ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602782A - Command, Control, Communications Technology**

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	20805	18115	18604	19705	20001	21012	21622
779	C2 & PLAT ELEC TECH	9061	7744	8445	9413	9904	10231	10616
H92	COMMUNICATIONS TECH	11744	10371	10159	10292	10097	10781	11006

A. Mission Description and Budget Item Justification: This program element (PE) researches advanced communications technologies and expands scientific knowledge of command and control (C2), and electronics systems/subsystems for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The intent is to provide the Army with enhanced capabilities for secure, mobile, networked communications, assured information delivery, presentation of information and decision-making. This will be achieved by improving the command, control, and communication systems (e.g. man-machine interface, mobility, security, capacity, safety, reliability, and survivability) for both air and ground platforms, including the dismounted soldier. Commercial technologies are continuously investigated and leveraged where possible. Research includes the investigation of infrastructures that allow timely distribution, display, and use of C2 data on Army platforms. This research also includes enhancements to the Global Positioning System (GPS) user equipment to provide a more robust, anti-jam capability, and improvements to man-machine interfaces and decision aids for increased operation tempo in an on-the-move, network-centric battlefield environment. This PE will provide technologies that allow Future Force field commanders to communicate on-the-move (OTM) to/from virtually any location, in a seamless, secure, self-organizing, self-healing, network. Integrated networks of unmanned remote sensors, maneuver and fire support elements, and situational awareness (SA) tools will allow the Future Force to achieve overmatch with agility and versatility. In addition, portions of the research support the Joint Tactical Radio System (JTRS) evolutions.

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this PE is related to and fully coordinated with efforts in PE 0603008A (Command, Control and Communications Advanced Technology), PE 0602783A (Computer and Software Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), PE 0603734A (Military Engineering Advanced Technology), and PE 62705 (Electronics & Electronics Devices). Work in this PE is performed by the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	21150	18728	18696
Current Budget (FY 2005 PB)	20805	18115	18604
Total Adjustments	-345	-613	-92
Congressional program reductions		-176	
Congressional rescissions			
Congressional increases			
Reprogrammings	-345	-437	
SBIR/STTR Transfer			
Adjustments to Budget Years			-92

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

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602782A - Command, Control, Communications Technology**	**779**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
779	C2 & PLAT ELEC TECH	9061	7744	8445	9413	9904	10231	10616

A. Mission Description and Budget Item Justification: This project researches and applies new concepts and techniques in command and control (C2) to achieve enhanced military capabilities for the Future Force. The Future Force will require leaders at all levels to have continuous situational awareness to make informed and rapid critical decisions to "shoot, move and communicate" more quickly than the adversaries. This project does the applied research that enables commanders at all echelons to have better and more timely information and allows them to command from anywhere on the battlefield, freed from their command posts and while on-the-move. Emphasis is on course of action determination and analysis, mission planning and rehearsal, mission execution monitoring and replanning, and precision positioning and navigation. New enabling technologies that support the current thrusts also are explored, such as advanced high resolution and large screen displays, multi-modal man-machine interactive technology, battle space visualization, automated cognitive decision aids, real-time collaborative tactical planning tools, data transfer, distributed data bases, advanced open system architectures, and integration concepts which contribute to more mobile operations. The Agile Commander Advanced Technology Demonstration (ATD) matures digital hardware and software technologies that provide agile, rapidly deployable, split-based C2 operations. The Networked Sensors for the Future Force ATD will model a lower echelon C2 information infrastructure to optimize information flow between dispersed C2 nodes and a series of unmanned platforms.

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Battle Space Awareness & Positioning: Mature positioning, navigation, and tracking sensor/integration technologies to provide position, velocity and time information to support operational and training requirements, especially in hostile electro-magnetic interference environments. In FY03, transitioned handheld GPS anti-jam antenna into low rate initial production. Conducted laboratory evaluation of individual positioning, navigation and tracking sensor hardware for use in urban and complex environments, evaluated integration algorithms for positioning, navigation and tracking sensor hardware via computer simulation. In FY04, evaluate positioning, navigation, and tracking prototype-integrated systems (Radio Frequency ranging (hardware and algorithms), an enhanced pedometer system, and network assisted GPS) in laboratory environments, and field test the components to evaluate potential use in military operations in urbanized terrain. In FY05, will integrate best performing components into a complete positioning, navigation and tracking system for complex and urban terrain, perform laboratory evaluation, and prepare for field testing of total system.	1285	1429	3455
- Command and Control (C2) On-The-Move Enabling Technologies: Investigate and mature technologies and decision aids that enable course of action (COA) generation and analysis, and enable C2 on-the-move. In FY03, evaluated a robust tool set optimized for the commander and staff informational needs, capable of operating in a distributed environment, using a variety of structured and unstructured data sources; investigated bi-directional links between these tools, intelligent agents, and other analytical or course of action tools to provide an integrated tool suite for the command and staff. Completed on-going technology efforts for transition of products and concepts into the Distributed Analysis Visualization Infrastructure for C4I (DaVinci) tool set. Performed collaborative COA generation and analysis and wargaming. Defined soldier network communications architecture to support Joint Tactical Radio System. In FY04, mature intelligent software agents for execution monitoring of 100 events and mature mobile adaptive computing capabilities for dispersed and on-the-move C2 operations. Identify tactical scenarios to evaluate decision aids and autonomous asset management tools, and provide an information management scheme based upon information exchange requirements for use in C2 functions in complex and urban terrain. In FY05, will mature tactical decision aids transitioned from the Army Research Laboratory, identify requirements for a distributed collaboration environment, and develop a networked software environment for decision tools to support C2 functions in complex and urban terrain.	6540	2920	1766
- Airborne Engineering Support: Conduct flight test evaluation for C4IEW systems.	482	519	664

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Networked Sensors for the Future Force: Prototype a Command and Control (C2) information infrastructure to prioritize information flow, based on user requirements and a standardized technique of tasking networked sensors and unmanned platforms. In FY03, designed C2 data framework definition/protocol, common tasking infrastructure and tasking language. In FY04, model the behavior of the C2 information system using Unified Modeling Language (UML) to demonstrate the flow of information between operators, the collaboration between networked subsystems, and the information exchange with unmanned platforms. Evaluate Common Object Request Broker Architecture (CORBA) as a means of information exchange using a publish/subscribe model. In FY05, will integrate the infrastructure and test in simulation against representation of unmanned networked sensors.	754	2450	1012
- Battle Information and Knowledge Exchange: Develop, test, and evaluate technologies to support interfacing and information exchange management between current Army, Joint, Coalition, and National information systems and FCS unit of action (UA)/unit of employment (UE). In FY04, analyze UE operational architectures developed by TRADOC and derive conceptual UE systems and technical architectures. In FY05, will develop interface and information exchange technologies compatible with the Global Information Grid Enterprise Service architecture and intelligent software agent technology to provide customized decision making information to the commander and the command staff.	0	395	1548
Small Business Innovative Research/Small Business Technology Transfer Programs	0	31	0
Totals	9061	7744	8445

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February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602782A - Command, Control, Communications Technology**	**H92**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H92	COMMUNICATIONS TECH	11744	10371	10159	10292	10097	10781	11006

A. Mission Description and Budget Item Justification: This project researches and applies advanced communications and network technologies to meet the network-centric battlefield needs of the Future Force, including the dismounted soldier. The strategy is based on leveraging and adapting commercial technology to the maximum extent possible and focusing research efforts on those areas not addressed elsewhere (e.g. mobile radio based infrastructures, security in narrowband environments, multiband on-the-move (OTM) transmit and receive antennas, adaptive protocols and low probability of interception/low probability of detection). The main effort of this project concentrates on Dynamic Readdressing and Management (DRAMA), Advanced Antennas, C4ISR OTM Demo, Soldier Radio Waveform, Networked Sensors for the Future Force (NSFF), Free space Optical /Near-Optical Communications Systems (FOCUS) and Spectrum Utilization Program for Enhanced Radio Network (SUPERNET). These programs focus on key areas of research include: Mobile wireless technologies for hostile mobile environments (FOCUS), and to meet the size, weight and power needs of the individual dismounted soldier (Soldier/Squad Level Comms); quality of service techniques that enable efficient, automatic bandwidth management for mobile, wireless networks (DRAMA); open systems designs for wideband networking waveforms; and mobile internet protocols operating across different networks; networking technologies that support unattended sensors with the ability to task unmanned sensors and transport data and images from them to data fusion points and tactical commanders (NSFF Comms); research realistic models for emerging communications systems in dynamic field environments and network protection technologies; research Spectrum efficient communication through application of emerging spectrum efficient technologies. It leverages a variety of efforts including the DARPA Sensor Information Technology (SensIT), NeXt Generation (XG) program as well as technologies matured by Army Research Laboratory. In addition, this project investigates tactical antenna technologies to reduce the number required, and increase the range and throughput; Ferroelectric materials for reduced cost wideband on-the-move phased array antennas; and technology to increase survivability by reducing the antenna visual signature.

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Communications-Electronics Research Development and Engineering Center (CERDEC), Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Dynamic Readdressing and Management (DRAMA): This effort investigates advanced networking protocols and management enabling, robust, on-the-move communications. In FY03, integrated dynamic addressing and IP multicast protocols into Multifunctional On-the-move Secure Adaptive Integrated Communications (MOSAIC) Ad-Hoc mobility protocol suite. Tested and evaluated advanced, automated, fault-isolation and root cause analysis network management software in the C4ISR On-the-Move Demonstration. In FY04, develop and demonstrate intelligent agent and mobile agent software network management tools for automated network control and management of traffic flow (voice, data, video) over the network. Develop and demonstrate the operational capabilities of dynamic addressing and network reconfiguration based upon the intelligent agent assessment of network dynamics. Capabilities will be demonstrated in both the MOSAIC Capstone demonstration and in the C3OTM Test bed demonstrations. In FY05, will evaluate enhanced Automated Net Management tools to include integration with net management agents, enhance intelligent agents and mobile agents to operate in wireless OTM tactical network environment, and scalability of dynamic readdressing and IP multicast protocols along with network management tools in large, tactical, OTM networks. Will research, analyze, and evaluate conceptual technical architecture/framework, advanced technologies, correlation algorithms, and dynamic database mapping techniques to support the Network Operation concept of an integrated Network Management, Information Assurance, and Information Dissemination Management capability.	3514	4014	4875

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Advanced Antennas: In FY03, investigated low profile antennas for ground/rotary wing aviation platforms leveraging component technologies from conformal body borne antenna efforts to provide low observable antennas covering the 225-2000MHz communication bands. Investigated the radio frequency (RF) radiation hazard safety assessments for the conformal body borne vest and helmet antennas to determine specific absorption rates (SAR) and safety compliance levels. In FY04, enhance, modify, and validate the modeling algorithms for antenna design to include the body borne, low profile and multiband antennas, platform antenna placement, cosite interference mitigation, and complete human RF Safety Assessment. In FY05, will investigate technologies for the Multi-beam Phased Array on the move antenna to enable multi-mission, simultaneous communications with the Global Broadcast System (GBS), Wide-band Gapfiller and MILSTAR satellite systems. Will investigate technologies for a family of Rotary Wing Aircraft multi-band antennas, lightweight body borne antennas (helmet and vest), and low-cost, reconfigurable, band-switched antennas to comply with JTRS communications requirements for various ground and air platforms.	2430	2100	1000
- Soldier/Squad Level Communications: In FY03, conducted performance trade-off and affordability analyses for Small Unit Operations Situation Awareness System (SUO SAS) tactical radio communications leading to the definition of JTRS Cluster 5 small form fit configuration and JTRS Software Communications Architecture (SCA)-compliant embedded network communications Soldier Radio Waveform for FCS Unit of Action (UA). In FY04, mature and integrate a miniaturized RF front-end (225-1000 MHz) and programmable radio modem with link-layer intranet processor to begin Soldier platform installation assessment and definition of functional interfaces.	2600	788	0
- Free Space Optical/Near-Optical Communications (FOCUS) and Sensors Networking: In FY03, extended FCS architecture to include maneuver layer interoperability to sensor communication relays and gateways under the Network Sensors for the Future Force (NSFF) effort, investigated Comm-Node effort for Terrestrial/Airborne System and investigated limited tracking using modulating retro reflector. Investigated advanced wireless network access control technologies. In FY04, refine sensor communications requirements; integrate protocols and waveforms into model hardware, commence design of subsystem including transmitter laser, tracking hardware, down conversion (extract data from laser) unit for FOCUS. In FY05, will conduct early laboratory experiments to establish performance against program goals and evaluation criteria for NSFF and conduct laboratory demonstration emphasizing subsystem investigation for FOCUS.	1752	3308	2067

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Adaptive Communications Networking: In FY05, will research cost effective, dynamic spectrum allocation devices and new wave forms using novel spectrum optimization techniques for reliable and secured high-bit-rate communication. Will develop the technologies, applications, and associated set of tools to define, implement, and manage network policies to provide all of the information necessary to effectively and efficiently build a Networked Common Operational Picture.	0	0	2217
- Portable Emergency Broadband System (PEBS): This one-year Congressional add investigated emerging wireless technology to enable rapidly deployable voice and data communications for connectivity between emergency personnel in the "hot zone" and to the command center. No additional funds are required to complete this effort.	1448	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	161	0
Totals	11744	10371	10159