Exhibit R-2, PB 2011 Army **RDT&E Budget Item Justification**										**DATE:** February 2010	
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 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	121.326	115.338	98.087	0.000	98.087	99.355	109.073	111.335	113.489	0	866.090
F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*	0.000	4.954	5.030	0.000	5.030	4.761	5.195	5.321	5.347	Continuing	Continuing
H04: *HBCU/MI CENTERS - TRADOC BATTLELABS*	2.646	2.732	2.776	0.000	2.776	2.826	2.877	2.927	2.974	Continuing	Continuing
H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*	10.724	8.543	9.672	0.000	9.672	11.214	12.494	12.712	12.918	Continuing	Continuing
H09: *ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)*	4.242	4.519	5.077	0.000	5.077	4.884	5.490	5.586	5.677	Continuing	Continuing
H50: *Network Sciences CTA*	6.975	2.645	3.289	0.000	3.289	2.908	3.301	3.395	3.487	Continuing	Continuing
H53: *Army High Performance Computing Research Center*	3.386	3.426	3.706	0.000	3.706	3.955	4.467	4.847	5.319	Continuing	Continuing
H54: *Micro-Autonomous Systems Technology (MAST) CTA*	7.422	8.014	8.050	0.000	8.050	7.445	8.290	8.434	8.570	Continuing	Continuing
H56: *Adv Decision Arch Collab Tech Alliance (CTA)*	5.771	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
H59: *UNIV CENTERS OF EXCEL*	5.078	5.506	5.580	0.000	5.580	6.356	7.431	7.543	7.647	Continuing	Continuing
H62: *Institude for Advanced Technology (IAT)*	5.963	6.403	5.506	0.000	5.506	5.623	6.741	6.859	6.970	Continuing	Continuing
H64: *MATERIALS CENTER*	2.734	2.823	2.869	0.000	2.869	2.920	2.971	3.023	3.072	Continuing	Continuing
H73: *Automotive Research Center (ARC)*	2.863	2.926	2.947	0.000	2.947	2.994	3.049	3.102	3.153	Continuing	Continuing

Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification									DATE: February 2010		
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J08: *INSTITUTE FOR CREATIVE TECHNOLOGY*	7.457	7.750	7.878	0.000	7.878	8.022	8.167	8.310	8.444	Continuing	Continuing
J12: *Institute for Soldier Nanotechnology (ISN)*	9.782	10.211	10.487	0.000	10.487	10.787	10.891	11.081	11.261	Continuing	Continuing
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	24.419	25.665	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
J14: *ECYBERMISSION*	4.481	5.246	5.330	0.000	5.330	5.426	5.522	5.619	5.710	Continuing	Continuing
J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*	7.669	8.104	8.072	0.000	8.072	8.217	8.363	8.510	8.647	Continuing	Continuing
J16: *NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE*	2.902	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
J17: *VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE*	1.968	2.033	2.066	0.000	2.066	2.104	2.141	2.178	2.213	Continuing	Continuing
J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*	4.844	3.838	9.752	0.000	9.752	8.913	11.683	11.888	12.080	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) supports future force capabilities by providing research that supports enabling technologies for future force capabilities. Broadly, the work in this project falls into three categories: Collaborative Technology Alliances (CTAs), University Centers of Excellence (COE), and paradigm-shifting centers - University-Affiliated Research Centers (UARCs). The Army formed CTAs to leverage large investments by the commercial sector in basic research areas that are of great interest to the Army. CTAs involve partnerships between industry, academia, and the Army Research Laboratory (ARL) to incorporate the practicality of industry, the expansion of the boundaries of knowledge from universities, and Army scientist to shape, mature, and transition technology. CTAs have been competitively established in the areas of Micro Autonomous Systems Technology (MAST), Network Sciences, Robotics and Cognition and Neuroergonomics. This PE includes the Army's COE, which focus on expanding the frontiers of knowledge in research areas where the Army has enduring needs, such as rotorcraft, automotive, microelectronics, materials, and information sciences. COEs couple state-of-the-art research programs at academic institutions with broad-based graduate education programs to increase the supply of scientists and engineers in information sciences, materials science, electronics, automotive, and rotary wing technology. Also included is eCYBERMISSION, the Army's national web-based competition to stimulate interest in science, math, and technology among middle and high school students. This PE also includes the four Army UARCs, which have been created to exploit opportunities to advance new capabilities through a sustained long-term multidisciplinary

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effort. The Institute of Advanced Technology funds basic research in electromagnetic and hypervelocity physics. 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, focusing on enabling network centric-technologies, will broaden the Army's use of biotechnology for the development of bio-inspired materials, sensors, and information processing. The Institute for Creative Technologies is a partnership with academia and the entertainment and gaming industries to leverage innovative research and concepts for training and simulation. Examples of specific research of mutual interest to the entertainment industry and the Army are technologies for realistic immersion in synthetic environments, networked simulation, standards for interoperability, and tools for creating simulated environments. Historically Black Colleges and Universities and Minority Institution (HBCU/MI) Centers of Excellence address critical research areas for Army Transformation. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this PE is managed by: the Army Research Lab (ARL) in Adelphi, MD; the US Army Tank-Automotive Research, Development, and Engineering Center (TARDEC) in Warren, MI; the Simulation and Training Technology Center (STTC) in Orlando, FL; and the US Army Research Institute for the Behavioral and Social Sciences (ARI) in Arlington, VA.

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	130.291	96.144	99.016	0.000	99.016
Current President's Budget	121.326	115.338	98.087	0.000	98.087
Total Adjustments	-8.965	19.194	-0.929	0.000	-0.929
• Congressional General Reductions		-6.606			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		25.800			
• Congressional Directed Transfers					
• Reprogrammings	-5.342	0.000			
• SBIR/STTR Transfer	-3.623	0.000			
• Adjustments to Budget Years	0.000	0.000	-0.929	0.000	-0.929

Change Summary Explanation

FY10 Congressionally directed increases.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
F17: *NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE*	0.000	4.954	5.030	0.000	5.030	4.761	5.195	5.321	5.347	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports the Neuroergonomics Collaborative Technology Alliance (CTA), a competitively selected industry and university consortium, to leverage world-class research in support of future force and Army transformation needs. Escalating levels of complexity and uncertainty on the current and future battlefield present conditions which have never existed before now. Solution strategies and approaches must be developed or tailored. The emerging field of neuroergonomics, which seeks to understand the brain at work and to leverage that understanding to optimize system design, offers tremendous potential for providing the solutions needed to meet the needs of Army forces in the future. This CTA addresses the solution strategies and approaches needed to design systems to fully exploit investments in revolutionary technological advances in areas such as robotics, microelectronics, and computer and network information systems. These technologies present significant opportunities to enhance Army mission capabilities, but impose significant burdens on the human brain, which will ultimately limit Soldier-system effectiveness, sustainability, and survivability. The technical barriers associated with this project include: immature knowledge base to guide the neuroergonomic approach to human-system integration; inadequate capabilities to sense and extract information about brain activity in dynamic, operational environments; lack of valid measures to robustly and uniquely characterize operationally-relevant cognitive performance; lack of techniques for integrating advanced understandings of brain activity into systems designs, including real-time use of measures of cognitive behavior as system inputs and the capability to account for individual differences in maximizing Soldier-system performance. This CTA conducts an intensive and accelerated program to formulate, validate, and transition basic research findings through multi-dimensional approaches (e.g., genetics, computational modeling, neuroimaging, and performance) focused in three areas: maximal effectiveness of information transfer between the system and Soldier; identification of mental states, traits, and experiences that impact commander-level decisions; individualized, real-time measurements and analysis of cognitive processing under operationally-relevant stressors. This Neuroergonomics Collaborative Technology Alliance begins in FY10. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed by the Army Research Laboratory (ARL) in Adelphi, MD. Funding was restructured from the Advanced Decision Architecture Collaborative Technology Alliance in PE 0601104A, project H56.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	0.000	1.400	1.540	0.000	1.540

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Maximize effectiveness of information transfer between system and Soldier. In FY10, investigate perceptual-motor interactions, including those between sensory-perceptual channels and motor systems; explore the complex effects of information quality and quantity on physical and cognitive performance. In FY11, will explore models of information presentation, including multi-modal and adaptive displays; will examine the effects of information systems on physical and cognitive performance. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Identify mental states, traits, and experiences that impact commander-level decisions. In FY10, explore the neural representations of command-level decision making through identification of information representation; examine factors leading to successful or faulty decisions, including biases, heuristics, implicit versus explicit knowledge, context and stressor. In FY11, will examine how the nervous system filters large-scale, multi-dimensional data sets for decision making; will identify individual differences in neural processing underlying successful and unsuccessful decision making. *FY 2009 Accomplishments:* FY 2009	0.000	1.440	1.540	0.000	1.540

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Individualize real-time measurement and analysis of cognitive processing under operationally-relevant stressors. In FY10, identify key individual differences and stressors and investigate their impact on neural processing and cognitive performance; explore the appropriate neuro-sensing approaches for assessment in operational environments. In FY11, will explore methods for state detection and signal processing techniques for signal integration; will develop static algorithms that account for the variability in individual differences and/or environmental stressors on performance. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	1.975	1.950	0.000	1.950

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #4	0.000	0.139	0.000	0.000	0.000
Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	0.000	4.954	5.030	0.000	5.030

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H04: *HBCU/MI CENTERS - TRADOC BATTLELABS*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H04: *HBCU/MI CENTERS - TRADOC BATTLELABS*	2.646	2.732	2.776	0.000	2.776	2.826	2.877	2.927	2.974	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project transitions advances resulting from basic research to technology demonstration as rapidly as possible. Centers of Excellence have proven effective in harnessing a critical mass of university research expertise and focusing their intellectual capabilities on Army unique science and technology problems. This project takes that approach one step further by partnering the university researchers at Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) with Army Training and Doctrine Command (TRADOC) Battle Labs to gain first hand perspective of the end-user's needs. Through these centers, the Army user begins the collaboration with university researchers from the outset of the research. These Centers of Excellence will join with Army and industrial partners to accelerate the transition from research phase to actual technology demonstration. In addition, these Centers of Excellence will recruit, educate, and train outstanding students and post doctoral researchers in science and technology areas relevant to Army Transformation. This project was previously funded in PE 0601104A, project H59 (University Centers of Excellence) and is being transferred into a distinct project for visibility and management. The cited work is consistent with the Director, Defense Research and Engineering Strategic Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work on this project is performed extramurally by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.646	2.656	2.776	0.000	2.776
HBCU/MI Centers of Excellence for Battlefield Capability Enhancements (BCE): The centers are: Tuskegee University (Flexible Extremities Protection); NCA&T State University (Environmentally-stable Flexible Displays), and (Human-centric Command and Control Decision Making: predictive modeling of group situational awareness); Tennessee State University (Sensor Fusion); and Prairie View A&M University (Beyond-Line-of-Sight Lethality).In FY09, culminated the first five year BCE effort. Emphasis on transitioning technologies to advanced/applied research occurred and collaborations with TRADOC Battle Labs helped accelerate technology transitions to the battlefield to include devised enhanced protection capability of final fabric designs, delivery of deployable decision support programs for test command groups, designed and fabricated hybrid semiconductor devices on flexible substrates and evaluated their environmental stability; showed full data-fusion for large-scale					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
sensor networks; and showed protocols for wireless sensor network. In FY10, initiate the next five year BCE effort. Once new centers of Excellence for Battlefield Capability Enhancements are selected, efforts in these areas will continue in FY10 and FY11. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.000	0.076	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	2.646	2.732	2.776	0.000	2.776

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.

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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 H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H05: *INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES*	10.724	8.543	9.672	0.000	9.672	11.214	12.494	12.712	12.918	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports the Army's Institute for Collaborative Biotechnologies (ICB), a University Affiliated Research Center led by the University of California-Santa Barbara, and two major supporting partners, the California Institute of Technology and the Massachusetts Institute of Technology. The ICB is the Army's primary conduit for leveraging biotechnology for: 1) advanced sensors; 2) new electronic, magnetic, and optical materials; and 3) information processing and bioinspired network analysis. The objective is to perform sustained multidisciplinary basic research supporting technology to provide the Army with biomolecular sensor platforms with unprecedented sensitivity, reliability, and durability; higher-order arrays of functional electronic and optoelectronic components capable of self-assembly and with multi-functions; and new biological means to process, integrate, and network information. These sensor platforms will incorporate proteomics (large scale study of proteins) technology, DNA sequence identification and detection tools, and the capability for recognition of viral pathogens. A second ICB objective is to educate and train outstanding students and post doctoral researchers in revolutionary areas of science to support Army Transformation. The ICB has many industrial partners, such as IBM and SAIC, and has strong collaborations with Argonne, Lawrence Berkley, Lawrence Livermore, Los Alamos, Oak Ridge, and Sandia National Laboratories, the Army's Institute for Soldier Nanotechnologies, the Institute for Creative Technologies, and Army Medical Research and Materiel Command (MRMC) laboratories.The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed extramurally by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	7.722	7.074	8.453	0.000	8.453
Institute for Collaborative Biotechnologies In FY09, defined a biocatalytically derived route to low-cost fuel and fuel-cell feedstock using microbes to produce fuels directly from biomass including novel cellulose enzymes to break down biomass; characterized and further developed microfluidic chip-based bioseparation technology; researched new bio-inspired nanoparticles to yield optimal signal enhancement in microfluidic channel biomolecular sensors; investigated bio-templated ultra-lightweight batteries for micro-unmanned air vehicles. In FY10, translate discoveries of the mechanisms by which lightweight biological composites dissipate					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
energy and resist fracture into new approaches for blast-resistant materials and structures; develop a blood-based assay for specific markers of 9 traumatic brain injuries (TBI); develop decentralized bio-inspired algorithms for information processing and control by networks of autonomous agents in the presence of unexpected and unfriendly environments. In FY11, will devise a platform that integrates surface enhanced Raman spectroscopy technologies into a free surface fluidic explosives detection system with an open surface microchannel system featuring controlled flow velocities; will build multi-scale mathematical models that describe coral reproduction accounting for the response to global and local signals; will develop optimized materials as implantable, biodegradable tissue scaffolds for eventual application to battlefield trauma; will develop viral templates for the deposition of iridium oxide nanowire films as the catalyst for the synthesis of hydrogen for fuel cell applications. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Neuroscience: In FY09, researched the emerging area of cognitive neuroscience, examining functional magnetic resonance imaging (fMRI) techniques coupled with electroencephalogram (EEG) results designed to increase understanding of fast decision making processes, memory retrieval, categorization, aptitudes for specific tasks and other brain functions. Investigated the use of other potential brain imaging techniques such as positron emission tomography (PET) and magnetoencephalography (MEG) to enhance understanding of brain function. Studied	3.002	1.229	1.219	0.000	1.219

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
and characterized individual differences in brain strategy. Researched methods within neuroscience to provide optimal control for human/machine interfaces. In FY10, extend brain mapping to evaluate Army personnel with field experience for decision making, executive function and memory performance. Partner with the Institute for Creative Technologies (ICT) to design, develop and implement standard virtual human-agent interaction contexts and scenarios in order to create standard test-bed scenarios for determining the human interactional efficacy of virtual human agents. In FY11, will use EEG and fMRI methods to understand the neural underpinnings leading to successful perceptual discrimination. Will improve the characterization of neural data developed in this research effort using methodologies in network dynamics, optimal control and complex systems. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009	0.000	0.240	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	10.724	8.543	9.672	0.000	9.672

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H09: *ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)*	4.242	4.519	5.077	0.000	5.077	4.884	5.490	5.586	5.677	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; and understanding the interaction of humans with machines focusing upon intuitive control by Soldiers that minimizes cognitive burden. The program will conduct both analytic and validation studies. Research products will be transitioned to the companion applied technology program, PE 0602618A, project H03, for integration and evaluation in test bed platforms and will form the scientific basis for new technology that will migrate into Army and Joint advanced and system development programs to provide highly capable unmanned systems for the future force. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed by the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	4.242	4.392	5.077	0.000	5.077
Autonomous systems: 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 In FY09, focused on techniques for fusion of the key perception algorithms to enable an unmanned vehicle to maneuver with a high degree of autonomy in urban environments; examined perception based navigation, especially for indoor and GPS denied environments; explored approaches for autonomous activity recognition; evaluated the performance of both					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H09: *ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
perception and behavior algorithms in varied tactical environments. Conducted research to explore human robot interaction, dynamic scene understanding and contextual situational awareness. In FY10, expand research to include a more complete understanding of control and interaction between humans and robots through non-verbal cues and natural language; autonomous understanding and retention of salient features and activities to promote learning and adaptation to dynamic, unknown environments; and novel structural and control techniques to enable more dexterous manipulation. In FY11, will research expanded abilities to perceive and understand activities, including intent, consistent with complex urban environments and begin to investigate concepts underlying the planning and coordinated response by multiple heterogeneous robots. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009	0.000	0.127	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H09: *ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	4.242	4.519	5.077	0.000	5.077

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H50: *Network Sciences CTA*	6.975	2.645	3.289	0.000	3.289	2.908	3.301	3.395	3.487	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports a competitively selected university and industry consortium, the Communication and Networks Collaborative Technology Alliance (CTA) that was formed to leverage commercial research investments to provide solutions for the Army's requirements for robust, survivable, and highly mobile wireless communications networks. The future force has a requirement for state-of-the-art wireless mobile communications networks for command-on-the-move. The objectives include designing communications systems for survivable wireless mobile networks; providing signal processing for communications-on-the-move; secure jam-resistant communications; and tactical information protection. The CTA facilitates the exchange of people among the collaborating organizations to provide cross-organizational perspectives on basic research challenges, as well as the use of state-of -the-art facilities and equipment at the participating organizations. This CTA accelerates the transition of communications and networks technology to PE 0602783A (Computer and Software Technology). The results of this work will significantly affect future force communications and networking formulation efforts. The Communications and Networks CTA ended in FY09. In FY10, a portion of this program shifts to in-house efforts in PE 0601102A/project H48. The remainder of the program is re-focused in FY10 on the Network Sciences CTA to more strongly emphasize Information Assurance and Network Science as defined by the December 2005 National Research Council Board on Army Science and Technology study. Since the International Technology Alliance on Network and Information Sciences (PE 0601104A/project J15) was established in 2006, joint planning of the research programs prevents redundancies and leverages accomplishments from both programs.The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.717	0.000	0.000	0.000	0.000
Survivable Wireless Mobile Networks: This work performs research in dynamically self-configuring wireless network technologies that enables secure, scalable, energy-efficient, and reliable communications for command on-the-move. Devise techniques to model, design, analyze, predict, and control the performance of mobile ad hoc networks. In FY09, designed networking techniques for sensing the networking operating environment, identified the best networking functional components, and dynamically composing protocols for superior performance.					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Signal Processing for Communication-on-the-Move: This effort performs research in signal processing techniques to enable reliable low-power multimedia communications among highly mobile users under adverse wireless conditions. In FY09, designed optimal channel-adaptive distributed multiple access techniques to provide high capacity, interference-robust, multiple access networks for communications-on-the-move. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	1.600	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #3 Secure Jam-Resistant Communication: This effort performs research on secure, jam-resistant, multi-user communications effective in noisy and cluttered and hostile wireless environments enabling low probability of detection/intercept. In FY09, designed signal separation techniques to mitigate packet collisions and improved signal detection for improved network performance. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.021	0.000	0.000	0.000	0.000
Program #4 Tactical Information Protection: This work performs research in scalable, efficient, adaptive, and secure information protection for very resource-constrained and highly mobile ad hoc networks. In FY09, designed resilient clustering algorithms to provide a dynamic detection hierarchy to support detection and localization of attackers under mobile conditions.	1.637	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #5 Network Sciences Collaborative Technology Alliance (NS CTA): Beginning in FY10, this new CTA focuses on two new research areas: Information Networks and Social/Cognitive Networks; and builds upon successes of the Communications & Networks CTA for Communications Networks and Integration. The vision for the NS CTA is to develop a fundamental understanding of the ways that information, social/cognitive, and communications networks can be designed, composed, and controlled to dramatically increase mission effectiveness and ultimately enable humans to effectively exploit information for timely decision-making. Information Networks research develops the fundamental understanding of autonomous network activities and its linkage to the physical & human domains as related to human decision making within the networked command & control (C2) structure. Social/Cognitive Networks research is developing the fundamental understanding of the interplay of the various aspects of the social & cognitive networks with information & communications. Communications Networks research is developing the foundational techniques to model, analyze, predict, and control the behavior of secure tactical communication networks as an enabler for information and C2 networks. Integration is focused on achieving an integrated Information Networks, Social/Cognitive Networks, Communications Networks research program that significantly enhances the fundamental understanding of the underlying science of networks. In FY10, establish the Network Sciences CTA in support of the Network Science & Technology Research Center	0.000	2.571	3.289	0.000	3.289

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
(PE 0601104A/project J22). Research includes modeling to understand network centric organizations & develop mobile ad hoc network simulation & emulation technologies to evaluate networks in organizations. In FY11, will design evaluations for the verification & validation of models of trust in network supported decision making. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.000	0.074	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	6.975	2.645	3.289	0.000	3.289

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H53: *Army High Performance Computing Research Center*	3.386	3.426	3.706	0.000	3.706	3.955	4.467	4.847	5.319	Continuing	Continuing

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 PE 0602618A, project H03 (Robotics Technology). The project will also address research focusing on unmanned systems operating as a team with human supervisors and displaying a high degree of adaptability to dynamic environmental and tactical situations. The cited work is consistent with the Director, Defense Research and Engineering Strategic Basic Research Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed extramurally by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	3.386	3.330	3.706	0.000	3.706
AHPCRC. In FY09, implemented interdisciplinary methods to evaluate lightweight fabric structure systems; investigated computational approaches to analyze very large-scale networks for mobile network applications; explored advanced simulations to develop new materials for military vehicles and equipment, improved wireless battlefield communication, advanced the detection of chem/bio attacks and stimulate innovations in supercomputing; designed a common infrastructure model for a wide class of interdisciplinary applications; explored new scalable programming models for emerging multi-core computing architectures. In FY10, enhance lightweight fabric structure systems; enhance innovative scalable algorithms to analyze very large-scale complex mobile network simulation applications; develop new scalable multi-scale computational approaches for					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
micro-systems design, implement computational bio- and nano-science scalable algorithms. In FY11, will validate lightweight fabric structure systems, implement and evaluate new and novel programming models on heterogeneous systems; implement computational approaches to analyze very large-scale mobile network simulation applications; implement new multi-scale computational approaches for micro-systems design, advanced scalable algorithms for material sciences, computational bio- and nano-sciences; stimulate innovations in algorithms for new multi-core hybrid computing architectures. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.096	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	3.386	3.426	3.706	0.000	3.706

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H54: *Micro-Autonomous Systems Technology (MAST) CTA*	7.422	8.014	8.050	0.000	8.050	7.445	8.290	8.434	8.570	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	7.422	7.790	8.050	0.000	8.050
Micro Autonomous Systems Technology CTA. In FY09, performers investigated key technologies and techniques for autonomous navigation of microplatforms, low power and low bandwidth communication for collaborative behavior, low power sensing, low power processing, low Reynolds numbers aeromechanics, and ambulation of micro-ground platforms. Performed a capabilities analysis of microsystems and of a system of microsystems as an aid in microsystem design. Developed tools for microsystem design. In FY10, define information flow architecture for a candidate robotic platform, implement small group collaborative tactical behaviors, investigate tradeoffs in distributed processing and communications for perception and navigation, and incorporate sensing and processing into energy efficient architectures. Investigate novel concepts and develop initial models and prototypes in microelectronics for navigation, communication, information processing, and energy harvesting and sensing for micro-autonomous systems. In FY11, extramural partners will perform					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
modeling of multiple robotic platform architectures, explore autonomous tactical behaviors in realistic 3-D environments, and design holistic sensing, processing, actuation architectures, and transition processing algorithms to the Army. Will investigate contractor developed models and technologies for future implementation. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.000	0.224	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	7.422	8.014	8.050	0.000	8.050

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 H56: *Adv Decision Arch Collab Tech Alliance (CTA)*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H56: *Adv Decision Arch Collab Tech Alliance (CTA)*	5.771	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports a collaborative effort between the competitively selected industry and university consortium, the Advanced Decision Architecture (ADA) Collaborative Technology Alliance (CTA), and the Army Research Laboratory (ARL). These technologies will provide for real-time situational awareness (SA), distributed commander-staff-subordinate collaboration and planning, and execution monitoring in high-tempo, high-stress battlefield environments at speeds that permit operating inside the enemy's decision cycle. This project will conduct an intensive and accelerated program to formulate, validate, and transition basic research to provide solutions for the many requirements for understanding SA, expert decision making, team collaboration, the ability to display information in a way that facilitates knowledge assimilation on the battlefield, and visualization and decision support architectures. Research is conducted in four areas: cognitive process modeling and measurement, analytical tools for collaborative planning and execution, user adaptable interfaces, and auto-adaptive information presentation. The technical barriers associated with this project are: human-computer interface in an information rich environment; display configuration; real time visualization; information presentation; and control coupling This CTA accelerates the transition of advanced decision architecture technology to PE 0602716A (Human Factors Engineering Technology) and PE 0602783A (Computer and Software Technology). The ADA CTA ends in FY09 and this program will be re-focused to emphasize individual Soldier, squad, and platoon level tools and information and knowledge fusion. Research partnerships will be established with the Institute for Creative Technology (PE 0601104A, project J08) and the Flexible Display Center (PE 0602705A, project H17). The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed by the Army Research Laboratory (ARL) in Adelphi, MD. The Advanced Decision Architecture CTA ends in FY09 and beginning in FY10 funding will be transferred to PE 0601104A/project F17, for the Neuroergonomics CTA.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.357	0.000	0.000	0.000	0.000
Modeling and measurements of cognitive processes of Army commanders and staffs (decision makers).In FY09, validated software agent architecture for enhancing the performance of human teams using advanced artificial intelligence techniques including context-sensitive information sharing, automated development of shared situation awareness and recognition-primed decision support, a naturalistic decision making (NDM) technique					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
used by experienced decision makers to quickly scan an array of displays or information and "instantly" know the best course of action to pursue. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Analytical tools for collaborative planning and execution: Create tools that effectively support teams in coordinating and collaborating to achieve mission success across the spectrum of operations.In FY09, devised theoretical foundations and empirical findings on the design of collaborative systems to make Soldiers more effective as sensors in the Brigade and Below Battlefield Awareness Network environment and to enhance Soldier-automation collaboration. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	1.301	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 H56: *Adv Decision Arch Collab Tech Alliance (CTA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 User-adaptive interfaces: Explore ideas, frameworks, and technologies that assist the Soldier in understanding, problem solving, planning, and decision-making. In FY09, validated functional model of the capabilities of new sensor/network technologies as they could contribute to perceptual awareness including concepts such as trust. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.843	0.000	0.000	0.000	0.000
Program #4 Auto-adaptive information presentation: Investigate how to make autonomous machines team players with their human partners or supervisors in warfighting operations. In FY09, devised a distributed system for real-time target tracking of multiple entities in an area under surveillance exploiting a reasoning-based approach to include diagrammatic reasoning, domain knowledge, and algorithmic solutions.	1.270	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	5.771	0.000	0.000	0.000	0.000

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT H59: *UNIV CENTERS OF EXCEL*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H59: *UNIV CENTERS OF EXCEL*	5.078	5.506	5.580	0.000	5.580	6.356	7.431	7.543	7.647	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds the International Technology Centers (ITCs), the Foreign Technology (and Science) Assessment Support (FTAS) program, and a Basic Research Center for Network Science located at the United States Military Academy. The nine ITCs located in Australia, the United Kingdom, Canada, France, Germany, Japan, Chile, Argentina, and Singapore support the Army's goals of providing the best technology in the world to our Warfighters by leveraging the Science and Technology (S&T) investments of our international partners. The ITCs perform identification and evaluation of international technology programs to assess their potential impact on the Army's S&T investment strategy. ITC "technology finds" are submitted as technology information papers (TIPs) to various Army S&T customers including the Army Research Laboratory (ARL), the Research Development and Engineering Centers (RDECs) of the Research Development and Engineering Command (RDECOM), RDECOM technology Integrated Process Teams, the Rapid Equipping Force (REF), and others 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 an early assessment of the technology's potential contributions to the Army's S&T strategy. In FY09, this project funds a Basic Research Center in Network Science at the United States Military Academy (USMA) to further the theoretical understanding and develop the engineering design principles leading to the development of a science about networks and how they operate. Work in this project is coordinated with and complementary to the work at the Network Science and Technology Research Center funded under PE 0601104A/project J22. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed extramurally by RDECOM HQ and the Army Research Laboratory (ARL)in Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	4.077	4.391	4.593	0.000	4.593
International Technology Centers (ITC): In FY09, the ITCs improved upon execution of their international technology search process by focusing on critical technology capability gaps based upon direct face-to-face feedback with the RDECOM Commanding General and RDECOM center and lab directors. In FY09 the ITC Atlantic began design of a SharePoint tool to improve the linkage between requirements and tech search results.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
In FY10, the ITCs are working to make progress in several main areas of foreign technology identification and support to international collaboration including: unmanned systems, Counter-Improvised Explosive Devices, active protection, and power and energy and the ITC Atlantic will replicate the SharePoint tool to the other ITCs. In FY11 the ITCs will enhance and refine their technology search capabilities using feedback from their customers, i.e. RDECs, PMs and labs to focus on near and long term capabilities. FTAS Program: During FY09, two of the four FY07 FTAS projects were completed and have shown to have successfully advanced technology programs for ARL and CERDEC. In FY09 6 new projects with technology originating in 5 different countries were initiated from TIPs received. In FY10, six FY09 FTAS projects will be completed for ARL AMRDEC, ARDEC, TARDEC and CERDEC. In FY11, will continue to solicit projects and build on the success of the FTAS Program. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Basic Research Center in Network Science at the United States Military Academy (USMA): In FY09, efforts were conducted to further the theoretical understanding and develop the engineering design principles leading to the development of a science about networks. The Center made progress in several main areas of study including: dynamics, spatial location, and information propagation in networks, through better understanding	1.001	0.983	0.987	0.000	0.987

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
of the relationship between the architecture of a network and its function. Science was leveraged to develop the backbone of the Army's future fighting force with fundamental knowledge to support the Army's Basic Research Program in Network Science developed and enhance the education of the Corps of Cadets in these matters. Performed modeling and analysis of very large networks using tools, abstractions, and approximations that allow reasoning about large-scale networks, as well as techniques for modeling networks characterized by noisy and incomplete data. In FY10, contributing to and facilitating the Army transformation to network-centric operations (NCO), and promote the professional development of the United States Military Academy (USMA) faculty in the physical, mathematical, engineering, biological, behavioral, and social sciences relevant to network science. The goal is the creation of tools that allow the design and synthesis of networks to obtain desired properties, and, to increase the level of rigor and mathematical structure in network science. In FY11, the center will abstract common concepts across fields, perform evaluations and measurements of network structure, to allow enhancement of the robustness and security of networks; advance scientific and technological knowledge needed to support NCO and contribute to the tactics, techniques and procedures using the existing USMA knowledge of present/contemplated Army doctrine, world geo-political circumstances, and the Army as an organization. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3	0.000	0.132	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	5.078	5.506	5.580	0.000	5.580

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, PB 2011 Army RDT&E Project Justification									DATE: February 2010		
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 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
H62: *Institude for Advanced Technology (IAT)*	5.963	6.403	5.506	0.000	5.506	5.623	6.741	6.859	6.970	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds a University Affiliated Research Center, 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. 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 Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	**FY 2010**	**Base FY 2011**	**OCO FY 2011**	**Total FY 2011**
Program #1	2.568	2.850	2.683	0.000	2.683
Pulsed Power: In FY09, provided technology for large-scale solid state converters. In FY10, analyze methods to increase energy density of pulsed alternators. Evaluate the design options for moderate-sized advanced pulsed power system tests of new concepts, especially including battery-inductor arrangements, for Army EM gun applications to define their operating system characteristics. In FY11, will analyze advanced pulsed power concepts that are reduced in size and weight and will identify gaps in understanding of pulsed power research.					
FY 2009 Accomplishments: FY 2009					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Launch: In FY09, examined thermal management of EM launchers. In FY10, investigate techniques to increase rail life and show higher muzzle energy railgun operation with integrated launch packages that contain realistic flight bodies. Update theories for elevated temperature railgun operation based on experiments and simulations. In FY11, will incorporate FY10 investigation results into advanced rail and armature design. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.647	1.660	1.391	0.000	1.391
Program #3	1.748	1.714	1.432	0.000	1.432

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Electromagnetic Lethality. In FY09, completed and validated numerical model of armature physics including gouging and transition; examined coupled high density/reactive materials during target interaction at hypervelocity. In FY10, study target effects of novel penetrator concepts for precision fires and other high velocity impact conditions. Study target effects of novel penetrator concepts for precision fires and other high velocity impact conditions. In FY11, will initiate theory critical evaluations that determine the lethality potential of novel concepts. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.179	0.000	0.000	0.000

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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 H62: *Institude for Advanced Technology (IAT)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	5.963	6.403	5.506	0.000	5.506

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H64: *MATERIALS CENTER*	2.734	2.823	2.869	0.000	2.869	2.920	2.971	3.023	3.072	Continuing	Continuing

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): (1) Composite Materials Research; (2) Advanced Metals and Ceramics Research; and (3) Polymer Materials Research. Each MSERA pursues thematic research thrusts that address topics pertinent to lightweight vehicle protection and that are aligned with the Army's strategic materials research vision enabling long-term synergistic collaboration between the Army Research Laboratory (ARL) scientists and university researchers. The Materials Cooperative Research Agreements provide for mutual exchange of personnel and sharing of research facilities with the University of Delaware, Johns Hopkins University, Rutgers University, Drexel University, and Virginia Polytechnic Institute and State University. Lightweight, multi-functional composites, advanced armor ceramics, dynamic response of metals, protective polymer, and hybrid systems are emphasized. This project is closely coordinated with ARL in-house materials research projects (PE 0601102A, project H42) to promote effective and efficient transfer of fundamental scientific research addressing lightweight protective material requirements for the future force. The center accelerates the transition of technology to PE 0602105A (Materials Technology). The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.734	2.744	2.869	0.000	2.869
Materials Research for vehicle protection In FY09, utilized multifunctional composites to validate potential composite weight reductions; characterized and quantified performance of newly synthesized energy absorbing polymers; and validated effects of armor ceramic processing and materials selection on mechanical properties. In FY10, examine high rate deformation mechanisms for ceramics and other advanced materials; examine the role of defects; characterize materials using advanced microscopy methods; and develop microstructure-processing relationships for severely plastically deformed materials. In FY11, will research the relationship between microstructures of nanoscale composites and observations of high rate deformation; and examine the dynamic response of multifunctional materials systems.					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.079	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	2.734	2.823	2.869	0.000	2.869

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H73: *Automotive Research Center (ARC)*	2.863	2.926	2.947	0.000	2.947	2.994	3.049	3.102	3.153	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project significantly enhances the Army's transformation to the future force by the application of novel, high payoff technologies that can be integrated into Army ground platforms. The Center of Excellence for Automotive Research is part of the basic research component of the National Automotive Center (NAC), a business group within the US Army Tank-Automotive Research, Development, and Engineering Center (TARDEC). The Center of Excellence for Automotive Research is an innovative university/industry/government consortium leveraging commercial technology for potential application in Army vehicle systems through ongoing and new programs in automotive research, resulting in significant cost savings and performance enhancing technological opportunities. The research performed in this project contributes to formulating and establishing the basic scientific and engineering principles for these technologies. Efforts are fully coordinated and complementary to those performed by the NAC and TARDEC under PE 0602601A (Combat Vehicle and Automotive Technology). Selected university partners include: University of Michigan, University of Wisconsin, Wayne State University, University of Alaska, University of Tennessee, and Clemson University. Key industry partners include all major US automotive manufacturers and suppliers. The Automotive Research Center (ARC) formulates and evaluates advanced automotive technologies and advances state-of-the-art modeling and simulation for the Army's future ground vehicle platforms. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed by TARDEC, Warren, MI.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.863	2.848	2.947	0.000	2.947
Automotive Research Center (ARC): In FY09, extended the applicability of the advanced automotive models to future Army ground vehicle requirements to address elevated temperatures, increased terrain severity, ultra-reliability and general new global embedded constraints. Performed new extended model validations of these broadened areas of Army ground vehicle automotive models, using advanced instrumentation and efficient state-of-the-art data analysis procedures. In FY10, exploring and developing mobility and propulsion models for unmanned ground vehicles; developing more detailed vehicle thermal management models for hybrid electric tactical ground vehicles; and studying the feasibility of advanced materials for reducing Army ground vehicle					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
weight while meeting survivability needs with a focus on improved fragmentation protection models. In FY11, will explore advanced automotive propulsion concepts that will potentially improve the fuel economy and mobility of military ground vehicles including novel hybrid electric architectures; will investigate the feasibility of advanced materials for reducing Army ground vehicle weight while meeting survivability needs; and will assess the impact of alternative diesel and jet fuels on advanced automotive and heavy-duty diesel engines combustion characteristics. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.078	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	2.863	2.926	2.947	0.000	2.947

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.

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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
J08: *INSTITUTE FOR CREATIVE TECHNOLOGY*	7.457	7.750	7.878	0.000	7.878	8.022	8.167	8.310	8.444	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.874	2.850	3.050	0.000	3.050
Immersive Environments: 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. In FY09, investigated the use of emerging technologies, such as wide-field head mounted displays and interactive soundscapes to create immersive environments; investigated approaches for a social simulation framework comprised of multi-resolution models of groups and individuals. In FY10, develop semi-automatic environment setup and alignment system that will allow rapid setup and configuration of immersive environments. In					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY11, will investigate methods of interaction between multiple real and virtual humans in virtual immersive environments. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Graphics and Animations: Research will improve computational techniques in graphics for achieving real-time photo-realistic rendering of physical and synthetic environments for training and simulations. Research into auditory aspects of immersion will provide the sound stimulus for increasing the realism for military training and simulation devices. In FY09, explored concepts for facial and body animation controlled by avatars in real time and investigate methods for development of virtual speakers in immersive environments; investigated approaches for holographic displays. In FY10, investigate technologies for near-photo real, life-like characters; investigate methods for metadata tagging of historical art assets. In FY11, will develop tools for rapidly creating virtual characters that can be animated based on real people. *FY 2009 Accomplishments:* FY 2009	1.668	1.730	1.732	0.000	1.732

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Techniques and Human-virtual Human Interaction - Conduct basic research to investigate methods and techniques for improving the perception, communication, understanding, and responsiveness of virtual humans when interacting with live humans. In FY09, assessed adequacy of virtual human models against models of human behavior and used feedback to guide further research. Developed tools and techniques to speed creation and adaptation of virtual humans. In FY10, investigate technologies for enabling virtual humans to sense a person's gestures or facial expressions. Develop new virtual human cognitive architecture to model complex human mental processes within virtual humans. In FY11, will investigate techniques for allowing multiple real people to interact with multiple virtual humans. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	2.915	2.953	3.096	0.000	3.096

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J08: *INSTITUTE FOR CREATIVE TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #4 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.217	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	7.457	7.750	7.878	0.000	7.878

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
J12: *Institute for Soldier Nanotechnology (ISN)*	9.782	10.211	10.487	0.000	10.487	10.787	10.891	11.081	11.261	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.485	2.498	2.651	0.000	2.651
Nanomaterials: Conduct research in light-weight, multifunctional nanostructured fibers and materials. In FY09, used Monte Carlo simulation methods to optimize 2-D and 3-D structural configurations for simultaneous control of light and sound propagation and reflection; fabricated desired structures by interference lithography and tested the resulting materials for the directional dependence of energy flow. Devised mechanically robust initiated chemical vapor deposition coatings fully compatible with electro-spun mats that provided high surface area and a diversity of substrate materials. In FY10, nanostructures are being prepared with unique, controlled sizes and shapes for sensing light; development is continuing of microfluidic reactors for the synthesis of					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
complex, engineered nanostructured quantum dots; engineering and functionalization of carbon nanotubes (CNTs) to enhance ability of CNTs to generate photocurrents following absorption in the infrared and visible spectra;, development of an acoustic fiber having acoustic wave detection and modulation capabilities is also occurring. In FY11, models will be used with evaluations to characterize the absorption and emission properties of nanoparticles; toward the development of photodetector arrays, development of design rules for optimized incorporation of quantum dots into organic and inorganic thin film structures; initiate development of technology for the controlled assembly of large-scale ordered CNT arrays; a library of new responsive thermoplastic elastomers containing attached field responsive groups will be developed for the generation of electro-actuating, chemically responsive or temperature/light responsive contractile fibers or porous fabrics. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Blast Effects on Soldier: Conduct research in Battle Suit Medicine and Blast and Ballistic Protection. In FY09, explored relation of molecular structural features to resultant toughness, including high strain rate testing; development of polymeric nanostructures by synthesis of high molecular weight conducting polymers resulting in superior molecular actuation; determined critical biosensory signatures of inflammatory reaction for integration into multiplexed microfluidic sensing system; developed methodologies to quantitatively assess	4.811	4.941	5.185	0.000	5.185

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
the mechanical properties of hard nanostructured biocomposites and to measure local property gradients and heterogeneity. In FY10, develop models predicting transdermal transport in skin and investigate various transport pathways and mechanisms; designing of nanosized micellar structures formed as a block copolymer thin film on surfaces and interfaces for non-invasive drug delivery; tethering of amplified fluorescent polymers for pre-symptomatic biosensing system via polymeric nanocoatings deposited by chemical vapor deposition; portable electro-microfluidic devices for real-time medical monitoring, modeling and simulation of the next-generation of "induced charge electro-osmosis" nanoscale fluid flow regimes; flexible armor based on grapheme chainmail structures. In FY11, will synthesize controlled release films using layer-by-layer technique; use transfer printing of grapheme-carbon nanotube multilayers to build stacked, alternate laminates of grapheme chainmail structures; evaluate mechanical properties of superelastic alloys as a function of their nano-scale dimensions and at blast application rates; conduct novel nanomechanical impact loading experiments to map hydrated-tissue mechanical properties and impact penetration resistance in the absence and presence of protective materials. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Soldier Protection: Conduct research on Soldier Survivability and Protection and Nanosystems Integration.In FY09, explored chemical sensing based upon nanoelectronic building blocks; to improve the function of	2.486	2.486	2.651	0.000	2.651

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
cell-based biosensors, switchable surfaces were created to facilitate the patterned adhesion of various cell types allowing control of the spatial location of multiple cell types relative to each other; derivatization of hyperbranched poly-electrolytes designed for virucidal applications and the incorporation of these coatings onto surfaces using layer-by-layer techniques. In FY10, strategy for electrical contacts for optoelectronic fibers; testing of virucidal coatings for activity and toxicity and elucidation of mechanism of virucidal action; demonstrate amplifying fluorescent chemical sensing devices with plasmon-mediated electrical transduction to produce resistivity-based chemical sensing. In FY11, will prepare optoelectronic fiber materials with electrical contacts; extend the optical resolution limits of current chemical microscopy methods providing chemically specific mapping of surfaces with a lateral resolution of 5 nm; production of a new class of nanoscale materials whose macroscopic optical properties change in the presence of specific chemical analytes; establish approaches enabling 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 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4	0.000	0.286	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	9.782	10.211	10.487	0.000	10.487

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	24.419	25.665	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for University and Industry Initiatives.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.392	3.182	0.000	0.000	0.000
Nanotubes Optimized for Lightweight Exceptional Strength Composite Materials. In FY09 this Congressional Interest Item exploited novel properties and fabrication opportunities associated with nano-based "Bucky-paper" technology, which includes enhancing flame retardance of polymer composites, low energy displays, and novel, low energy bimorph actuator mechanism development. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	1.196	1.193	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Visualization for Training and Simulation in Urban Terrains. In FY09 this Congressional Interest Item project focused on refining the visualization and simulation capabilities so that they would be more realistic and could be used in war game scenarios and troop training simulations. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Center for Information Assurance. This Congressional Interest Item project focused on information assurance techniques for sensor networks in a tactical environment *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.797	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #4 Florida Collaborative Development of Advanced Materials for Strategic Applications. This Congressional Interest Item project utilized new nanotechnology infrastructure and recent technological nano-materials breakthroughs to enable the research and development of novel property-specific nanoscale materials. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.196	0.000	0.000	0.000	0.000
Program #5 Nanosensor Stagegate Accelerator. This Congressional Interest Item project accelerated research, development and deployment of innovative nanoscale-enabled products that support the Army's transition to a lighter, more agile and more effective force, as well as applications in the aerospace, energy and transportation sectors. *FY 2009 Accomplishments:* FY 2009	1.197	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Development of Enabling Chemical Technologies for Power from Green Sources. In FY09 this Congressional Interest Item explored molecular structure, assembly, and physical properties, and their impact on performance. Specific research efforts included: 1) molecular design and synthesis, 2) physical characterization of molecules and marcomolecules, 3) bulk materials characterization at soft-hard interfaces, 4) device fabrication and characterization, and 5) theoretical modeling. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.195	1.194	0.000	0.000	0.000
Program #7	0.797	0.398	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Manufacturing and Industrial Technology Center. In FY09 this Congressional Interest Item established an Advanced Manufacturing Training Center at Tallahassee Community College. Provided manufacturing and technology training that combined effective uses of technology to prepare students for success in science and technology-based professions. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #8 Nanoscale Biosensor Research. In FY09 this Congressional Interest Item conducted research on newly discovered nanoscale materials and used visualization techniques to image and manipulate them at the scale of the individual atom using the nanoscale ferroelectric, magnetic and quantum dot material fabrication facilities at the University of Arkansas. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	2.492	2.984	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #9 MEMS Antenna for Wireless Comms/UAVs. In FY09 this Congressional Interest Item developed Micro-Electro-Mechanical Systems (MEMS) based electronically steered antenna by leveraging Radio Frequency MEMS switch technology currently under development by industry and government. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	2.392	2.387	0.000	0.000	0.000
Program #10 Center for Education in Nanoscience and Nanotechnology. This Congressional Interest Item project provided infrastructure for undergraduate education in nano-technology at the University of Northern Iowa.	0.638	0.000	0.000	0.000	0.000

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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 J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #11 Novel Methods for Detecting and Inhibiting Corrosion. This Congressional Interest Item performed modeling and formulation studies to better understand the degradation and failure of Army coating systems. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.356	0.000	0.000	0.000	0.000
Program #12	0.797	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Center for Nanoscale Bio-Sensors as a Defense Against Biological Threats to America. This Congressional Interest Item conducted research on nanoscale materials for application as biological sensors. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #13 Academic Support and Research Compliance for Knowledge Gathering. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.994	1.990	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #14 Large Area Monitoring Network (LAMNET). This effort established a program at Western KY University, dedicated to computer network intrusion detection and an ancillary test range that allows for the deployment and testing of new technologies ensuring faster insertion into operational capabilities. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	5.980	0.000	0.000	0.000	0.000
Program #15 Ink-Based Desktop Electronic Material Technology. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.000	1.592	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #16 Army Material Degradation. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.637	0.000	0.000	0.000
Program #17 Center for Hetero-Functional Materials. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.796	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #18 ARL-ONAMI Center for Nanoarchitectures for Enhanced Performance. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.796	0.000	0.000	0.000
Program #19 High Performance Computing in Biomedical Engineering and Health Sciences. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009	0.000	1.194	0.000	0.000	0.000

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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 J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #20 Intelligent Network-Centric Sensor Development Program. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	1.194	0.000	0.000	0.000
Program #21 Materials Processing and Application Development Center of Excellence for Industry. This is a Congressional Interest Item.	0.000	1.194	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #22 Advanced Polymer Systems for Defense Applications - Power Generation, Protection and Sensing. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	2.387	0.000	0.000	0.000
Program #23	0.000	2.547	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
DoD Diabetes Research and Development Initiative (DRDI). This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	24.419	25.665	0.000	0.000	0.000

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J14: *ECYBERMISSION*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
J14: *ECYBERMISSION*	4.481	5.246	5.330	0.000	5.330	5.426	5.522	5.619	5.710	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports eCYBERMISSION, a nation-wide, web-based, science, technology, engineering and mathematics (STEM) competition designed to stimulate interest and encourage continued education in these areas among middle and high school students nationwide. The project supports Army Transformation by providing a pool of technologically literate citizenry that potentially grow to become future Soldiers and civilians for the Army workforce of tomorrow. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, the Army Science and Technology Master Plan, the Department of Defense Basic Research Plan, and the President's initiative for education. Work in this project is executed by the U. S. Army Research, Development and Engineering Command (RDECOM).

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	4.481	5.099	5.330	0.000	5.330
FY09: Sustained eCYBERMISSION and implemented enhancements as necessary based on lessons learned from previous years. Increased team participation. FY10: Continues to seek increased participation from existing levels and to increase geographic diversity and sustains eCYBERMISSION and implements enhancements based on lessons learned from previous years. FY11: Will continue to seek increased participation from existing levels and to increase geographic diversity and will sustain eCYBERMISSION and implement enhancements based on lessons learned from previous years.					
FY 2009 Accomplishments: FY 2009					
FY 2010 Plans: FY 2010					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.147	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	4.481	5.246	5.330	0.000	5.330

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*	7.669	8.104	8.072	0.000	8.072	8.217	8.363	8.510	8.647	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	7.669	7.877	8.072	0.000	8.072
Network and information science basic research for US/UK coalition operations information.In FY09, investigated models, theory, and algorithms for creating self-organizing wireless networks inspired by highly adaptive biological systems. Investigated cognitive and socio-cultural factors on coalition command processes and coalition networks to enhance situational awareness and decision-making. Established and validated analytic frameworks, leading to tradeoffs between sensing, computing, communications, and actuation, for classes of wireless sensor networks. In FY10, devise efficient robust resource usage algorithms for operations without centralized control, and with inaccurate knowledge of operating conditions for enhanced network capabilities. Investigate trust models to ensure distributed sensor data fusion under uncertainty. Devise agent reasoning					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
models and agent interaction models & algorithms to allow for effective agent support for human ad hoc teams in time stressed environments. In FY11, will establish theoretical foundations for policy specification with formal representations at various levels of abstraction. Will devise mathematical models to represent mappings between events, sensor monitored information, and end-uses; optimal compression of information flows based on human cognition metrics. Will design reasoning algorithms to enable the creation of agents that promote trust among teammates and manage differing levels of trust. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.227	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J15: *NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	7.669	8.104	8.072	0.000	8.072

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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 J16: *NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
J16: *NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE*	2.902	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts basic research in nano and micro technologies to improve the performance and effectiveness of portable electronic equipment for the warfighter. This will be accomplished by reducing power and weight while increasing real-time interactivity of vital information content between the warfighters and their environment. The Center for Nanotechnology and Microelectronics (CNAM) is a university research effort focusing on the development and application of nanotechnology that can be integrated with microelectronic systems while not duplicating existing nanoelectronics research programs. The objective is to accelerate the deployment of nanotechnology for military applications by focusing on applications where nanotechnology complements rather than replaces microelectronics. The research program will concentrate on four technology areas focused on resolving key issues associated with military applications of microelectronics and power electronics. Research thrusts include: 1) Thermal Management - the removal of heat from electronics and power electronics is the primary limit on the performance of small devices. Nanotechnology may improve the performance of thermal management systems by enhancing the cooling properties of materials, interfaces, and fluids for microelectronics; 2) Hybrid nano/micro structures and devices - bottom-up self-assembly of nanoscale components onto/into microelectronic platforms can lead to electronic components that integrate nanoscale optical interconnects, produce significantly less waste heat, and integrate on-board sensing; 3) Nanotechnology-enhanced transparent electronic materials - transparent materials can be used for microelectronics, increasing the designers flexibility in integrating microelectronics into other systems; 4) Active Cooling - nanotechnology-based active cooling technology such as high efficiency thermoelectric coolers and nano-enhanced adsorption/ desorption cooling can, in theory, cool microelectronics to temperatures below ambient or even to cryogenic temperatures, thus improving performance. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed extramurally by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.902	0.000	0.000	0.000	0.000
Research thrusts include thermal management, hybrid nano/microstructures and devices, nanotechnology-enhanced transparent electronic materials, and active cooling for improved portable warfighter electronic equipment In FY09, implemented thermal management techniques that provided improved thermal conductivity and studied methods to functionalize the thermal interfaces to improve heat transfer; fabricated novel nano-					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 J16: *NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
electronics for low power sensors and systems; studied nanotechnology-enhanced electronic materials that provide superior electrical capabilities; researched advanced nanotechnology-enhanced cooling techniques including thermoelectric and adsorption/desorption. This effort ended in FY2009. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	2.902	0.000	0.000	0.000	0.000

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, PB 2011 Army RDT&E Project Justification									DATE: February 2010		
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 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
J17: *VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE*	1.968	2.033	2.066	0.000	2.066	2.104	2.141	2.178	2.213	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project is for Vertical Lift Research Center of Excellence to couple state-of-the-art research programs with broad-based graduate education programs at academic institutions with the goal of increasing the supply of scientists and engineers who can contribute to Army Transformation. Work will provide research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project is performed extramurally by the Aeroflightdynamics Directorate of the Aviation and Missile Research, Development, and Engineering Center (AMRDEC) (located at the NASA Ames Research Center, Moffett Field, CA).

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	**FY 2010**	**Base FY 2011**	**OCO FY 2011**	**Total FY 2011**
Program #1	1.968	1.976	2.066	0.000	2.066
Vertical Lift Research Center of Excellence: In FY09, developed light-weight high-flexibility rotorcraft shafts using flexible matrix composites and active bearing controls; and developed efficient and affordable joining concepts for high-stiffness, light-weight composites. In FY10, design and fabricate robust wind tunnel testing system for rotating icing environment tests; build and test active trailing edge flaps rotor configurations for reducing rotor vibrations, power, and noise; investigate the performance improvements in the tip/casing region of ducted fan systems; and demonstrate health monitoring capability of hybrid carbon-fiber/carbon-nanotube epoxy composites. In FY11, will develop a method to describe nonlinear propagation path of rotor noise, will develop a methodology for airfoil design that accounts for unsteady aerodynamics, will use validated 3-D model to explore helical gear vibration, and will compute induced power for typical rotor configurations and compare with measured data.					
FY 2009 Accomplishments: FY 2009					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.057	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	1.968	2.033	2.066	0.000	2.066

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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*

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, PB 2011 Army RDT&E Project Justification										DATE: February 2010	
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 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*	4.844	3.838	9.752	0.000	9.752	8.913	11.683	11.888	12.080	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds the establishment of the Network Science and Technology Research Center (NSTRC). The NSTRC will be competitively awarded and managed by the Army Research Laboratory (ARL). ARL researchers, with partners at other sites, will collaborate in a virtual center environment. There will be an effort undertaken to include additional partners such as universities, industry, and other government agencies. Network Science is the study of network representations of physical, biological, and social phenomena leading to predictive models of these phenomena. As such, network science may be seen as the cornerstone for future military operations and the conduct of network-centric warfare. The mission of this center will be to strengthen the theoretical underpinnings of network science; conduct basic research on how and why biological and social (non-physical) networks function and determine their applications to military networks; to manage the activities in network science research, technology development, and network experimentation for the Army; to focus science and technology investments to enable network-centric operations and warfare; to focus applied science and technology to enable social networks important to Army operations; and to enable the development of network science applications and facilitate their transition to Army and Joint operations. Network science, technology, and evaluations encompasses all information and information exchange, visualization, collaboration, manipulation, protection, restoration, transport, services, data storage, and application layers, including the knowledge that human use of networks is a critical component. Establishment of the center will require a phased approach cable of supporting development of fundamental network theory and network technologies, and carry out the assessment of impacts upon human performance; the integration of new technologies and social networks into capabilities; and experimentation as a means to test and confirm fundamental theories and predictive models and/or characterize new technologies and operational concepts while also being capable of promoting training of personnel when applicable. Unlike the Training and Doctrine Commands on-going efforts within their centers, schools, and battle-labs, the focus of the NSTRC will be to develop the framework to perform research important to the Army in the areas of modeling, simulation and testing of very large networks, command and control of joint/combined networked forces, impact of network structure on organizational behavior, security and information assurance of networks, swarming behavior, and managing network complexity. It will also have a significant focus on and investment in the discovery and foundational aspects of the science of networks both human engineered and biologically evolved. Work is this project is coordinated with and complementary to the work at the United States Military Academy (USMA) Basic Research Network Science Center funded under PE 0601104/project H59. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this project will be primarily preformed extramurally with a small intramural effort by the Army Research Laboratory (ARL) in Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	4.844	3.730	9.752	0.000	9.752
Network Science and Technology Research Center (NSTRC): 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. In FY09, established the NSTRC capability through a multitude of geographically diverse, interdisciplinary researchers working collaboratively on military network research issues, using shared or existing resources, and exploiting advances in computing, communications, collaboration, and other information technologies to make research and technology development efficient and seamless. In FY10, develop diagnostic models and methods to advance the science of social/cognitive networks. Establish a synergistic framework for physics-based and human-based information fusion. Develop models of mobile ad hoc networking to define interactions and behavior among information networks. In FY11, will study cross-domain issues to develop trust models that will support networks of humans connected through wireless mobile ad hoc networks.					
FY 2009 Accomplishments: FY 2009					
FY 2010 Plans: FY 2010					
Base FY 2011 Plans: FY 2011 Base					
OCO FY 2011 Plans: FY 2011 OCO					
Program #2	0.000	0.108	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601104A: *University and Industry Research Centers*	PROJECT J22: *NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Small Business Innovative Research/Small Business Technology Transfer Program *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	4.844	3.838	9.752	0.000	9.752

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

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