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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603008A: <i>Electronic Warfare Advanced Technology</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	55.903	50.359	57.963	-	57.963	54.882	55.429	55.962	56.623	Continuing	Continuing
TR1: <i>TAC C4 TECHNOLOGY INT</i>	36.346	37.862	36.673	-	36.673	34.328	34.455	34.404	34.740	Continuing	Continuing
TR2: <i>Secure Tactical Information Integration</i>	12.554	12.497	21.290	-	21.290	20.554	20.974	21.558	21.883	Continuing	Continuing
TR8: <i>C3 DEMONSTRATIONS (CA)</i>	7.003	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates technologies to address the seamless integrated communications challenge with distributed, secure, mobile, wireless, and self-organizing communications networks that will operate reliably in diverse and complex terrains, in all environments. Efforts demonstrate seamlessly integrated communications and information security technologies across all network tiers, ranging from unattended networks and sensors through maneuver elements and airborne and space assets. Project TR1 investigates and leverages external communication technologies and combines technology options in a series of Command, Control, Communications, and Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) On-The-Move (OTM) demonstrations to measure the potential battlefield effectiveness. Project TR2 provides information security technologies for tactical wireless networks against modern network attacks; and supports collaborative technologies for information sharing between battlefield functional communities. Project TR8 funds congressional special interest items.

Work in this PE is complimentary of PE 0602782A (Command, Control, Communications Technology), and fully coordinated with PE 0602783 (Computer and Software Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602120A (Sensors and Electronic Survivability), and PE 0602270A (EW 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 is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ and Aberdeen Proving Ground, MD.

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APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE				
2040: Research, Development, Test & Evaluation, Army		PE 0603008A: Electronic Warfare Advanced Technology				
BA 3: Advanced Technology Development (ATD)						
B. Program Change Summary (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget		57.199	50.359	53.896	-	53.896
Current President's Budget		55.903	50.359	57.963	-	57.963
Total Adjustments		-1.296	-	4.067	-	4.067
• Congressional General Reductions			-			
• Congressional Directed Reductions			-			
• Congressional Rescissions		-	-			
• Congressional Adds			-			
• Congressional Directed Transfers			-			
• Reprogrammings		0.153	-			
• SBIR/STTR Transfer		-1.449	-			
• Adjustments to Budget Years		-	-	4.067	-	4.067

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Army									DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 3: Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603008A: Electronic Warfare Advanced Technology				PROJECT TR1: TAC C4 TECHNOLOGY INT			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
TR1: TAC C4 TECHNOLOGY INT	36.346	37.862	36.673	-	36.673	34.328	34.455	34.404	34.740	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project matures and demonstrates key communications, mobile networking technologies, including antennas, radio components, and networking software to enable commanders and individual Soldiers to survive and fight by providing secure, reliable, mobile communications network solutions that function in complex and diverse terrains. Efforts here concentrate on three major goals: to provide a series of technology demonstrations of new and emerging Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) technology enabled capabilities to significantly reduce risk associated with the network-of-networks concept; to provide critical links in the ability to communicate and move large amounts of information across the force structure in a seamless, integrated manner conducive to a highly mobile manned and unmanned force structure; and to assess the Technology Readiness Level (TRL) of emerging network technologies in an operationally relevant environment. Several tasks are conducted in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the other Services.

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, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ and Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: Antenna Technologies	5.969	8.967	11.276
Description: This effort matures and demonstrates low cost, power efficient, antenna technologies for terrestrial and tactical satellite ground terminals. Work accomplished under PE 0602782A/project H92 compliments this effort.			
FY 2010 Accomplishments: Completed development of low profile Ka/Ku single beam satellite communications (SATCOM) on the move (OTM) antenna and conducted field demonstration; integrated Ka/Q band power amplifiers into a single demonstrator and conducted lab experiments; matured and assessed single beam low profile hybrid Ka/Q band SATCOM OTM antenna; improved small aperture blue force tracking (BFT) SATCOM terminal to enable accurate position location dissemination using military satellite to replace costly commercial satellite services.			
FY 2011 Plans: Mature and demonstrate K/Ka/Q band low profile electronically steered SATCOM antenna components and aperture with integrated drive and tracking system; demonstrate BFT SATCOM antenna, modem architecture and preliminary network design;			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
mature conformal and embedded antenna design; conduct sub-system compatibility testing for a selected platform using electromagnetic modeling and simulation (M&S); and develop mockup brassboard for validation. FY 2012 Plans: Will investigate and refine embedded armor antennas; will fabricate internet protocol based antenna feed demonstrators; will integrate antenna apertures and feed systems into vehicle armor; will support the Tank and Automotive Research Development and Engineering Center during ballistic assessments of embedded armor antennas; will demonstrate integrated K/Ka/Q band low profile electronically steered SATCOM antenna; will integrate single package Ka/Q band integrated power amplifier into the K/Ka/Q band SATCOM antenna; will refine BFT SATCOM antenna network concepts and demonstrate medium scale performance.				
Title: Applied Communications and Information Networking (ACIN) Description: This effort adapts and matures emerging commercial wireless, networked communications technologies for military use. FY 2010 Accomplishments: Adapted emerging commercial (802.16e, 802.22 and 802.11n) wireless networking technologies for use in military frequency bands and assessed security vulnerabilities; modified radio frequency propagation M&S and planning tools for use in urban environments and complex terrain; assessed and adapted commercial software defined radios with cognitive radio technology. FY 2011 Plans: Adapt and assess emerging cognitive and commercial networking technologies for wireless networks including cognitive radios and cross layer network protocols; investigate associated communications architectures and hardware components; develop digitized SATCOM technologies to reduce size, weight, power and cost (SWAP-C) for strategic ground terminals. FY 2012 Plans: Will assess emerging commercial wireless communications technologies for suitability in military wireless communications networks; will adapt, mature and demonstrate commercial wireless network operations control and visualization solutions in Army tactical environments; will assess emerging 4G commercial cellular technologies (e.g., long term evolution) for future adaptation to military networks.		0.905	1.642	2.001
Title: C4ISR On-The-Move (OTM) Description: This effort provides a venue for technology demonstrations of new and emerging C4ISR technology-enabled capabilities. FY 2010 Accomplishments:		9.069	8.131	9.552

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Assessed increments of Joint Tactical Radio System (JTRS) Handheld/Manpack/Small Form Factor (HMS) and Ground Mobile Radio (GMR) for mounted & dismounted Soldiers, unmanned ground and aerial sensors, non-line of sight launch systems and intelligent munitions systems; assessed Warfighter Information Network ? Tactical (WIN-T) functionality including quality of service architecture, information assurance solutions to enable network security with minimal data loss, selected network operations management functions, and associated networks; assessed the maturity of technology efforts in an operationally relevant environment; supported technical evaluations to explore programmed increments of Battle Command and Unified Battle Command.</p> <p>FY 2011 Plans: Assess the capability, functionality, and performance of network integrated architectures and emerging capabilities that support the Army Brigade Combat Team Modernization Plan; assess the FY11 programmed increments of JTRS for mounted and dismounted Soldiers and platforms, unmanned ground and aerial sensors, and intelligent munitions systems in support of the Army Brigade Combat Team Modernization Plan; assess WIN-T functionality, including enhanced quality of service architecture, information assurance solutions to enable network security across a wide area network using multiple encryption devices with minimal loss of data, and selected network operations management functions; assess the TRL of Army S&T efforts maturing in the FY11 timeframe in an operationally relevant environment to facilitate technology transition; continue to support research and development (R&D) of capability sets and accelerate such capabilities to enhance the current force.</p> <p>FY 2012 Plans: Will assess the capability, functionality, and performance of network integrated architectures and emerging capabilities that support the Army Brigade Combat Team Modernization Plan and Network Modernization Strategy; will assess the FY12 programmed increments of JTRS for mounted and dismounted Soldiers and platforms, unmanned ground and aerial sensors, and intelligent munitions systems in support of the Army Brigade Combat Team Modernization Plan; will assess WIN-T increment 2 and 3 functionality including enhanced quality of service architecture, information assurance solutions to enable network security across a wide area network using multiple encryption devices with minimal loss of data, and selected network operations management functions; will assess the TRL of Army S&T efforts maturing in the FY12 timeframe in a operationally relevant environment to facilitate technology transition.</p>			
<p>Title: C4ISR Network Mining</p> <p>Description: This effort matures data mining that provides the link between the transactions to be analyzed and analytical systems on large-scale information technology. Data mining consists of five major elements: 1. extract, transform, and load transaction data onto the data warehouse system; 2. storing, and managing the data in a multidimensional database system; 3. providing data access; 4. analyzing the data by application software; and 5. presenting the data in a useful format.</p>		5.211	5.345
			3.517

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>FY 2010 Accomplishments: Conducted analysis and performed M&S of intelligence, surveillance, and reconnaissance (ISR) performance over restricted bandwidth networks; examined and represented in M&S of varying fidelity, carrier to noise radio and voice over Internet protocol (IP) solutions for future force networks.</p> <p>FY 2011 Plans: Apply network mining software to analyze emerging protocols and standards for use over military networks; assess commercial technologies for potential transition into systems and develop architecture to decrease stovepipe and proprietary network implementations.</p> <p>FY 2012 Plans: Will apply network mining software to determine how a military "apps store" can be efficiently deployed on the network; will code and assess advanced spectrum management software tools to facilitate network operations where various types of networks converge using multiple transmission media.</p>			
<p>Title: Cognitive Networking</p> <p>Description: This effort matures and demonstrates technologies enabling wireless networks to sense network and spectrum conditions, and automatically adapt for more efficient use. Work accomplished under PE 0602782A/project H92 compliments this effort.</p> <p>FY 2010 Accomplishments: Improved cognitive radio policy software by standardizing dynamic spectrum access (DSA) policy language to allow interoperability of disparate next generation (XG) radio communications platforms; improved interoperability between spectrum sensors and cognitive antennas to more efficiently use current spectral resources; identified and assessed superconductor and non-superconductor technology to demonstrate preliminary all-digital receiver; developed digital signal processing components and requirements providing increased SATCOM capacity; improved cooperative SATCOM network routing technology to provide signal blockage mitigation.</p> <p>FY 2011 Plans: Mature the cognitive network tools developed under PE 0602782A/project H92 to be able to assess and analyze networks with and without cognitive capabilities; adapt and mature commercial RF cellular based technologies.</p> <p>FY 2012 Plans: Will mature all-digital strategic ground terminal architecture to enable improved tactical responsiveness to changing network needs and enable SATCOM to be responsive to cognitive ground networks; will mature digital transmitter and receiver interfaces and subsystem integration; will mature and demonstrate all-digital receiver; will demonstrate configurable baseband processor for</p>		3.984	4.481
			5.976

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
increased SATCOM throughput and integrate with digital receiver for proof of concept; will define requirements and architecture for digital transmitter; will demonstrate government off-the-shelf (GOTS) applique to enable operation of commercial wireless 3G technology in Army tactical environments with the addition of WiFi mesh, multicast routing and automated frequency, sensing and control.			
Title: Network Operations (NetOps) Description: This effort matures network operations technologies (network management, information dissemination management and cyber security) to simplify the planning, management and troubleshooting of complex tactical communications networks. FY 2012 Plans: Will demonstrate interoperability among disparate NetOps tools and technologies, leveraging existing GOTS/Commercial-off-the-shelf (COTS) tools being used in the field; will take advantage of NetOps tools that make sense while reducing the overall number of tools to significantly improve the network planning, management, configuring and monitoring of tactical networks; will research and improve tactical NetOps visualization capabilities and techniques based on how the Warfighter can best interpret the information; will consolidate and demonstrate NetOps tools (network management, information assurance, information dissemination management and signals management) into an intuitive multi-touch (touch screen) user environment to produce a more collaborative and centralized NetOps management capability.		-	4.351
Title: Wireless Information Assurance (IA) Description: This effort matures and demonstrates technologies to protect wireless tactical networks against computer network attacks with an emphasis on defending against attack methods not previously seen. Work accomplished under PE 0602782A/project H92 and PE 0603008A/project TR2 compliments this effort. FY 2010 Accomplishments: Wrote and demonstrated a mobile ad hoc networking (MANET) malicious code detection service to thwart zero-day attacks; demonstrated a response capability that receives the root cause analysis from the correlation engine then develops and recommends a response plan to address the security problem; matured autonomous adaptive middleware and assessed it in a laboratory environment. FY 2011 Plans: Develop and mature the mission generation engine to allow for dynamic reconfiguration of a subset of network parameters (e.g., topology) based on mission specifications; demonstrate computer network protection using mission to policy translation engine and adaptive middleware, tactical public key infrastructure, and cross domain solutions in a relevant environment.		9.249	9.296
Title: Dismounted Communications in Urban Terrain		1.959	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Description: This effort matures and demonstrates technologies that enable wireless networked communications for dismounted soldiers in complex terrain such as urban environments and inside buildings.</p> <p>FY 2010 Accomplishments: Coded space time adaptive processing for use on dismounted Soldiers' radio equipments; developed a tactical one-way certifiable (NSA security certification) cross domain (security levels) information sharing device.</p>			
Accomplishments/Planned Programs Subtotals		36.346	37.862
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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
TR2: <i>Secure Tactical Information Integration</i>	12.554	12.497	21.290	-	21.290	20.554	20.974	21.558	21.883	Continuing	Continuing
A. Mission Description and Budget Item Justification <p>This project matures and demonstrates technologies with enhanced capabilities to analyze, plan, execute, and assess operations, at tactical and strategic levels, by integrating decision support and intelligence based software to provide a more comprehensive understanding of adversaries and environments. Efforts mature and demonstrate technologies to improve mission execution success by providing software to more tightly couple operations and intelligence, and to better facilitate collaboration between individuals and teams. Efforts in tactical cross domain solutions demonstrate software based technologies enabling information sharing across operations and intelligence security domains that replace current application-specific hardware solutions.</p> <p>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.</p> <p>Work in this project is performed by the Army Research, Development, and Engineering Command, Communications (RDECOM)-Electronics Research Development and Engineering Center (CERDEC), Fort Monmouth, NJ and Aberdeen Proving Ground, MD, and the Army Research Laboratory (ARL), Adelphi, MD.</p>											
B. Accomplishments/Planned Programs (\$ in Millions)								FY 2010	FY 2011	FY 2012	
Title: Collaborative Battle Management								6.654	6.947	7.007	
Description: This effort matures and demonstrates technologies to improve sharing and understanding of data between the intelligence and operations communities.											
FY 2010 Accomplishments: Extended existing net-centric data strategies by adding concept-based data meta-tagging; matured portability framework and developed implementations for Force XXI Battle Command, Brigade and Below (FBCB2) and Distributed Common Ground Station-Army (DCGS-A); developed a universal collaboration bridge (UCB) permitting interoperability between mIRC (internet relay chat), Jabber (extensible messaging and presence protocol), Command Post of the Future and FBCB2; developed a digital mission model to enable collaboration between communities of interest (Intelligence (Intel)/Operations (Ops)/Geospatial (Geo)); coded software (SW) to associate Intel requirements, Geo data needs, and collection opportunities with operational mission tasks for Intel and Battle Command (BC) communities; integrated Intel and Ops decision support tools to include SW for managing planning and execution, priority information request, and collectors/sensors.											
FY 2011 Plans:											

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
Support limited distribution of the UCB; mature and demonstrate SW to associate Intel requirements, Geo data needs and collection opportunities with mission tasks for Intel and BC and allow Warfighter modification of system information to adapt to dynamic enemy tactics; mature Integrated Intel/Ops services for collaboration/visualization across SW environments; demonstrate integrated Intel/Ops decision support tools for planning and execution, priority information requests management, and collection/sensor management; mature and demonstrate multi-touch (MT) based mission collaboration. FY 2012 Plans: Will develop collaboration services to include browser-based components for visualization of strategic battle command data feeds and communications status; will develop SW environment permitting applications to execute on different operating systems (e.g., Windows, LINUX); will complete MT-based mission collaboration SW including information link analysis tools and Tactical Ground Reporting System (TiGR)-compatible MT display; will develop and mature general device-independent MT application framework; will complete Geo terrain analytical tools. These efforts will transition to PM Battle Command and PM Commercial Joint Mapping Toolkit.				
Title: Tactical Cross Domain Solutions Description: This effort matures and demonstrates service oriented architecture (SOA) cross domain solutions (CDS) to enable assured sharing of information across multiple security domains. FY 2010 Accomplishments: Improved and demonstrated cross domain web services on high assurance operating systems (e.g., Green Hills Integrity, Lynx Works LynxOS) that provided trusted labeling service (applied security labeling classification and releasability labels to data), data regarding service (used to sanitize security labeled messages before they cross security domain boundaries), and domain boundary service (ensured that cross security domain requirements were fulfilled before information was released from one security domain to another). FY 2011 Plans: Demonstrate one-way position location information (PLI) transfer from unclassified to classified networks, and further mature guard to process two-way digital data flow; mature and demonstrate a general tool to be used by any program to identify malicious code in a developed application or on the network. FY 2012 Plans: Will improve the one-way PLI data transfer and two-way digital data flow cross-domain software, integrate it with a military-hardened, tactical (small size, weight, and power) hardware platform complete with the necessary embedded security features to undergo NSA security certification and accreditation and demonstrate it on Ground Soldier equipment in a field environment.		5.900	5.550	5.824
Title: Information Assurance		-	-	8.459

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Description: This effort matures and demonstrates cyber security technologies that create new methods for defending wireless networks using nontraditional methodologies. Work being performed under PE /project 0602782/H92 and PE/project 0603008 TR1 complement this effort.</p> <p>FY 2012 Plans: Will integrate improved detection and automated response capabilities into Intrusion Detection System (IDS) technologies that resides on tactical host platforms, providing maximum protection to the host system with minimal resource usage; will develop IDS response component that collaborate with an Information Operations (IO) response component to take into account intelligence threat information and ascertain exactly who or what is causing the cyber threat; will integrate the IDS agents traversing the hosts and network into a common architecture; will evaluate the IDS components in a lab environment to ascertain the maturity of the functionality of each component of the architecture; will analyze and assess models of cyber attack behaviors to determine adversary objectives, attack vectors, and classes of attack to effect computer network defense (CND); will code and integrate a cyber tool kit for CND including dynamic protocols, a dynamic decentralized network remapping framework, and obfuscation (confusion) software for masking network role, system's identity, and cyber security protection from potential attackers.</p>			
Accomplishments/Planned Programs Subtotals		12.554	12.497
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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
TR8: C3 DEMONSTRATIONS (CA)	7.003	-	-	-	-	-	-	-	-	Continuing	Continuing
A. Mission Description and Budget Item Justification Congressional Interest Item funding for C3 Demonstrations.											
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2010	FY 2011	FY 2012
Title: Portable Mobile Emergency Broadband Systems (PMEBS) Description: This is a Congressional Interest Item. FY 2010 Accomplishments: Developed a rapidly deployable wireless ad-hoc portable communications system, that is self-configuring, self-healing and multi-hopping (Advanced Encryption Standard (AES)-256 mesh capable) as a low cost, near-term, off-the shelf solution that can supplement existing technology gaps for the last-mile tactical communications.									3.183	-	-
Title: Applied Communications and Information Networking (ACIN) Description: This is a Congressional Interest Item. FY 2010 Accomplishments: Matured and demonstrated commercial networking and communications technology in intelligent agents and mobile networking; provided rapid adaptation of commercial communications equipment for military use through the development of new architectures combining commercial and military unique technologies; provided modeling and simulation and planning tools for communications/network planning.									3.024	-	-
Title: Cybersecurity in Tactical Environments Description: This is a Congressional Interest Item. FY 2010 Accomplishments: Supported research in the area of Malware and focused on the current and emerging threats that impact software baselines today and also researched solutions that could effectively mitigate these threats.									0.796	-	-
Accomplishments/Planned Programs Subtotals									7.003	-	-

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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.		