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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology
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COST <i>(In Thousands)</i>	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	21597	19519	23314	20796	20772	21844	22876	Continuing	Continuing
AH92 Communications Technology	12327	11832	13490	11715	10827	11416	11807	Continuing	Continuing
A779 Command/Control (C2) and Platform Electronics Technology	6574	7687	9824	9081	9945	10428	11069	Continuing	Continuing
AJ06 Multimedia Tactical Adapter	2696	0	0	0	0	0	0	0	2696

A. Mission Description and Justification: This program element researches advanced communications technology and expands scientific knowledge for demonstration of command and control (C2) and electronic systems/subsystems. The intent is to continuously enhance and secure information transport and presentation by improving the command, control, and communication system (e.g. man-machine interface, mobility, security, capacity, safety, reliability, survivability) for all Army air and ground platforms, including the soldier. Commercial technologies are continuously investigated and leveraged whenever possible. Research includes investigation of an infrastructure that will allow timely distribution, display, and use of C2 data on Army platforms, making the global positioning system more robust and minimizing the registration errors and improving man-machine interfaces and decision aids for a digitized battlefield. These technologies will provide field commanders with the capability to communicate on-the-move (OTM) to and from virtually any place on earth in a seamless, secure, self organizing, self healing, networked fashion. In addition, parts of this research also are directed toward supporting the Joint Tactical Radio System (JTRS) concept. Technology in this PE also supports the objectives of the Future Combat Systems (FCS). The US Army Communications- Electronics Command (CECOM), Fort Monmouth, NJ, primarily manages this PE. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. Work in this program element is related to and fully coordinated with efforts in PE 0603006A (Command, Control and Communications Advanced Technology), PE 0602783A (Computer and Software Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and PE 0603734A (Military Engineering Advanced Technology).

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B. Program Change Summary	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
Previous President's Budget (<u>FY 2000/2001 PB</u>)	22359	19613	21010
Appropriated Value	22546	19613	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-187		
b. SBIR / STTR	-449		
c. Omnibus or Other Above Threshold Reductions		-51	
d. Below Threshold Reprogramming	-223		
e. Rescissions	-90	-43	
Adjustments to Budget Years Since (<u>FY 2000/2001 PB</u>)			+2304
Current Budget Submit (<u>FY 2001 PB</u>)	21597	19519	23314

Change Summary Explanation: Funding increase in FY 2001 due to reprogramming for higher priority activities (e.g. information assurance).

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BUDGET ACTIVITY 2 - Applied Research			PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology				PROJECT AH92		
COST (In Thousands)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH92 Communications Technology	12327	11832	13490	11715	10827	11416	11807	Continuing	Continuing
<p><u>Mission Description and Justification:</u> The focus of this project is to research communications and network technologies required to meet the network centric battlefield needs of the FCS, the dismounted soldier, Army 2010 and beyond. The strategy is based on leveraging and adapting commercial technology to the maximum extent possible and focusing development efforts on those areas not addressed by the commercial industry (e.g. mobile radio based infrastructures and backbones, security in narrowband environments, multiband on-the-move transmit and receive antennas, adaptive protocols, low probability of interception/low probability of detection). Maximum use is made of the Dual Use Science & Technology program. Key areas of research include: adaptation of Asynchronous Transfer Mode (ATM) technology for hostile mobile environments; quality of service techniques for mobile wireless internet protocol (IP) and IP/ATM-based networks; the adaptation and interface with commercial personal communications technology, and development of realistic models for emerging communications services systems in dynamic field environments. In addition, this project investigates tactical antenna technologies; photonic controls and ferroelectric materials for phased array antennas; and mobile internet protocols operating across different networks. These efforts directly support the information systems and defense technology objectives outlined in the Defense Technology Area Plan.</p> <p>FY 1999 Accomplishments:</p> <ul style="list-style-type: none"> • 3451 – Designed and documented analytic and computer models, selections and detailed specifications of dynamic resource allocation based mobile routing, protocols, controls and reconfiguration algorithms for advanced mobile wireless mixed multimedia systems using airborne base stations. <ul style="list-style-type: none"> – Designed and documented enhanced IP multicasting, IP over ATM multicasting, and ATM multicasting protocols for IP and ATM based mobile backbone and mobile subscriber networks in support of wireless mobile multimedia subscribers. – Integrated initial intelligent, rule-based modules with commercial off-the-shelf (COTS) network node manager and conducted laboratory prototype testing. – Tested three JTRS prototype antennas and started development of JTRS multiband mobile antenna in the 30 to 450 MHz frequency bands. – Conducted a cosite performance test and evaluation of very high frequency (VHF) multiplexer. – Conducted proof of principle demo for a single loop for the soldier Body Borne antenna. – Finalized a technical approach, fabricated and tested the mechanical inertial positioner and antenna for the super high frequency (SHF) communications on-the-move (COTM) antenna. • 3362 – Completed breadboard development of the integrated photonic control system for single/multi-panel phased arrays. <ul style="list-style-type: none"> – Investigated and began development of ultra high frequency (UHF) radio frequency multiplexer and wideband power amplifier technologies to reduce interference from co-located radios, reduce noise induced bit errors, and improve radio range performance. 									
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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology	PROJECT AH92
<p>- Installed and integrated Defense Advanced Research Projects Agency (DARPA) sponsored Simulation and Evaluation on Adaptive Mobile Large Scale Network Systems (SEAMLESS) hardware and software that has provided a powerful and flexible simulation environment to enable the conduct of experiments and evaluation of mobile communications technologies.</p> <p>FY 1999 Accomplishments: (continued)</p> <ul style="list-style-type: none"> • 2114 - Implemented emerging technologies to demonstrate advanced system concepts for future generation dismounted soldier personal communications. Tested and evaluated dismounted soldier personal communications technologies in laboratory test and field experiment environments under representative terrain conditions, and analyzed vulnerabilities to hostile communication threats. <ul style="list-style-type: none"> - Implemented advanced wireless mobile networking protocols on commercially available, portable computing hosts and radio platforms to demonstrate peer-to-peer and multi-hop packet relay communications networking capabilities. - Generated advanced future generation dismounted soldier personal communications by leveraging DARPA Small Unit Operations Situation Awareness System (SUO SAS) Program. • 3400 - Generated protection techniques for the tactical internet expanding the effort to address intrusion detection and host level protection. <p>Total 12327</p> <p>FY 2000 Planned Program:</p> <ul style="list-style-type: none"> • 4786 - Integrate, assess, prototype, demonstrate in testbed and document enhanced dynamic resource allocation based mobile routing, protocols, controls and reconfiguration algorithms for advanced mobile wireless mixed multimedia systems using airborne base stations. <ul style="list-style-type: none"> - Integrate, assess, prototype, demonstrate in testbed and document enhanced IP multicasting, IP over ATM multicasting protocols for IP and ATM based mobile backbone and mobile subscriber networks in support of wireless mobile multimedia subscribers. - Design advanced intelligent modules that inter-operate with fielded network node managers and conduct field testing. - Design UHF band for the Body Borne antenna concept/technologies in support of potential dismounted applications. - Generate an extremely high frequency (EHF) OTM satellite communications (SATCOM) antenna self-steering positioner/tracker. - Test JTRS multiband OTM antenna prototypes. - Complete design and initial development of a communications on-the-move phased array antenna using reduced cost techniques . - Model and simulate photo injection pin diode switch off-state capacitance effects upon the voltage standing wave ration (VSWR) performance of a structure tuned VHF folded monopole antenna. • 1748 -Transition virtual simulations and performance transition models to Common Modeling Environment (CME) to facilitate model enhancements for evolving digitized Army communications (FCS and Army 2010). • 5082 - Generate protection techniques for the tactical internet with emphasis on malicious code detection and eradication. <ul style="list-style-type: none"> - Generate future generation dismounted soldier personal communications to provide soldier alert functional requirements, assess situation awareness applications, and acquire advanced development prototypes for engineering analysis and system test and evaluation under DARPA SUO SAS Program. Complete development of technology transition strategies to JTRS ground forces domain (Handheld and Dismounted Warrior configurations). 		
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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology	PROJECT AH92
<p align="center">- Test and evaluate advanced wireless mobile networking protocols for dismounted soldier personal communications using laboratory test and field experiment environments. Implement networking protocols in computer modeling and simulation environment for evaluation of system scalability and performance issues.</p>		
<p>FY 2000 Planned Program: (continued)</p>		
<p>- Analyze and evaluate design and engineering approaches for reducing power, weight and size requirements while improving performance of future generation dismounted soldier personal communications.</p>		
<p>- Assess, characterize, and mature DARPA Global Mobile (GloMo) network protocol routing algorithms.</p>		
•	216	- Small Business Innovation Research/Small Business Technology Transfer Programs.
Total	11832	
<p>FY 2001 Planned Program:</p>		
•	5430	- Conduct and document detailed technical assessment and high level design of mobile agent based dynamic addressing algorithms and protocols, and dynamic network constitution and reconstitution algorithms and protocols for tactical survivable dynamic mixed networks.
<p>- Design a distributed network management architecture, which utilizes intelligent ‘super agents’ for semi-automated end-to-end network management.</p>		
<p>- Exhibit capability of JTRS compatible OTM multiband antenna, and begin development of expanded bandwidth OTM antenna (2 GHz).</p>		
<p>- Complete development and integration of communications on-the-move Phased Array Antenna.</p>		
•	1972	- Complete transition to common modeling environment (CME) and demonstrate next-generation simulation aids for initialization, management and data reduction.
<p>- Complete development, fabricate and demonstrate EHF positioner/tracker for EHF OTM low profile antenna.</p>		
•	6088	- Evolve protection techniques for the tactical internet with focus on automated security management.
<p>- Test and evaluate DARPA SUO SAS advanced development prototypes in laboratory test and computer modeling and simulation environments.</p>		
<p>- Demonstrate future generation dismounted soldier communications advanced system concepts in field experiment.</p>		
<p>- Evaluate engineering approaches for implementing second and third generation personal communication system (PCS) air interface standards in DARPA SUO SAS advanced development prototypes.</p>		
<p>- Investigate open system architecture hardware/software design requirements for future generation dismounted soldier communications to ensure JTRS compliance.</p>		
<p>- Analyze future generation dismounted soldier communications and mobile computing system advanced development prototypes to reduce power, weight and size requirements while improving performance of dismounted soldier personal communications.</p>		
<p>- Integrate DARPA GloMo routing algorithms into the Multifunctional OTM Secure Adaptive Integrated Communications (MOSAIC) ATD.</p>		
Total	13490	

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)							DATE February 2000			
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology				PROJECT A779		
COST (In Thousands)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost	
A779 Command/Control (C2) and Platform Electronics Technology	6574	7687	9824	9081	9945	10428	11069	Continuing	Continuing	
<p>Mission Description and Justification: The objective of this project is to explore new concepts and techniques in command and control (C2) and platform electronics integration to achieve new and enhanced military functional capabilities. Emphasis is on mission planning, rehearsal, execution and monitoring; precision navigation and landing; C2; and integration with the evolving digital battlefield. New enabling technologies that support the current thrusts also are explored, such as advanced controls and displays, multi-modal interactive technology, 4D visualization, decision aids and tactical planning tools, data transfer, distributed data bases, advanced open system architectures, visionics technology, and integration concepts which contribute to digitization of the battlefield and provide C2 on-the-move. The project serves as a direct technology feed to advanced warfighting experiments (AWEs), ATDs, advanced concept technology demonstrations (ACTDs) and defense technology objectives (DTOs), including the following: Battlespace C2 (BC2) ATD; Logistics C2 (Log C2) ATD; Command Post XXI (CP XXI) ATD; Consistent Battlespace Understanding DTO; Forecasting, Planning, and Resource Allocation DTO; Integrated Force Management DTO, Future Command Post Technologies DTO; and Forecasting, Planning and Resource Allocation DTO.</p> <p>FY 1999 Accomplishments:</p> <ul style="list-style-type: none"> • 1188 – Generated models and simulated battlespace tactical navigation (BTN) system architecture concepts that provide robust and precise platform positioning. <ul style="list-style-type: none"> – Researched and evaluated Global Positioning System (GPS) pseudolites, anti-jam GPS, video/imagery registration and small, low cost self-contained sensor technologies. The system concept will be scalable in that it will support multiple platform types at all echelons. – Generated prototype designs for the evaluation of BTN concepts. • 4136 – Developed and demonstrated battle planning and visualization technology that integrates multiple existing DoD systems with emerging planning and user interface technologies to enhance all-echelon battlespace awareness down to the individual soldier. This battle planning and visualization technology will provide real-time/ near real-time hyperlinks to multiple battlefield information sources and innovatively display and interact with commanders and staff to accelerate and improve the commander’s nine-step planning process. Completed and transitioned the collaboration infrastructure to the BC2 ATD. <ul style="list-style-type: none"> – Tested and evaluated forecasting, continuous planning/scheduling, interactive 3-D exploration of the battlespace, speech/natural language interaction and other advanced capabilities in battlelab/field experiments. • 750 – Specified and generated a modeling and simulation/stimulation (MSS) environment to support man-in-the-loop evaluation and warfighter training for advanced C2 protect and attack (C2 P/A) capabilities. Evaluated the effects of C2 attack on tactical internet operations. • 500 – Improved modeling environment to support analysis of C4ISR. Improved execution time of simulation runs. Developed low fidelity quick turn around modeling capability. 										
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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology	PROJECT A779
Total	6574	
FY 2000 Planned Program:		
•	1049 – Evaluate GPS enhancement technologies (e.g., advanced filters, low power clocks, advanced antennas) and prepare for the demonstration of these technologies in air and ground platforms. Conclude simulation of navigation system/database registration error minimization.	
•	4881 – Develop a common operating environment (COE) compliant 3D visualization capability for the First Digitized Division. Develop a next generation graphics terrain engine for future battlespace visualization applications. – Develop course-of-action (COA) development enhancements to include optimization routines and forecasting. Transition to the BC2 ATD and the CP XXI ATD the initial increment of mobile/autonomous intelligent agents to support hasty planning and COA analysis. – Integrate voice recognition and natural language processing (NLP) into the collaboration environment. Develop techniques to speed up the donor enrollment process for speech recognition.	
•	701 – Integrate a C2 attack simulator with CECOM’s digital integrated laboratory and core distributed interactive simulation (DIS) facilities (CDFs). Conduct a distributed simulation to support development and training for integrated C2P capabilities.	
•	482 – Develop future TOC information and process models in support of the CP XXI ATD.	
•	456 – Develop an experimentation plan and testbed environment to evaluate future C2 needs of tactical commanders from battalion through platoon.	
•	118 – Small Business Innovation Research/Small Business Technology Transfer Programs.	
Total	7687	
FY 2001 Planned Program:		
•	2050 – Develop and demonstrate a real-time prototype of the navigation sensor/database error registration minimization algorithm.	
•	2294 – Evaluate improved C2P capabilities against each other in a virtual environment to support development and training for C2P capabilities. Integrate brigade and above communications models. Conduct a distributed simulation using live troops and multiple sites to support development and training for integrated C2P capabilities.	
•	500 – Complete transition of all virtual and systems performance mission planning/training models to high level architecture (HLA) and provide a leave behind capability that supports early warfighter evaluation.	
•	1800 – Conduct laboratory and field experiments with candidate collaborative planning, tactical display, and man-machine interface concepts, built within a portable testbed. Concepts will show proof-of-principle improvement in battlespace situation awareness and decision-making processes for commanders from battalion to squad levels. Concepts will be evaluated toward feasible solutions for smaller, lighter, energy efficient, and software reprogrammable applications.	
•	2653 – Develop an on-line analytical processing information mining prototype that queries the maneuver data in the Joint Common Data Base for decision support. Develop intelligent agent applications.	
•	527 – Flight test developmental C4IEW systems.	
Total	9824	
Project A779		
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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)							DATE February 2000			
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602782A Command, Control, Communications Technology				PROJECT AJ06		
COST (In Thousands)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost	
AJ06 Multimedia Tactical Adapter	2696	0	0	0	0	0	0	0	2696	
<p><u>Mission Description and Justification:</u> The objective of this one year Congressional special interest project is to investigate methods that provide a seamless interface from standards/commercial based communications products to the Warfighters Information Network (WIN). The Multimedia Tactical Adapter program will develop an operational prototype to address the interoperability of voice, data and video over a single military communications infrastructure. It will provide the soldier with state of the art technology, while adapting commercial technology for use in the tactical environment. The Multimedia Tactical Adapter program will develop a means to a more reliable, efficient, and cost effective multimedia communications system. A Multimedia Inter-Working Functions (IWF) will be developed to provide gateway and gatekeeper functions for various standards-based (H320 and H323) interoperability technologies. Methods to control available bandwidth usage for these technologies will be investigated, as well as defining and implementing a scheme to allow for preemption and prioritization of the users multimedia communications. This effort will give the warfighter an enhanced capability that will save setup time, prioritize usage, and conserve precious tactical bandwidth based upon network traffic.</p> <p>FY 1999 Accomplishments:</p> <ul style="list-style-type: none"> • 848 -Completed investigation of approaches to integrate and control various standards based video teleconferencing techniques into tactical communications networks. • 1848 -Completed design and development of the appropriate hardware and software required prototypes to interface and control Multimedia Communications on tactical Networks. <p>Total 2696</p> <p>FY 2000 Planned Program: Project not funded in FY 2000</p> <p>FY 2001 Planned Program: Project not funded in FY 2001</p>										
Project AJ06			Page 8 of 8 Pages				Exhibit R-2A (PE 0602782A)			