Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	31.691	25.573	26.116	-	26.116	26.710	27.233	27.284	27.762	Continuing	Continuing
779: *Command, Control and Platform Electronics Tech*	9.905	10.583	10.759	-	10.759	11.027	11.252	11.455	11.668	Continuing	Continuing
H92: *Communications Technology*	14.464	14.990	15.357	-	15.357	15.683	15.981	15.829	16.094	Continuing	Continuing
TR9: *C3 COMPONENT TECHNOLOGY (CA)*	7.322	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) researches and develops communications technologies, command and control (C2), and electronics systems and subsystems that provide the Army with enhanced capabilities for secure, mobile, networked communications, assured information delivery, and presentation of information that enables decision-making. Commercial technologies are continuously investigated and leveraged where possible. Project 779 researches and develops technologies that enable management of information across the tactical and strategic battle space; provide automated cognitive reasoning and decision making; and allow timely distribution, display, and use of C2 data on Army platforms. Project H92 supports research in technologies which potentially allow field commanders to communicate on-the-move to/from virtually any location, through a seamless, secure, self-organizing, self-healing, network. Project TR9 funds congressional special interest efforts.

Work in this PE is complimentary of PE 0602705A (Electronics and Electronic Devices), PE 0603008A (Electronic Warfare Advanced Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and is fully coordinated with PE 0602120A, (Sensors and Electronic Survivability), PE 0602783A (Computer and Software Technology), and PE 0602874A (Advanced Concepts and Simulation).

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 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army					DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*			
B. Program Change Summary ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**
Previous President's Budget	30.036	25.573	26.227	-	26.227
Current President's Budget	31.691	25.573	26.116	-	26.116
Total Adjustments	1.655	-	-0.111	-	-0.111
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	1.990	-			
• SBIR/STTR Transfer	-0.335	-			
• Adjustments to Budget Years	-	-	-0.111	-	-0.111

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*	PROJECT 779: *Command, Control and Platform Electronics Tech*	

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
779: *Command, Control and Platform Electronics Tech*	9.905	10.583	10.759	-	10.759	11.027	11.252	11.455	11.668	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project researches technologies that enable commanders at all echelons to have better and more timely information and allows them to execute mission command from anywhere on the battlefield. Emphasis is on data management and automated analysis to provide course-of-action determination, mission planning and rehearsal, mission execution monitoring and re-planning, and precision positioning (pos) and navigation (nav). This project researches technologies that support multi-modal man-machine interactive technologies, battle space visualization, positioning and navigation in degraded environments (poor Global Positioning System (GPS) performance), automated cognitive decision aids, real-time collaborative tactical planning tools, data transfer, distributed data bases, open system architectures, service oriented architecture (SOA), and integration concepts which contribute to more mobile operations.

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: Battle Space Awareness and Positioning	1.776	1.800	2.152
Description: This effort investigates pos, nav and tracking sensor/integration technologies to provide position, velocity, and time information to support operational and training requirements, especially in hostile electro-magnetic interference and other radio frequency (RF) degraded/denied environments. Work being accomplished under PE 0603772A/project 101 compliments this effort.			
FY 2010 Accomplishments: Fabricated advanced pos/nav sensors, especially those that exploit the synergy between communications and position, such as RF ranging and network-assisted navigation for operation in GPS-denied environments.			
FY 2011 Plans: Evaluate candidate pos/nav sensors including micro-electrical mechanical and vision based sensors, evaluate integration techniques and navigation enhancing radio technologies for improved urban and indoor position performance.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*	PROJECT 779: *Command, Control and Platform Electronics Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will develop sensor integration algorithms to combine the selected pos/nav sensors in radios both with and without radio based nav technologies; will begin assessing brassboard sensor/radio system/suite in a laboratory environment.			
Title: Command and Control (C2) On-The-Move (OTM) Enabling Technologies	8.129	8.783	8.607
Description: This effort investigates and develops technologies to improve the Warfighters ability to access, use, present and understand relevant battle command information. Work on this effort transitions to PE 0603772A/project 101. ***FY 2010 Accomplishments:*** Coded speech and optical character recognition translation services within a SOA framework to allow Coalition forces to communicate more efficiently and securely, while providing additional translation options; coded text-to-text machine translation algorithms to enable translation of low density languages (languages currently not widely used), that are on the Defense Language Agency prioritized language list; investigated coordinated planning and execution software for multiple, heterogeneous, teamed unmanned ground vehicle/unmanned aerial system (UGV/UAS) platforms and developed user interface enhancements to more efficiently manage multiple, teamed vehicles; devised benchmarks/metrics for shared situation awareness and decision-making, and identified emerging patterns of interaction between individuals, intelligent agents, and teams of agents and humans; performed work flow analyses, based on approved scenarios, to identify and assess cognitive processes in decision-making and collaboration. ***FY 2011 Plans:*** Expand machine translation services to include speech-to-speech translation capabilities; integrate additional translation engines for increased language coverage; continue to investigate enhancement of unmanned collaboration and coordination between multiple assets and sensors, more complex UGV/UAS platform behaviors, and mission planning in urban and complex environments to produce technologies capable of dynamic mission management for multiple robotic assets; investigate workflow analyses to identify and assess technology to augment human cognition while performing Battle Command processes and evaluate methods to improve information sharing, decision-making, and collaboration in network-enabled operations; investigate techniques to enable users to share Warfighter composed software via a web-based gallery. ***FY 2012 Plans:*** Will refine how human understanding can be measured and improved; will refine how large and differing amounts of information can be presented to best align with human processing; will continue to improve technologies to enable collaborative mission execution and C2 for near-autonomous and autonomous unmanned systems; will investigate and devise techniques to automate portions of the governance and accreditation process for edge-enabled applications; will code and integrate intelligent agent technology for language translation services, which will provide automated intelligent reasoning of foreign language data.			
Accomplishments/Planned Programs Subtotals	9.905	10.583	10.759

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*	PROJECT 779: *Command, Control and Platform Electronics Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

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

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*	PROJECT H92: *Communications Technology*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H92: *Communications Technology*	14.464	14.990	15.357	-	15.357	15.683	15.981	15.829	16.094	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops and applies advanced communications and network technologies by leveraging and adapting commercial technology to the maximum extent possible and focusing research efforts on emerging technology areas (e.g., mobile radio-based infrastructures, cyber security in narrowband environments, multiband on-the-move (OTM) transmit and receive antennas, adaptive protocols, and low probability-of-interception/low probability of detection waveforms).

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	4.130	5.703	6.394
Description: This effort fabricates and assesses low cost, power efficient, directional antenna technologies for terrestrial, airborne, and tactical satellite ground terminals to enable them to operate OTM over multiple frequency bands; and further investigates armor embedded antenna technologies. Work being accomplished under PE 0603008A/project TR1 compliments this effort.			
FY 2010 Accomplishments: Assessed C/Ku directional antenna and integrated platform feed and evolutionary aperture design to reduce antenna profile and cost; developed multi-beam low profile electronically steered Ka/Q band SATCOM OTM antenna components.			
FY 2011 Plans: Complete K/Ka/Q multi-beam low profile electronically steered SATCOM components and aperture development; integrate the SATCOM aperture with a drive and tracking system; develop single package Ka/Q band integrated power amplifiers; develop a blue force tracking (BFT) SATCOM antenna and modem architecture; investigate meta-materials for miniaturized antenna technologies; develop conformal antenna systems for ground and air platforms			
FY 2012 Plans: Will complete 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 complete development of blue force tracking			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
(BFT) SATCOM antenna and modem; will develop wafer scale and distributed antenna components and architecture for very small profile on-the-move SATCOM antennas; will assess the Ku Band Simple Manufacturing Array Technology (SMArT) card antenna on an unmanned aerial system; will execute antenna performance and ballistic assessment on armor embedded antenna candidates.			
Title: Wireless Information Assurance (IA) ***Description:*** This effort investigates, codes and fabricates technologies to protect wireless tactical networks against computer network attacks. Work being accomplished under PE 0603008A/project TR1 compliments this effort. ***FY 2010 Accomplishments:*** Investigated distributed security key management concepts and technologies that allow mobile users to automatically affiliate, de-affiliate, and re-key the network to respond to a change or a compromise without requiring pre-placed keys; evaluated software cross-domain security services providing software separation of kernel that protected and established separation of classification levels; investigated adaptive middleware that supports interactive applications for mobile devices and smart phones; and conducted lab assessments of these technologies. ***FY 2011 Plans:*** Develop tactical intrusion detection system (IDS) to accommodate the small tactical bandwidth environment along with a common operational picture that provides a homogenous view of the IDS activity on the network. ***FY 2012 Plans:*** Will research and code IDS technology to proactively ascertain local threats on tactical host systems and networks using minimal system resources; will code technologies to automatically self-inoculate these systems to limit impact and contain spread of malicious activity; will devise suitable IDS agent collaboration schemes to ensure that trusted decisions are made in response to malicious behavior. Will configure IDS agents to share actionable security information with sustaining base assets for further analysis while still allowing the Warfighter to maintain mission focus and continuity while operating at the resource-constrained tactical edge.	2.662	2.489	3.331
Title: Cognitive Networking ***Description:*** This effort investigates, evaluates and creates a set of advanced cognitive networking technologies enabling wireless networks to sense the dynamic and uncertain nature of mobile ad-hoc multi-tiered, multi-band network environments and spectrum conditions, and automatically adapts to increase network level performance while reducing the time and human effort required to operate the network. Work being accomplished under PE 0603008A/project TR1 compliments this effort. ***FY 2010 Accomplishments:***	1.497	3.791	4.004

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Began the design and development of cognitive network tools for mobile ad hoc networks that take into consideration network connectivity, end-to-end user requirements (bandwidth), survivability and optimality (goodness of design), and provide knowledge oriented representation of radio frequency (RF) connectivity, network operations/behaviors, and effectiveness of learning/ prediction techniques in a dynamic environment. ***FY 2011 Plans:*** Develop and refine a cognitive network design tool set; design and develop initial protocol function and capability for cognitive networking; conduct modeling and simulation on small scale networks to evaluate protocol functionality. ***FY 2012 Plans:*** Will exercise the Cognitive Network Engineering Design Analytic Toolset (CNEDAT) with 10 cognitive radios in a coordinated fashion through a set of assessments; will use the CNEDAT to design a cognitive network to meet a set of performance goals or requirements (such as robustness to node or link outage); will implement these designs in the radio hardware/software, and under the same set of traffic loads; will compare the measured network parameters (i.e., throughput, delay, loss, etc) with those predicted by the design tool; will conduct specific experiments in total applied traffic load, and/or various traffic mixes (voice, video, data, imagery, chat) as well as different mobility rates, mobility patterns, and different node/link outages due to simulated jamming and/or node destruction.			
Title: Dynamic Spectrum and Network Technologies ***Description:*** This effort investigates and fabricates technologies for radios and network management systems to enable access to spectrum that is unavailable because of current inefficient spectrum management methods. Work being accomplished under PE 0603008A/project TR1 compliments this effort. ***FY 2010 Accomplishments:*** Investigated and coded software policy agents for integration into software defined radios to allow the radios to accept dynamic spectrum access (DSA) from the network management system over the air; adapted the DARPA Disruption Tolerant Networking (DTN) technology for military communications systems to improve reliability and transportability. ***FY 2011 Plans:*** Expand the DSA policy generation design to include parameters for co-existence operations of DSA enabled radios with tactical communications and Intelligence, Surveillance and Reconnaissance (ISR) systems; integrate the DSA policy generation tool with existing spectrum database. ***FY 2012 Plans:***	2.975	3.007	1.628

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will code DSA technologies and add them to the automatic frequency channel sensing and selection capabilities of cellular base stations in order to assist the network planners to set the frequencies for mobile base station setup.			
Title: Network Designs ***Description:*** This effort investigates and devises technologies to support designing the next generation of mobile ad-hoc wireless networks to enable wireless networks to sense network and spectrum conditions and automatically adapt for more efficient use. ***FY 2010 Accomplishments:*** Enhanced the basic network design tool and performed a number of assessments using typical military maneuver and network traffic scenarios to ensure the tool successively met the goals for connectivity, throughput, delay, loss and time slot transmission schedules of all radio frequency links in the generated network structure.	3.200	-	-
Accomplishments/Planned Programs Subtotals	14.464	14.990	15.357

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

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

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*	PROJECT TR9: *C3 COMPONENT TECHNOLOGY (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
TR9: *C3 COMPONENT TECHNOLOGY (CA)*	7.322	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for C3 Component Technology applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Mobile Mesh Network Node ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item provided a low latency, high data rate, secure, Wi-Fi mesh network communications technology for the dismounted Soldiers using smart phones operating on commercial cellular networks.	1.751	-	-
Title: Lightweight 10-Meter Antenna Mast ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item developed a lightweight, reliable, corrosion resistant telescoping mast for use on shelters, vehicle platforms, and ground applications.	1.989	-	-
Title: Nanophotonic Devices ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated approaches to analyze and fabricate efficient light-emitting and sensing devices at the nano-scale.	1.592	-	-
Title: Integrated Lightweight Tracker System ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed a plastic housing for a prototype tracker system.	1.990	-	-
Accomplishments/Planned Programs Subtotals	7.322	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*	PROJECT TR9: *C3 COMPONENT TECHNOLOGY (CA)*

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.