating cognitive theory and biologically constrained computational models with multimodel imaging to further develop enabling technologies that support improved methods for Soldier training; continue investigations of genetic markers that can be linked to abilities in classification learning; investigate the shared neural substrates for action simulation and intention understanding. ***FY 2013 Plans:*** Will continue studies of genetic, anatomic, and strategic differences of cognitive performance using EEG and fMRI methods to characterize individual differences of brain activity; will begin design and validation of new methods to characterize brain anatomic networks and dynamical patterns relevant to neuroimaging studies.	1.176	1.214	1.418
Accomplishments/Planned Programs Subtotals	9.327	12.195	12.326

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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 2013 Army			DATE: February 2012
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 CTA*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H09: *ROBOTICS CTA*	4.897	5.276	5.550	-	5.550	5.649	5.695	5.842	5.940	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.

Work in this projects builds fundamental knowledge for and complements the companion applied technology program, PE 0602120A, project TS2 (Robotics).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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 2011	FY 2012	FY 2013
Title: Autonomous systems	4.897	5.276	5.550
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 2011 Accomplishments: Researched expanded abilities to perceive and understand activities, consistent with complex urban environments and investigated concepts underlying the planning and coordinated response by multiple heterogeneous robots.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 CTA*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Explore 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; evaluate the learned recognition of terrain and objects with placement into context; assess situational awareness within human-robot teams; and explore methodologies for coordinated manipulation. ***FY 2013 Plans:*** Will investigate incorporation of learning into recognition of relationships between both static and dynamic elements of the environment; will explore mechanisms for common understanding between humans and machines to enable effective teaming; will examine fundamental principles and mechanics of grasping, manipulation, and ambulation.			
Accomplishments/Planned Programs Subtotals	4.897	5.276	5.550

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H50: *Network Sciences CTA*	3.172	12.888	12.968	-	12.968	14.951	15.729	16.020	16.044	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports a competitively selected university and industry consortium, the Network Sciences Collaborative Technology Alliance (NS 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, meeting the Army's needs for a state-of-the-art wireless mobile communications networks for command-on-the-move. The NS CTA performs foundational, cross-cutting research on network science leading to: a fundamental understanding of the interplay and common underlying science among social/cognitive, information, and communications networks; determination of how processes and parameters in one network affect and are affected by those in other networks; and prediction and control of the individual and composite behavior of these complex interacting networks. This research will lead to optimized human performance in network-enabled warfare and greatly enhanced speed and precision for complex military operations. 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.
Beginning in FY12, all funds from PE 61104/project J22 were realigned to this project.

Work in this project builds fundamental knowledge for and accelerates the transition of communications and networks technology to PE 0602783A (Computer and Software Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Network Sciences Collaborative Technology Alliance (NS CTA)	3.172	12.888	12.968
Description: The Network Sciences CTA focuses on four major research areas: Information Networks, Communication Networks, Social/Cognitive Networks, and Interdisciplinary Research 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 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			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
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 2011 Accomplishments:*** Designed an evaluation scheme for the verification and validation of models of trust in network supported decision making. ***FY 2012 Plans:*** Develop models of network performance that capture the complex interactions between social, cognitive, information and communication networks; Extend the initial trust model that will improve network fidelity and reliability in the tactical mobile ad hoc network (MANET) environment; develop theoretically grounded empirical models of emergence and propagation of trust and beliefs in insurgent-civilian populations and in battle command decision-making; produce experimentally-confirmed results in dynamics and stability of large-scale, dynamic, distributed, human-centric networks of information; and investigate the impacts of mobility and adversarial attacks on the dynamics of information quality delivered through mobile communication networks. ***FY 2013 Plans:*** Using human-in-the-loop and simulation-emulation experiments, along with collections of empirical data, will extend, calibrate and validate theories and models of complex interactions between social, cognitive, information and communication networks, particularly in the evolution and propagation of information, trust and beliefs in insurgent-civilian populations, as well as in battle command decision-making under the conditions of dynamics and adversarial attacks.			
Accomplishments/Planned Programs Subtotals	3.172	12.888	12.968

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H53: *Army High Performance Computing Research Center*	3.574	4.348	4.516	-	4.516	4.902	6.193	6.991	7.109	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 Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: AHPCRC	3.574	4.348	4.516
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 in such areas as combat systems survivability, and chemical and biological defense.			
FY 2011 Accomplishments: Validated lightweight fabric structure systems; implemented and evaluated new and novel programming models on heterogeneous systems; implemented computational approaches to analyze very large-scale mobile network simulation applications; implemented new multi-scale computational approaches for micro-systems design; advanced scalable algorithms for material			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
sciences, computational bio- and nano-sciences; and stimulated innovations in algorithms for new multi-core hybrid computing architectures. ***FY 2012 Plans:*** Developing 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. Investigated scalable algorithms for large-scale social networks and validate multi-scale computational approach for micro-systems design. ***FY 2013 Plans:*** Will develop reduced order modeling (ROM) concepts for underbody blast problems by developing and solving high-fidelity fully-coupled blast-structure interaction application and then developing appropriate complex mathematical formulations for accurate reduced models; will develop scalable approaches for drug delivery through non-fluidic methods for Army medical applications; validated preliminary simulations for all electron battery; will perform validation of back projection applications for battle command applications on new hybrid computing architecture; and will investigate scalable algorithms for large-scale graphene modeling software and associated validation approaches with ARL experiments.			
Accomplishments/Planned Programs Subtotals	3.574	4.348	4.516

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H54: *Micro-Autonomous Systems Technology (MAST) CTA*	7.763	7.932	8.127	-	8.127	8.296	8.648	9.081	8.969	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project fosters basic research through 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.

Work in this project complements and is fully coordinated with the Tank and Automotive Research and Development Center (RDEC) (TARDEC); the Natick Soldier RDEC (NSRDEC); and the Special Operations Command (SOCOM).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Micro Autonomous Systems Technology CTA	7.763	7.932	8.127
Description: Enhance tactical situational awareness in urban and complex terrain by enabling the autonomous operation of a collaborative ensemble of multifunctional mobile Microsystems. ***FY 2011 Accomplishments:*** Extramural partners modeled multiple robotic platform architectures; explored autonomous tactical behaviors in realistic 3-D environments, designed holistic sensing, processing, actuation architectures; and transitioned processing algorithms to the Army robotics community. Investigated contractor developed models and technologies for future implementation. Investigated methods			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
to optimize and implement microelectronics technology for navigation, communication, information processing, and sensing for micro-autonomous systems. ***FY 2012 Plans:*** Experimentally validating 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 conduct experiments on the ability of small air and ground platforms to navigate to a waypoint based on sensor input. ***FY 2013 Plans:*** Will experimentally validate the ability of small air platforms to navigate autonomously in disturbed air and develop technology to allow micro ground platforms to move over rough terrain. Will conduct experiments on the ability of small air and ground platforms to work collaboratively to enter and explore an urban structure.			
Accomplishments/Planned Programs Subtotals	7.763	7.932	8.127

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 2013 Army			DATE: February 2012
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: *International Tech Centers*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H59: *International Tech Centers*	5.396	6.346	7.503	-	7.503	7.609	7.708	7.832	7.964	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 the 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.

Work in this project related to the USMA Basic Research Center for Network Science is fully coordinated with and complementary to PE 0601104/Project H50 (Network Science CTA).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: International Technology Centers (ITC)	4.440	5.359	6.514
Description: Funding is provided for the following effort.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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: *International Tech Centers*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Continued to solicit projects and build on the success of the FTAS Program. Continued efforts to explore ITCs technology based on critical Army requirements. Eleven additional projects with technology originating from eight different countries were worked on in FY11. These projects were initiated from TIPs received and submitted by AMRDEC, ARDEC, ARL, CERDEC and TARDEC. ***FY 2012 Plans:*** Continue to solicit projects and build on the success of the FTAS Program; continue to enhance and refine technology search capabilities using feedback from customers (RDECs, PMs and labs) to focus on near and long term capabilities. ***FY 2013 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 coordination with the NS CTA. ***FY 2011 Accomplishments:*** The Center abstracted common concepts across fields, performed evaluations and measurements of network structure, to allow enhancement of the robustness and security of networks; advanced scientific and technological knowledge needed to support NCO and contributed 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:*** Greater emphasis is given on studying emerging markets and the role they play in the economic development of a country; research biological networks to understand the impact of environmental contaminants on genetic and metabolomic circuits in the human body. ***FY 2013 Plans:*** Will investigate cooperation networks and how these theoretical frameworks can improve systems and organizations; will continue to research biological networks and implement these insights towards improvement in communication and organizational networks; will study economic cascading events in order to better understand obstacles to the economic development of a country.	0.956	0.987	0.989
Accomplishments/Planned Programs Subtotals	5.396	6.346	7.503

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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: *International Tech Centers*

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H62: *Institude for Advanced Technology (IAT)*	5.310	1.421	-	-	-	-	-	-	-	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 2011	FY 2012	FY 2013
Title: Pulsed Power ***Description:*** This effort investigates advanced pulsed power concepts. ***FY 2011 Accomplishments:*** Analyzed advanced pulsed power concepts that are reduced in size and weight and identify gaps in understanding of pulsed power research.	2.566	-	-
Title: Launch ***Description:*** This effort investigates rail and armature design. ***FY 2011 Accomplishments:***	1.330	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Incorporated FY10 investigation results into advanced rail and armature design.			
Title: Electromagnetic Lethality	1.414	1.421	-
Description: Funding is provided for the following effort. ***FY 2011 Accomplishments:*** Conducted theory critical evaluations that determine the lethality potential of novel concepts. ***FY 2012 Plans:*** Complete theoretical investigations of novel lethal concepts and document findings; and will finalize contract obligations.			
Accomplishments/Planned Programs Subtotals	5.310	1.421	-

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H64: *MATERIALS CENTER*	2.766	2.915	0.758	-	0.758	-	-	-	-	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.

Work in this project builds fundamental knowledge supporting ARL in-house materials research projects (PE 0601102A, project H42) and accelerates the transition of technology to PE 0602105A (Materials Technology). In FY13, the efforts of the Materials Center scale back and the advanced materials emphasis for the Army will focus on multi-disciplinary, multi-scale materials behavior in extreme environments conducted in PE 0601104A Project VS2 titled Center for Advanced Research.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Materials Research for vehicle protection	2.766	2.915	0.758
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 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Researched the relationship between microstructures of nanoscale composites and observations of high rate deformation; and examined the dynamic response of multifunctional materials systems. ***FY 2012 Plans:*** Investigating the role of non-traditional deformation mechanisms in the failure and flow of potential armor materials; and modeled the twinning (local intermediate plastically) behavior of non-cubic metals and ceramic materials. ***FY 2013 Plans:*** Will finalize mechanism-based multi-scale approach to microstructure design for dynamic applications; and will develop understanding of size effects in magnesium vis-à-vis etching and orientation for quantifying demonstrated enhanced mechanical properties.			
Accomplishments/Planned Programs Subtotals	2.766	2.915	0.758

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H73: *Automotive Research Center (ARC)*	2.845	3.988	4.092	-	4.092	4.195	4.197	4.251	4.321	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project fosters basic research in 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.

Work in this project complements and is fully coordinated with work 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 Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Automotive Research Center (ARC)	2.845	3.988	4.092
Description: Funding is provided for the following effort.			
FY 2011 Accomplishments: Explored advanced automotive propulsion concepts that will potentially improve the fuel economy and mobility of military ground vehicles including novel hybrid electric architectures; investigate the feasibility of advanced materials for reducing Army ground			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
vehicle weight while meeting survivability needs; and assessed the impact of alternative diesel and jet fuels on advanced automotive and heavy-duty diesel engines combustion characteristics. ***FY 2012 Plans:*** Researching fundamental challenges synthesizing and advancing ground vehicle technologies as well as power systems to improve mobility and reliability; addressing novel electronic architectures, alternative fuels and advanced materials for weight reduction. ***FY 2013 Plans:*** Will conduct research in areas that include: non-traditional off-road vehicle dynamics and controls, soldier/vehicle interaction modeling, high-performance/lightweight structures and materials, advanced alternative propulsion systems including hybrids, strategic and innovative thermal management schemes, and vehicle system optimization and design for reliability with robustness. Research will target key areas such as fuel economy, safety, system compactness, soldier/vehicle performance, cost savings, vehicle control (including autonomous vehicles), and system optimality/reliability.			
Accomplishments/Planned Programs Subtotals	2.845	3.988	4.092

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 2013 Army			DATE: February 2012
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 TECHNOLOGIES (ICT)*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
J08: *INSTITUTE FOR CREATIVE TECHNOLOGIES (ICT)*	7.598	8.009	8.003	-	8.003	8.404	9.051	9.955	10.123	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports simulation and training technology research at the Army's Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. The ICT was established as a University Affiliated Research Center (UARC) to support Army training and readiness through research into simulation and training technology for applications such as mission rehearsal, leadership development, and distance learning. The ICT 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.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Immersive Environments	2.930	3.098	3.063
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 2011 Accomplishments: Investigated methods of interaction between multiple real and virtual humans in virtual immersive environments.			
FY 2012 Plans: The use of large scale 3D displays for immersive simulation and learning environments is being investigated; and social perception as well as reactivity studies to improve virtual human responsiveness and rapport is being completed.			
FY 2013 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 TECHNOLOGIES (ICT)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will implement psychophysiology to improve the simulation fidelity of virtual immersive environments. Will continue evaluation of techniques and methods to address the rapid development of synthetic environments.			
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 provides the sound stimulus for increasing the realism for military training and simulation devices. ***FY 2011 Accomplishments:*** Developed tools for rapidly creating virtual characters that can be animated based on real people. ***FY 2012 Plans:*** Researching novel approaches for using specialized light sources to facilitate 3D modeling; develop algorithms that provide real-time reconstruction of geometric shapes using a single photographic view of an object. ***FY 2013 Plans:*** Will further research the creation of photo-real characters and environments and demonstrate these capabilities. Will develop comprehensive facial performance capture techniques, develop software for rendering multiple faces and will complete the research investigation of high-fidelity eye models for virtual characters.	1.732	1.780	1.788
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 2011 Accomplishments:*** Investigated techniques that allow multiple real people to interact with multiple virtual humans. ***FY 2012 Plans:*** Toolkits for virtual humans to accelerate the development of virtual humans via collaborations with external organizations are being enhanced; and statistical models of culture-specific behaviors for conversations are being developed. ***FY 2013 Plans:*** Will integrate virtual human system with life-like graphics, facial and body animations and develop multiple forms of learning algorithms as a part of Virtual Humans. Group behavior prediction models and algorithms will be developed to include social cognition, social perception and social reactivity models and algorithms for Virtual Humans.	2.936	3.131	3.152
Accomplishments/Planned Programs Subtotals	7.598	8.009	8.003

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 TECHNOLOGIES (ICT)*

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
J12: *Institute for Soldier Nanotechnology (ISN)*	10.113	10.770	10.706	-	10.706	11.308	11.396	11.589	11.784	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports sustained multidisciplinary research at the Army?s Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute of Technology. The ISN was established as a University Affiliated Research Center (UARC) to support research to devise nanotechnology-based solutions for the Soldier. 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. 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 Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Nanomaterials	2.551	2.748	2.705
Description: Nanomaterials research efforts focus on light-weight, multifunctional nanostructured fibers and materials.			
FY 2011 Accomplishments: Characterized the absorption and emission properties of nanoparticles using models and experimental tests; toward the development of photodetector arrays, designed rules for optimized incorporation of quantum dots into organic and inorganic thin film structures are being developed; began development of technology for the controlled assembly of large-scale ordered carbon nano-tube (CNT) arrays and develop library of new responsive thermoplastic elastomers containing attached field responsive			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
groups for the generation of electro-actuating, chemically responsive or temperature/light responsive contractile fibers or porous fabrics. ***FY 2012 Plans:*** Design and fabricate photoconducting and photodiode fibers with bandwidth and noise equivalent power commensurate with communication system specifications; investigate the electrical tunability of conductive electrospun fibers establishing a clear processing-structure-property relationship for these fibers; examining properties of nanoparticle-containing layer-by-layer films, including films designed to be self-cleaning and with decontamination properties. ***FY 2013 Plans:*** Will examine carbon nanotube/conducting polymer composite films assembled onto electrospun nanofibers to determine sensing properties; will study properties conferred by various functional group additions/modifications to polymers for potential sensing applications; will investigate the range of electrical robustness of conductive electrospun fibers for future signal communications; will investigate mechanical properties of electrospun materials.			
Title: Blast Effects on Soldier ***Description:*** Blast Effects on Soldier research involves the areas of Battle Suit Medicine and Blast and Ballistic Protection. ***FY 2011 Accomplishments:*** Synthesized controlled release films using layer-by-layer technique; used transfer printing of graphene-carbon nanotube multilayers to build stacked, alternate laminates of graphene chainmail structures; evaluated mechanical properties of superelastic alloys as a function of their nano-scale dimensions and at blast application rates; conducted 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:*** Model shock propagation in new polymeric materials; 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; examine properties of new aluminum nanoscale crystalline alloys and develop underpinning theory for stabilizing these alloys; continuing development of nanostructured contractile polymers to serve as new actuator material technologies. ***FY 2013 Plans:*** Will investigate natural armor systems to determine related mechanical behavior and penetration resistance; will explore how new biological-design concepts can be scaled to resist forces proportional to blast or ballistic impact; will assess new membranes for	5.010	5.275	5.295

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
peptide immobilization and potential as a high-throughput assay of peptide activity; will synthesize and characterize continuous shape memory alloy fibers.			
Title: Soldier Protection ***Description:*** Soldier Protection research efforts focus on Soldier Survivability and Protection and Nanosystems Integration. ***FY 2011 Accomplishments:*** Prepared 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; initiated chemical vapor deposition (iCVD) films containing sensing functionalized groups; fabricate into various geometries and optimize for sensing sensitivities; investigated new approaches to enable seamless integration of multiple detection functions on the single fiber level as well as the level of fiber assembly; continued 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:*** 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; evaluated hemorrhagic shock device and continue to develop rapid reconstitution prototype to be integrated in a spring-loaded syringe; and characterizing novel nanoscale virucidal and bactericidal coatings for equipment surface protection. ***FY 2013 Plans:*** Will investigate nanotube-based assemblies for detection of DNA and determine whether structures can be adapted to detect other chemicals and biological warfare agents; will synthesize and characterize high-quality nanoscale virucidal and bactericidal coatings of sensory polymers using photochemical grafting and other fabrication methods; will develop and characterize new fiber designs to determine structures that improve fiber sensing functionality; will functionalize surface of graphene sensing devices to confer different electrochemistries and determine changes in selectivity.	2.552	2.747	2.706
Accomplishments/Planned Programs Subtotals	10.113	10.770	10.706

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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)*

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	-	19.968	-	-	-	-	-	-	-	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 2011	FY 2012	FY 2013
Title: Historically Black Colleges and Universities (HBCU) ***Description:*** This is a Congressional Interest Item. ***FY 2012 Plans:*** Congressional increase for HBCU	-	19.968	-
Accomplishments/Planned Programs Subtotals	-	19.968	-

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 2013 Army			DATE: February 2012
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: *Army Educational Outreach Program*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
J14: *Army Educational Outreach Program*	3.628	5.417	9.593	-	9.593	9.738	9.864	9.935	10.038	Continuing	Continuing

Note

Consolidated funds from 0605803 729 and 06061104 J14 to align educational outreach program elements into a central funding line of accounting.

A. Mission Description and Budget Item Justification

This project supports science activities that encourage elementary/middle/high school and college youths to develop an interest in and pursue higher education and employment in the science, mathematics, and engineering (STEM) fields. These activities are consolidated within the Army Educational Outreach Program (AEOP) that links and networks appropriate components to derive the best synergies to present the Army to a larger pool of technical talent and to provide students with Army-unique practical experiences at Army laboratories, centers, and institutes to fill future Army Science and Technology workforce needs. AEOP increases interest and involvement of students and teachers across the nation in science, mathematics, and engineering at all proficiency levels and backgrounds to include under-represented and economically disadvantaged groups through exposure to Army sponsored research, education, competitions, internships, and practical experiences. This project enhances the national pool of science and engineering personnel that in turn supports defense industry and Army laboratory and research, development, and engineering center needs.

In FY13, activities and funds for educational outreach are consolidated here from PE 61104/J14 (eCybermission) and PE65803/729 (Youth Science Activities)

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus area, the Army Modernization Strategy, the Department of Defense STEM Educational Outreach Strategic Plan and the President's "Educate to Innovate" campaign for STEM education.

Work in this project is performed by the Research, Development, and Engineering Command (RDECOM), the Army Research Institute (ARI) for the Behavioral and Social Sciences, the Army Corps of Engineers' Engineer Research and Development Center (ERDC), Medical Research and Materiel Command (MRMC), and Space and Missile Defense Command (SMDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: eCYBERMISSION	3.628	3.628	3.628
Description: This program supports a nation-wide, web-based, science, technology, engineering and mathematics (STEM) competition for students grades 6 through 9, designed to stimulate interest and encourage continued education in these areas among middle and high school students nationwide.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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: *Army Educational Outreach Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Continued to seek increased participation from existing levels and increased geographic diversity; sustained eCYBERMISSION and implemented enhancements based on lessons learned from previous years. ***FY 2012 Plans:*** Work to increase participation from existing levels and to increase geographic diversity; Sustain CYBERMISSION and implemented enhancements based on lessons learned from previous years. ***FY 2013 Plans:*** Will work to increase participation from existing levels with a concentrated effort in underserved populations, and to increase geographic diversity; will sustain eCYBERMISSION and implement enhancements based on lessons learned from previous years.			
Title: Educational Outreach and Workforce Development ***Description:*** Beginning in FY13, funds for this effort are transferred fromPE 0605803 Project 729 to align educational outreach program elements within a single Project. ***FY 2013 Plans:*** Will continue AEOP support to reach under-represented and economically disadvantaged areas to enhance STEM education through student experiences in Army labs and academic partner institutions. Will provide direct mentorship to students to broaden their interest in and their development of STEM education	-	-	2.416
Title: Army Educational Outreach Program Cooperative Agreement ***Description:*** Youth Science Cooperative Outreach Agreement (COA) encompasses a variety of outreach activities that are part of the AEOP. This activity supports a strong partnership with government, academia and industry to address the shortfall of clearable STEM skilled talent preparing for the workforce. These activities include Army-sponsored research, education, competitions, internships and practical experiences designed to engage and guide students and teachers in Army sponsored STEM programs. The funding for this line item was consolidated from PE 0605803 Project 729. ***FY 2012 Plans:*** This funding was executed for the Army Educational Outreach program support. Effort for this will be fully rolled into 0601104 J14 from 0605803 729 in 2013. ***FY 2013 Plans:*** Will continue to increase Army lab and research center sponsorship of students and STEM education opportunities. Will provide competition incentives in STEM competitions that include scholarships, experiences and mentorships as well as expose students to DoD career opportunities. Will streamline processes, leverage funding and build educational partnerships.	-	1.789	3.211
Title: West Point Cadet Research	-	-	0.338

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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: *Army Educational Outreach Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: Beginning in FY13, funds for this effort are transferred fromPE 0605803 Project 729 to align educational outreach program elements within a single Project. ***FY 2013 Plans:*** Will conduct West Point cadet research internship program to enhance cadet training through field experience within Army research labs and centers.			
Accomplishments/Planned Programs Subtotals	3.628	5.417	9.593

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 2013 Army			DATE: February 2012
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: *NETWORK SCIENCES ITA*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
J15: *NETWORK SCIENCES ITA*	7.786	8.204	4.048	-	4.048	4.125	4.242	4.321	4.601	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports research at a competitively selected United States (US)/United Kingdom (UK) government, university, and industry consortium established to perform fundamental network and information science investigations 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 with the emphasis on integration of multiple technical disciplines in an international arena. 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 cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Network and information science basic research for US/UK coalition operations information.	7.786	8.204	4.048
Description: This research will address the fundamental science underpinning the complex information network issues that are vital to future US/UK coalition military operations and to fully exploit the joint development of emerging technologies necessary to enable coalition operations.			
FY 2011 Accomplishments: Established theoretical foundations for policy specification with formal representations at various levels of abstraction. Devised mathematical models to represent mappings between events, sensor monitored information, and end-uses; optimized compression of information flows based on human cognition metrics. Designed reasoning algorithms to enable the creation of agents that promote trust among teammates and manage differing levels of trust.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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: *NETWORK SCIENCES ITA*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Devise mathematical models to reason about network behaviors and composite security metrics to improve the security of heterogeneous coalition networks; investigate efficient and effective distributed federated database techniques to fuse and aggregate data from heterogeneous networks in support of dynamic coalition operations. ***FY 2013 Plans:*** Will develop scaling laws for hybrid networks with less restrictive assumptions regarding network homogeneity (relax the assumptions to account for variable bandwidth, network management information, etc.). Will develop techniques for the management and control of hybrid coalition networks and techniques for the security of distributed services. These efforts will contribute to the creation of novel capabilities to assist coalition Warfighters' capability to manage secure distribution of information in coalition networks, with efficiency and agility.			
Accomplishments/Planned Programs Subtotals	7.786	8.204	4.048

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
J17: *VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE*	1.992	2.650	2.771	-	2.771	3.062	3.026	3.189	3.243	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project fosters research to provide vertical lift capability and engineering expertise for the Army. The focus of the 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 Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC) (Aeroflightdynamics Directorate located at the NASA Ames Research Center, Moffett Field, CA).
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 2011	FY 2012	FY 2013
Title: Vertical Lift Research Center of Excellence	1.992	2.650	2.771
Description: Funding is provided for the following effort			
FY 2011 Accomplishments: Developed a method to describe nonlinear propagation path of rotor noise, developed a methodology for airfoil design that accounts for unsteady aerodynamics, used validated 3-D model to explore helical gear vibration, and compute induced power for typical rotor configurations and compared with measured data. The Vertical Lift Research Center of Excellence (VLRCOE) program was re-competed in FY2011 and new agreements initiated in 4th quarter FY2011.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Fully implement multiple new VLRCOE agreements, with substantial participation by Navy and NASA that includes experimental and analytic work toward basic research applicable to future DoD rotorcraft fleet requirements. ***FY 2013 Plans:*** Will implement year two of new VLRCOE agreements with Penn State University, University of Maryland, and Georgia Institute of Technology; will secure Navy and NASA funding to supplement a robust experimental and analytic basic research program in rotorcraft technologies including: Aeromechanics, Structures, Flight Dynamics and Control, Rotorcraft Design and Concepts, Vibration and Noise Control, Propulsion, Affordability, Safety and Survivability, and Naval Operations.			
Accomplishments/Planned Programs Subtotals	1.992	2.650	2.771

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 2013 Army			DATE: February 2012
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*	9.404	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project fosters basic research in Network Science. Beginning in FY12 all funds in this project were realigned to PE 61104/Project H50.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Network Science and Technology Research Center (NSTRC)	9.404	-	-
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 2011 Accomplishments:*** Studied relevant cross-domain issues and developed trust models that support networks of humans connected through wireless mobile ad hoc networks. Studied mathematical models and human/metric-driven mobility modeling to develop a better understanding of the dynamic behaviors of composite networks; investigated 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	9.404	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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 2013 Army			DATE: February 2012
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 VS1: *CENTER FOR FLEXIBLE ELECTRONICS*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
VS1: *CENTER FOR FLEXIBLE ELECTRONICS*	-	-	-	-	-	-	-	-	2.058	Continuing	Continuing

Note

No funding for this program in FY13

A. Mission Description and Budget Item Justification

No Funding for this program in FY13

B. Accomplishments/Planned Programs ($ in Millions)

N/A

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 2013 Army			DATE: February 2012
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: *Multi-scale Materials Modeling Centers*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
VS2: *Multi-scale Materials Modeling Centers*	-	5.192	8.326	-	8.326	9.514	10.163	10.851	11.240	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project supports a competitively awarded external center 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. Research 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.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Multi-Disciplinary, Multi-Scale Materials Behavior in Extreme Environments.	-	5.192	8.326
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 2013 Army		DATE: February 2012
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: *Multi-scale Materials Modeling Centers*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
An external center was competitively awarded to establish first- generation modeling and experimental techniques for multi-scale materials modeling. ***FY 2013 Plans:*** Will demonstrate real-time microstructural interrogation of materials during high-rate experiments; will identify key microstructural phenomena related to high-rate deformation, fracture, and failure at critical length and time scales; and accurately predict one or more bulk dynamic properties based upon models built up from smaller size scales in each of the four selected material systems (metallic, polymeric, ceramic, and composite).			
Accomplishments/Planned Programs Subtotals	-	5.192	8.326

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 2013 Army			DATE: February 2012
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 VS3: *CENTER FOR QUANTUM SCIENCE RESEARCH*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
VS3: *CENTER FOR QUANTUM SCIENCE RESEARCH*	-	-	-	-	-	-	2.125	2.530	3.087	Continuing	Continuing

Note

no funding for this program in FY13

A. Mission Description and Budget Item Justification

No funding for this program in FY13

B. Accomplishments/Planned Programs ($ in Millions)

N/A

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.