ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2005

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603008A - Electronic Warfare Advanced Technology

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		58181	57662	45322	48050	42142	44231	48733	47083
TR1	TAC C4 TECHNOLOGY INT	12391	17025	22028	24407	15780	15994	16057	14168
TR2	DIGITAL BATTLEFLD COMM	36448	33352	23294	23643	26362	28237	32676	32915
TR8	C3 DEMONSTRATIONS (CA)	9342	7285	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The goal of this PE is to provide enabling technologies for a secure, mobile, wireless network that will operate reliably in diverse and complex terrain, in all environments for the Army's Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. Technologies will be matured and demonstrated to address this challenge with distributed, mobile, secure, self-organizing communications networks. A key objective is to demonstrate seamlessly integrated communications technologies across all network tiers, ranging from unattended networks and sensors through maneuver elements and airborne/space assets. To accomplish the goal this PE will investigate and leverage external communication technologies and combine technology options in a series of Command, Control, Communications, and Computers Intelligence, Surveillance and Reconnaissance (C4ISR) On-The-Move (OTM) experiments to measure the battlefield effectiveness for Future Combat Systems (FCS) and the Future Force. This PE also provides: protection technologies for tactical wireless networks against modern network attacks; smart communication technologies to network and control unmanned systems anywhere on the battlefield enabling timely sensor-decider-engagement linkage to defeat critical targets; advanced antenna technologies for greater communications mobility, range and throughput; and automated network management aids. Adaptive Joint C4ISR Node (AJCN) Advanced Concept Technology Demonstrations (ACTD) makes a significant contribution to this program by providing 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 force spread over wide areas. Several tasks are conducted in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the other Services. Project TR8 funds Congressional special interest efforts.

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 contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0602782A (Command, Control, Communications Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology). Work is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2005)	41760	47260	49687
Current Budget (FY 2006/2007 PB)	57662	45322	48050
Total Adjustments	15902	-1938	-1637
Net of Program/Database Changes			
Congressional Program Reductions	-1180		
Congressional Rescissions			
Congressional Increases	18600		
Reprogrammings			
SBIR/STTR Transfer	-1518		
Adjustments to Budget Years		-1938	-1637

Change Summary Explanation:

Three FY05 Congressional adds totaling $18600 were added to the PE.

FY05 Congressional adds with no R-2A:
($10549) Applied Communications and Information Networking (ACIN) Program, Project TR2: The purpose of this one year Congressional add is to fund the Applied Communications and Information Networking Program. No additional funding is required to complete this project.

($1918) Portable Emergency Broadband Systems (PEBS), Project TR8: The purpose of this one year Congressional add is to mature an in-building position location capability and extend the range to outdoor networks with a reachback capability. No additional funds are required to complete this effort.

($5370) Networking Environment for C3 Mobile Services (NECMS), Project TR8: The purpose of this one year Congressional add is to mature instrumented nodes for data collection, data transmission, and data storage/analysis. This project also matures an instrumented “war room” capability for network environment demonstration, testing, monitoring, and control. No additional funds are required to complete this project.

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February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**	**TR1**

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
TR1	TAC C4 TECHNOLOGY INT	12391	17025	22028	24407	15780	15994	16057	14168

A. Mission Description and Budget Item Justification: This project matures and demonstrates key communications, mobile networking, and information assurance technologies for the dismounted Soldier, future combat networks, embedded network communications, and the Future Force. These technologies will enable commanders and individual soldiers to survive and fight by providing secure, reliable, mobile communications network solutions that function in complex and diverse terrain. The Joint Tactical Radio System (JTRS) Squad-Level Communications program matures and demonstrates communications technology to provide a JTRS Software Communications Architecture (SCA) Soldier Radio Waveform (SRW). This effort addresses communications connectivity and network interoperability between dismounted Soldiers and FCS manned and unmanned systems under the size, weight, power consumption, and safety constraints of embedded JTRS Cluster 5 Small Form Fit (SFF) platform environments. Advanced Antennas matures a family of efficient and affordable antennas across a wide spectrum (30 MHz to 44 GHz) for increased throughput and range. This will include a robust and dynamic reachback capability to enable Global Information Grid (GIG) connectivity. The Tactical Wireless Network Assurance (TWNA) program provides network protection for mobile wireless ad hoc networks and provides safeguards against modern network attacks. It provides network assurance through enhanced net access controls. It also focuses on wireless intrusion detection to detect unauthorized access attempts. The program matures and demonstrates mobile data security solutions and protection of secure database elements. TWNA leverages and matures a variety of security efforts from DARPA and the Army Research Lab (ARL). The Multi-Dimensional Assured, Robust, Communications for an OTM (MARCON-I) Network effort matures and integrates directional networking technologies that address the barriers of insufficient bandwidth and limited spectrum to provide the warfighter with a robust, efficient, high capacity Anti-Jam Low Probability of Intercept (AJ/LPI) directional communications network. The Communications Planner for Operational and Simulation Effects with Realism (COMPOSER) program will mature software tools that enable the Warfighter to dynamically plan, predict and visualize network communications performance due to maneuver and environmental effects faster than real time (virtual). COMPOSER will provide an open and scalable communications planning solution for dynamic OTM networks, providing the commander with the ability to ensure full network connectivity throughout the battle.

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 Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
- JTRS Squad-Level Communications: In FY04, completed implementation of lightweight Core Framework and integration with Soldier Radio Waveform (SRW) software application; developed software programmable modem and baseband processor with radio frequency agile front-end prototype environment and validated SRW design in laboratory and field environments. In FY05, complete SRW software application development, integrate in prototyping environment to validate dismounted Soldier voice and data communications services, and demonstrate interoperability with manned and unmanned systems through implementation of 2-independent transceiver gateway configuration; interface SRW with JTRS Cluster 1 heterogeneous network software application core and implement extensions to support FCS Unmanned Aerial Vehicle and Unmanned Ground Vehicle functions; release SRW application software to initiate porting to JTRS Cluster 1. In FY06, will develop SRW enhancements to validate dismounted Soldier voice and data communications services with single transceiver channel gateway configuration; will release SRW application software to initiate porting to JTRS Cluster 5, will participate in Future Force Warrior ATD and FCS Unit of Action (UA) experimentation. In FY07, will finalize SRW effort; will complete porting to JTRS Clusters 1 and 5; and will transition the SRW to the JTRS Joint Program Office.	1500	8550	11000	10000
- Advanced Antennas: In FY04, completed testing of Phase 2 body-wearable prototypes, Phase 1 3-port multiband prototypes and Phase 1 low profile prototypes. In FY05, perform technical evaluation and integration for Multiband Phased Array antenna technologies to maintain OTM SATCOM links over rolling terrain; mature the body-wearable, aviation and low profile antennas to improve performance and conduct Radio Frequency (RF) performance; conduct RF safety evaluation. In FY06, will complete development of body-wearable, low profile and rotary wing aviation antennas.	1000	2866	2800	0

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
- Tactical Wireless Network Assurance (TWNA): In FY05, mature and evaluate Tactical Public Key (TPK) enabling technologies to ensure secure user access to platforms and services; mature and test wireless intrusion detection technologies to detect cyber attacks against distributed mobile hosts and networks; mature and test database access control and authentication of mobile data technologies that restrict unauthorized modification to software on mobile platforms. In FY06, will provide intrusion detection algorithms for FCS UA to deter intruders and recognize attempts to attack/exploit Mobile Ad-hoc Networks (MANETs); will mature and test TPK enabling capabilities in a simulated MANET environment; will mature and perform testing of adaptive security management technologies that effectively reduce the time needed by a user to detect, react and respond to attacks/exploits within mobile networks. In FY07, will mature intrusion detection system framework and integrate with security management capability; will mature and perform testing of adaptive/distributive security management technologies that allow rapid response to intrusions within MANETs; will mature and test mobile agent technologies that restrict unauthorized modification to mobile code used on MANET platforms; will mature certificate revocation capability within TPK framework to reduce impact of security overhead on MANETs; will provide demonstration encapsulating matured wireless security capabilities.	450	2795	4000	4865
- Multi-Dimensional Assured, Robust, Comms for OTM Network (MARCON-I): In FY04, completed architecture design trades and technology analysis for directional networking; conducted feasibility studies for link selection. In FY05, perform system design and development of link selection and directional networking technologies; conduct Modeling & Simulation (M&S) effort to support link selection and directional networking development efforts. In FY06, will perform initial implementation and controlled environment testing of link selection algorithms; will conduct M&S with initial performance results of the algorithms. In FY07, will mature and demonstrate link selection technologies in an outdoor/operationally relevant environment on representative platforms to assess protocol maturity; will perform M&S and compare M&S results to hardware demonstration results to verify completion of protocol development.	500	2814	3952	8698
- Communications Planner for Operational and Simulation Effects with Realism (COMPOSER): In FY06, will mature Communications Effects Simulator with predicted Network Planner and a dynamic 2D/3D visualization, then integrate the tools into the Battle Lab Collaborative Simulation Environment and Modeling Architecture for Technology and Research Experimentation. In FY07, will integrate COMPOSER technologies with applications from the Project Manger Warfighter Information Network-Tactical (PM WIN-T) and Program Manager Unit of Action Network Systems Integration (PM UA NSI) programs.	0	0	276	844

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
- Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC) ATD: In FY04, performed integration of all MOSAIC networking and Quality of Service (QoS) technologies; incorporated MOSAIC networking and QoS technologies into the Fort Dix C4ISR Experiment for validation of MOSAIC automatic network initialization/configuration, re-configuration and ad-hoc mobility exit criteria; integrated MOSAIC QoS technologies into a high assurance internet protocol encryption compliant networking solution for transitionability.	6941	0	0	0
- On-The-Move (OTM) Satellite Communications (SATCOM): In FY04, conducted the Technology Readiness Level (TRL) 6 demonstration of the Wideband OTM blockage mitigation capability and transitioned to Warfighter Information Network-Tactical (WIN-T) and High-Capacity Communications Capability (HC3); integrated Wideband OTM capability into the FY04 C4ISR OTM experiment; matured Milstar OTM blockage mitigation approach for networks of terminals.	2000	0	0	0
Totals	12391	17025	22028	24407

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**	**TR2**

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
TR2	DIGITAL BATTLEFLD COMM	36448	33352	23294	23643	26362	28237	32676	32915

A. Mission Description and Budget Item Justification: This project matures and demonstrates an integrated Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) On-The-Move (OTM) (sensor to shooter) capability for the Future Force, to include Future Combat Systems (FCS), and where feasible, exploits opportunities to enhance Current Force capabilities. It seeks to provide the ability to move large amounts of data over extended ranges with minimal infrastructure, tying in networks of unattended sensor fields. The efforts here concentrate on two major goals: provide a series of technology demonstrations of C4ISR capabilities to significantly reduce the risk associated with the networks of networks approach to the FCS integrated on-the-move lethal force structure; and 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. Several key programs support these goals. The C4ISR OTM test bed provides a venue for the experimentation of emerging C4ISR technologies and architectures that will increase the survivability and lethality of Future Force platforms. The experiments will expand both the functionality and complexity of the integrated C4ISR system-of-systems, including the participation of Joint, Current, and dismounted elements experiments align with Army Transformation critical objectives for C4ISR, and exploit opportunities to enhance Current Force (e.g. Stryker Brigade Combat Team) modernization. Adaptive Joint C4ISR Node (AJCN) ACTD for mobile airborne communication nodes seeks to provide assured communications for the Unit of Action (UA) and also has the capability to perform signals intelligence, information warfare and electronic attack missions simultaneously. Network Sensors for the Future Force (NSFF) Communications will enable adaptable, self healing, low power, integrated communication nodes for unmanned sensor networks. The Multi-Dimensional Assured, Robust, Communications for an OTM Network (MARCONi) will integrate directional networking protocols with prototype hardware platforms in support of Technology Readiness Level (TRL) 6 field testing. The Command, Control and Communications (C3) OTM Network Mining matures and demonstrates network technologies that exploit and fuze existing data on the network to enable critical combat functions such as countermine/counter Improvised Explosive Devices (IED), rapid Battle Damage Assessment (BDA), targeting/retargeting, and Combat Identification (CID). Radio Enabling Technologies and Nextgen Applications (RETNA) matures and demonstrates affordable radio components and enabling technologies to improve Cluster 1 Joint Tactical Radio range, throughput and reliability performance.

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 Army Research, Development and Engineering Command, Communications-Electronics Research Development and Engineering Center (CERDEC), Fort Monmouth, NJ, and the Army Research Laboratory, Adelphi, MD.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
- C4ISR On-The-Move Experiment: In FY04, conducted live Joint experiments with integrated C4ISR technologies focused on intelligence surveillance and reconnaissance fusion, a common operating picture, weapons-target pairing, combat identification, and rapid battle damage assessment; evaluated the feasibility of vertical maneuver concepts equipped with emerging Future Force C4ISR technologies. In FY05, conduct experiments to mature concepts and evaluate risk areas from the FCS program to support program milestone decisions and applicability of technologies/systems to meet the acceleration of future force C4ISR concepts to current force requirements; integrate a surrogate (Future Force) C4ISR architectural framework to examine battle command, communications, and intelligence, reconnaissance and surveillance interdependencies integrating Army Science and Technology (S&T), DARPA, National Laboratory, Joint Service and Coalition capabilities. In FY06, will continue to mature and refine the C4ISR framework for system of systems trial experiments, and support TRADOC Army Concept Development Experiment Project priorities; will exercise first instances of the emerging Army Battle Command capabilities to inform and establish a baseline that confirms the level of interoperability and connectivity available for UA, Unit of Employment, Joint, coalition, national and sustaining base C4ISR information assets. In FY07, will revise experimentation, planning and lessons learned analyses to support the establishment of multiple C4ISR baselines for system interdependencies and integration investigation from which capability gaps can be surfaced and mitigated; will demonstrate application of network mining and its tools and associated technologies within the C4ISR architecture.	11000	10000	13500	12800

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
- Adaptive Joint C4ISR Node (AJCN) ATCD: In FY04, developed prototype payload and demonstrated its functional capability; installed the prototype payload on an Army aircraft and conducted flight demonstration; addressed top-level metrics by performing an initial capability in four functional areas including Communications, Signals Intelligence, Electronic Warfare, and Information Operations; performed Initial Joint Military Utility Assessment (IJMUA) during the flight-testing. In FY05, mature payload functionalities, complete payload integration, and demonstrate three payloads; install payloads and antennas on the Air Force's Paul Revere and two Army Hunter aircrafts; conduct flight tests to verify operation of payload and AJCN network at first JMUA exercise. In FY06, will conduct second JMUA exercise and finalize CONOPS, TTPs, training package, and recommendations to Doctrine, Organization, Training, Materiel, Logistics, Personnel and Facilities; will refine system performance requirements; will conduct Extended User Evaluation (EUE) and provide sustainment support for leave behind equipment. In FY07, will conduct porting of software waveforms to the payloads as they become available from JTRS Joint Program Office (JPO); will continue with EUE and sustainment for leave behind equipment.	10000	8850	1950	1120
- Networked Sensors for the Future Force (NSFF) Communications: In FY04, demonstrated a 10 node robust, self-healing, jam-resistant, Low Probability of Intercept/ Low Probability of Detection, energy-efficient network with networking protocols for internode unmanned ground sensor communications with a range of 200 meters and sensor to gateway connectivity to 3 kilometers in flat open terrain; matured low cost, JTRS software communications architecture soldier radio waveform sensor communications breadboard models. In FY05, simulate a 100 node network to determine large sensor network effectiveness; integrate and test a 50-node network to demonstrate sensor network capabilities and to validate the simulation; demonstrate communications range 200-400m and sensor connectivity of 3-10km depending on sensor type and terrain.	1700	3962	0	0
- Multi-Dimensional Assured, Robust, Communications for an OTM Network (MARCONi): In FY06, will mature directional networking technologies and conduct initial functionality testing. In FY07, will conduct interim demonstration of directional networking technologies; assess protocol maturity and compare test results obtained against expect performance outputs from M&S studies.	0	0	2872	2680
- C3OTM Network Mining: In FY06, will mature algorithms, intelligent agent technologies and decision aids that exploit individual and combined network sources to enhance countermine/counter IED and rapid BDA; will validate methodologies in the context of the C4ISR OTM experimentation. In FY07, will evaluate networked target identification and situation awareness for improved CID capability by testing and demonstrating at the C4ISR OTM experimentation.	0	0	3865	5311

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
- Radio Enabling Nextgen Applications (RETNA): In FY06, will identify, evaluate, and adapt emerging commercial technologies for military application; will mature a pre-MIL-qualified Wideband Power Amplifier (WBPA) Line Replacement Unit (LRU) and test in a JTRS Cluster 1 test bed, to enhance current range and link closure performance for ground applications; apply passive Graphite Foam (PGF) technology, used to dissipate heat from Cluster 1 thermal hot spots to a selected Cluster 1 LRU. In FY07, will mature and transition a Form, Fit, and Function military-qualified WBPA LRU with PGF to the JTRS Cluster 1 Program for its Low Rate Initial Production (LRIP); will mature Rotary Wing (RW) Electro Magnetic Interference (EMI) filter to reduce size, weight, and power, ensuring the required filter performance compliance and focusing on miniaturization.	0	0	1107	1732
- Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC) ATD: In FY04, conducted ATD exit demonstration with Quality of Service (QoS), ad-hoc mobility, and advantaged node technologies consisting of 22 nodes covering 20 square miles with MOSAIC ad hoc mobility, heterogeneous QoS, and advantaged node technologies hosted on surrogate JTRS radio/router platforms, commercial radios/routers, satellite communications terminals, and an airborne node; demonstrated multiple Internet Protocol applications to show mixed traffic types (voice, video, and data) sharing the same network/resources.	4118	0	0	0
- Applied Communications & Information Networking (ACIN): In FY04, this one year Congressional add matured and demonstrated emerging commercial communications technologies in the areas of Information Assurance, Software Defined Radio, Modeling and Simulation, Subterranean Communications, and Ultra Wideband Amplifier. No additional funds were required to complete this effort.	9630	0	0	0
- Applied Communications & Information Networking (ACIN): In FY05, this one year Congressional add is to mature and demonstrate commercial communications technologies in the areas of high power wideband amplifiers, Ku/Ka-Band SATCOM subsystem transceiver modules, predictive network planning, IPv4 to IPv6 conversion, and software defined radios modeling and simulation. No additional funds are required to complete this effort.	0	10540	0	0
Totals	36448	33352	23294	23643