

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced technology development

0603008A - Electronic Warfare Advanced Technology

COST (In Thousands)	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	58185	60515	44022	37663	37780	43456	41175
TR1 TAC C4 TECHNOLOGY INT	17567	21714	22319	13993	13215	16277	14365
TR2 DIGITAL BATTLEFLD COMM	33336	28845	21703	23670	24565	27179	26810
TR8 C3 DEMONSTRATIONS (CA)	7282	9956	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 System (FCS) Brigade Combat Team (BCT) 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. 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.

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	FY 2005	FY 2006	FY 2007
<u>B. Program Change Summary</u>			
Previous President's Budget (FY 2006)	57662	45322	48050
Current BES/President's Budget (FY 2007)	58185	60515	44022
Total Adjustments	523	15193	-4028
Congressional Program Reductions		-792	
Congressional Rescissions		-615	
Congressional Increases		16600	
Reprogrammings	523		
SBIR/STTR Transfer			
Adjustments to Budget Years			-4028

Seven FY06 Congressional adds totaling \$16600 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):

(\$1500) Advanced Antenna Technologies
 (\$6500) Applied Communications and Information Networking (ACIN)
 (\$1700) Joint Unified Maritime Protection System (JUMPS)
 (\$2500) Portable and Mobile Emergency Broadband System
 (\$1700) Rock Drill Battlefield Planning Tool
 (\$1700) Soldier/Sensor Intrusion Detection
 (\$1000) TACOM Software Tools Supporting Structural Assessment of Wheeled Vehicles

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BUDGET ACTIVITY 3 - Advanced technology development			PE NUMBER AND TITLE 0603008A - Electronic Warfare Advanced Technology			PROJECT TR1	
COST (In Thousands)	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	17567	21714	22319	13993	13215	16277	14365
<p>A. Mission Description and Budget Item Justification: This project matures and demonstrates key communications, mobile networking, and information assurance technologies for the dismounted Soldier, 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 Future Combat System (FCS) Brigade Combat Team (BCT) manned and unmanned systems under the size, weight, power consumption, and safety constraints of embedded JTRS Cluster 5 Small Form Fit (SFF) platform environments. Antenna Technologies will develop a family of mission tailored antennas to provide higher gains to sustain Wideband Network Waveform (WNW) link connectivities, reduce visual signature on ground platforms, increase resistance to damage from ballistic debris strikes, reduce the number of platform antennas while increasing their ability to support multiple waveforms and integrate conformal, lightweight antennas within the soldiers' protective combat wear for suppressed equipment visual signatures, improved mobility and improved survivability. 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 Proactive Integrated Link Selection for Network Robustness effort matures and integrates technologies to provide automatic link selection that address challenge of limited network connectivity due to an inability to optimally use all available communication link types. 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.</p> <p>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.</p>							
Accomplishments/Planned Program				<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>	
- JTRS Squad-Level Communications: In FY05, completed development of Software Radio Waveform (SRW) software for Non-Line of Site Launch System and Dismounted Soldier applications; fabricated and assembled 102 software defined radio(SDR) prototypes supporting Radio Frequency (RF) operation across 225-960 MHz band; validated communications system design demonstrating interoperability between manned and unmanned systems; characterized system performance of integrated SRW voice and data network communications services; demonstrated a 85 node SDR network in mounted, dismounted and unattended operational environments which included the employment of actual troops, training, tactics and procedures at the C4ISR OTM experiment. In FY06, deliver initial release of SRW application software to JTRS JPEO for porting to JTRS Clusters 1 and 5 target operating environments to support Future Combat				8550	11000	10000	

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT		
3 - Advanced technology development	0603008A - Electronic Warfare Advanced Technology	TR1		
System (FCS) Brigade Combat Team (BCT) Spin Out #1 system integration; mature hardware to extend RF operation of radio prototypes in the 1350-2500 MHz band for aeronautical mobile applications; continue SRW spiral development to extend software application for FCS unmanned aerial vehicle and unmanned ground vehicle applications to support teleoperations/navigation, ISR data transport, and communications relay services; develop compatible interface with JTRS heterogeneous network services for Joint interoperability; participate in Future Force Warrior (FFW) ATD and FCS BCT Spin Out #1 experimentation. In FY07, will complete SRW voice and data communications services for Dismounted Soldier applications; will develop compatible interface to JTRS network management support application; will participate in follow-on FFW ATD and FCS BCT Spin Out #1 experiments; will deliver final release of SRW software application to JTRS JPEO for porting to JTRS Cluster 1 and Cluster 5 and for JTRS Software Communications Architecture certifications.				
- Antenna Technologies: In FY05, performed technical evaluation and integration for Multiband Phased Array antenna technologies to maintain OTM SATCOM links over rolling terrain; conducted evaluation of body wearable antenna prototypes and down selected to best designs; matured the body-wearable, aviation and low profile antennas to improve performance and conduct radio frequency (RF) performance; conducted RF safety evaluation. In FY06, complete development of Wideband Networking Waveform (WNW) high gain antennas and conduct test; evaluate tri-band antennas with improved gains and reduced form factors; develop a diplexer to couple a fourth waveform to the tri-band antenna; complete live fire evaluation of ballistic radome and improve gain of survivable low profile antenna and test antenna prototypes. In FY07, will improve gain performance of WNW high gain single antenna solution; will conduct test/demonstration of prototype WNW high gain antennas; will mature Ka band power amplifier (PA) material and initiate design PA module for directional antennas.	2858	4880	3248	
- Tactical Wireless Network Assurance (TWNA): In FY05, matured and evaluated Tactical Public Key (TPK) enabling technologies to ensure secure user access to platforms and services; matured and tested wireless intrusion detection technologies to detect cyber attacks against distributed mobile hosts and networks; demonstrated Group Key Management protocol in mobile ad-hoc field environment. In FY06, provide intrusion detection algorithms for FCS BCT to deter intruders and recognize attempts to attack/exploit Mobile Ad-hoc Networks (MANETs); mature and test TPK enabling capabilities in a simulated MANET environment. In FY07, will mature intrusion detection system framework and integrate with FCS security management capability; will mature certificate revocation capability within TPK framework to reduce impact of security overhead on MANETs; will provide demonstration encapsulating matured wireless security capabilities; will provide Tactical Public Key enabling technologies to FCS/WIN-T.	3345	3843	5044	
- Proactive Integrated Link Selection for Network Robustness: In FY05, completed initial system architecture design and development of planning mode link selection technologies; conducted modeling & simulation (M&S) effort to support link selection development efforts. In FY06, perform initial implementation of planning mode link selection algorithms; perform M&S and provide initial performance results. In FY07, will conduct integration of components of planning mode link selection algorithms onto prototype hardware/software platforms; will mature system architecture to include deploy mode link selection technologies; will conduct M&S of deploy mode link selection algorithms.	2814	1991	3183	
- Communications Planner for Operational and Simulation Effects with Realism (COMPOSER): In FY07, will integrate COMPOSER technologies to interface with applications from the Project Manager Warfighter Information Network-Tactical (PM WIN-T). Work on this program is also done in 62782/H92.	0	0	844	
Total	17567	21714	22319	

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BUDGET ACTIVITY 3 - Advanced technology development			PE NUMBER AND TITLE 0603008A - Electronic Warfare Advanced Technology			PROJECT TR2	
COST (In Thousands)	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	33336	28845	21703	23670	24565	27179	26810
<p>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, 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 Future Combat System (FCS) Brigade Combat Team (BCT) 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 experiment 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 BCT) modernization. Adaptive Joint C4ISR Node (AJCN) ACTD for mobile airborne communication nodes seeks to provide assured communications and also has the capability to perform signals intelligence, information warfare and electronic attack missions simultaneously. The Protective Integrated Link Selection for Network Robustness effort will integrate automatic link selection algorithm components in support of future 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 reduce Joint Tactical Radio System (JTRS) programmatic risk and improve performance reliability. Antenna technologies will be pursued that and will develop a family of mission tailored antennas for ground vehicles and for the Soldier. The ground vehicle antennas efforts will focus on high gain antennas to sustain Wideband Network Waveform (WNW) link connectivities, affordable On-the-Move (OTM) directional antenna technologies to reduce visual signature on ground platforms, and multi-band antennas that consolidate multiple waveforms using a single antenna to reduce the number of platform antennas. Soldier antenna efforts mature and integrate conformal, lightweight antennas within the soldiers' protective combat wear for suppressed equipment visual signatures, improved mobility and improved survivability.</p> <p>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.</p>							
Accomplishments/Planned Program				FY 2005	FY 2006	FY 2007	
- C4ISR On-The-Move Experiment: In FY05, conducted a series of experiments, in a fully instrumented, relevant operating field environment, to assess the increased force effectiveness of providing emerging C4ISR capabilities to a platoon size unit; demonstrated over 40 C4ISR enhanced capabilities including: 85 node software defined radio network operating the solder radio waveform (SRW), aerial communications relays, satellite communications reachback, a distributed unattended ground sensor system, and Force XXI Battle Command, Brigade-and-Below (FBCB2) battle command soldier interfaces; evaluated and provided resultant data against Future Combat				10000	12758	12013	

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3 - Advanced technology development	0603008A - Electronic Warfare Advanced Technology		TR2	
System (FCS) Brigade Combat Team (BCT) C4ISR risks. In FY06, conduct experiments to determine the impact of: (1) FCS BCT Spiral 1 network performance; (2) battle command interface functionality and decision aids, (3) how information quality is impacted by varying the number and types of sensor suites; different fusion processing techniques, and information dissemination architectures; and (4) how information affects leadership decision making and mission execution, on multiple variations (real and simulated) of Current and Future BCT platoon-sized reconnaissance units. In FY07, will conduct experiments with various platoon-sized infantry units to explore, observe, measure and quantify: (1) cross-domain and multi-level security communications, (2) networked unattended ground and air vehicles utilizing SRW for communications and data dissemination, (3) playing electronic attack capabilities to observe network performance vulnerabilities in a jamming environment, (4) on-the move distributed fusion for Distributed Common Ground System - Army spirals, (5) company to higher-level organization battle command interoperability addressing FCS BCT to Net-Centric Enterprise Services (NCES) service-oriented architecture issues, and (6) network-aware battle command application analysis.				
- Adaptive Joint C4ISR Node (AJCN) ATCD: In FY05, matured payload functionalities, completed payload integration, installed payloads and antennas on the Air Force's Paul Revere and two Army Hunter aircrafts; conducted flight tests to verify operation of payload and AJCN network at first Joint Military User Assessment exercise. In FY06, conduct Extended User Evaluation (EUE) flights and provide sustainment support for leave behind equipment and support transition initiatives. In FY07, will complete EUE and sustainment for leave behind equipment.	8850	1950	1120	
- Proactive Integrated Link Selection for Network Robustness: In FY06, conduct controlled environment testing/demonstration of stand-alone link selection algorithms. In FY07, will mature planning mode components; will implement deploy mode link selection algorithms; will mature interfaces and begin design of necessary interactions amongst link selection algorithms.	0	1922	2080	
- C4ISR Network Mining: In FY06, mature algorithms, intelligent agent technologies and decision aids that exploit individual and combined network sources to enhance countermine/counter improvised explosive devices and rapid battle damage assessment; validate methodologies in the context of the C4ISR OTM experimentation. In FY07, will mature and demonstrate networked target identification and situation awareness for improved combat identification at the C4ISR OTM experiment.	0	3865	4058	
- Radio Enabling Nextgen Applications (RETNA): In FY06, identify, evaluate, and adapt emerging commercial technologies for military application to Cluster 5 Manpack and embedded Wideband Power Amplifiers (WBPA's); apply thermal management technologies that efficiently transfer unwanted heat from targeted hot spots in JTRS radios. In FY07, will evaluate functional, integrateable, and operationally suitable products; will validate performance of thermal management technology via testing and analysis of Cluster 5 WBPA's' environmental performance.	0	607	1412	
- Antenna Technologies: In FY06, evaluate vest antenna prototypes and down-select to best designs for integration into FFW soldier ensemble; mature body wearable antennas to meet Ground Soldier System JTRS Cluster 5 requirements; conduct M&S of body wearable antenna designs & specific absorption rates for safety assessment. In FY07, will complete development and conduct test/demonstration of body wearable antenna prototypes for Ground Soldier System/Cluster 5.	0	1450	1020	
- Networked Sensors for the Future Force (NSFF) Communications: In FY05, simulated a 100 node network to determine large sensor network effectiveness; integrated and tested a 50-node network to demonstrate sensor network capabilities and to validate the simulation; demonstrated communications range 200-400m and sensor connectivity of 3-10km depending on sensor type and terrain; integrated Soldier Level Integrated Communications Environment radio hardware running JTRS compliant Soldier Radio Waveform (SRW) with tactical sensors and command and control software for the NSFF Advanced Technology Demonstration at Fort Knox.	3946	0	0	
- Applied Communications & Information Networking (ACIN): In FY05, this one year Congressional add matured and demonstrated commercial communications technologies in the areas of high power wideband amplifiers, Ku/Ka-Band SATCOM subsystem transceiver	10540	0	0	

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BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT
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modules, predictive network planning, IPv4 to IPv6 conversion, and software defined radios modeling and simulation. No additional funds are required to complete this effort.			
- Applied Communications & Information Networking (ACIN): In FY06, this one year Congressional add is to mature and demonstrate commercial networking and communications technology in the areas of intelligent agents across mobile networks, air-ground unmanned vehicle collaboration, real time change detection, and modeling and simulation for communications/network planner. No additional funds are required to complete this effort.	0	6293	0
Total	33336	28845	21703