

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY		PE NUMBER AND TITLE					
3 - Advanced technology development		0603008A - Electronic Warfare Advanced Technology					
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total Program Element (PE) Cost	49542	56591	50961	51967	55023	56251	57514
TR1 TAC C4 TECHNOLOGY INT	16176	35623	37502	38971	40928	41841	42781
TR2 DIGITAL BATTLEFLD COMM	23973	13118	13459	12996	14095	14410	14733
TR8 C3 DEMONSTRATIONS (CA)	9393	7850					

A. Mission Description and Budget Item Justification: The goal of this program element (PE) is to mature and demonstrate 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 are 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 investigates and leverages external communication technologies and combines 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 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.

Since the current program element 0603008A, project TR2 efforts are complementary to those funded from 0603008A, project TR1, all efforts funded and executed from project TR2 are being transferred to project TR1 in FY08 and beyond, to reduce administrative burden. In FY08 and beyond, TR2 will contain only those efforts transferred from 0603238A (Global Surveillance/Air/Precision Strike), project 177 (JT ALS PS DEMO) to support the advanced technology demonstration for the Program Executive Office Intelligence, Electronic Warfare, and Sensors (PEO IEW&S) that is executed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ. In FY08, the Joint Programs Sustainment and Development (JPSD) Project Office, an element of the PEO IEW&S, will be disbanded.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

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

<u>B. Program Change Summary</u>	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	53129	49199	51213
Current BES/President's Budget (FY 2009)	49542	56591	50961
Total Adjustments	-3587	7392	-252
Congressional Program Reductions		-508	
Congressional Rescissions			
Congressional Increases		7900	
Reprogrammings	-2294		
SBIR/STTR Transfer	-1293		
Adjustments to Budget Years			-252

Three FY08 congressional adds totaling \$7900 were added to this PE.

- (\$500) Advanced Wireless Technologies
- (\$3400) Portable Mobile Emergency Broadband Systems (PMEBS)
- (\$4000) Applied Communications and Information Networking (ACIN)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY 3 - Advanced technology development		PE NUMBER AND TITLE 0603008A - Electronic Warfare Advanced Technology					PROJECT TR1	
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
TR1 TAC C4 TECHNOLOGY INT	16176	35623	37502	38971	40928	41841	42781	

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 enable commanders and individual Soldiers to survive and fight by providing secure, reliable, mobile communications network solutions that function in complex and diverse terrain. 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 three 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; 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; and assess the Technology Readiness Level of emerging network technologies in an operationally relevant environment. Antenna Technologies mature 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, survivability, and fightability. Wireless information assurance efforts provide network protection for mobile wireless ad hoc networks and provides safeguards against modern network attacks. The Proactive Integrated Link Selection for Network Robustness effort matures and integrates technologies to provide automatic network communications link selections that address the challenge of limited network connectivity. The Communications Planner for Operational and Simulation Effects with Realism (COMPOSER) effort matures 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 is the Army component to the Coalition Joint Spectrum Management and Planning Tool (CJSMP) Joint Capability Technology Demonstration (JCTD).

Since the current program element 0603008A, project TR2 efforts are complementary to those funded from 0603008A, project TR1, all efforts funded and executed from project TR2 are being transferred to project TR1 in FY08 and beyond, to reduce administrative burden.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. 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.

<u>Accomplishments/Planned Program:</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Joint Tactical Radio System (JTRS) Squad-Level Communications: In FY07, completed Soldier Radio Waveform (SRW) voice and data communications services for dismounted Soldier applications; extended application for unmanned aerial vehicle and unmanned ground vehicle to support teleoperations/navigation, intelligence, surveillance and reconnaissance (ISR) data transport, and communications range extension services; completed validation of SRW network performance in technical test in laboratory and field environments; conducted follow-on operational experiments with Future Force Warrior ATD and FCS Brigade Combat Team Spin Out #1; and delivered final	7009		

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT		
3 - Advanced technology development	0603008A - Electronic Warfare Advanced Technology	TR1		
release of SLICE SRW 2.1 software application to JTRS Joint Program Office for porting to JTRS Ground Mobile Radio and Handheld, Manpack, and Small Form Fit (HMS) for JTRS Software Communications Architecture and NSA security certifications.				
Antenna Technologies: In FY07 improved gain performance of a triband antenna that provides 4 port capability; demonstrated prototype triband antennas; improved gain performance of survivable 2 port low profile antennas with a ballistic radome; demonstrated dual band (Ku/Ka band) antenna system in an on-the-move (OTM) environment; developed high efficiency Ku power amplifier module; matured Ka power amplifier module; and completed development of X-band OTM antenna system. In FY08, this work is being consolidated in this project from PE/project 0603008A/TR2; develop and demonstrate affordable terrestrial directional antenna; complete development and ruggedization of survivable 2 port low profile and triband antenna prototypes; develop and demonstrate broadband low cost low profile directional antenna prototypes for application to PM Signal Warfare requirements for reduced cosite interference; integrate and demonstrate a dual band SATCOM antenna on a Warfighter Information Network-Tactical (WIN-T) vehicle; complete development of power amplifiers and integrate into antenna assemblies; develop a low profile single beam SATCOM antenna; demonstrate vehicle X-band OTM antenna system. In FY09, will mature and demonstrate a low profile Ku/Ka SATCOM antenna; will begin to mature an ultra low profile Ka/Q SATCOM antenna with simultaneous beams.	3077	7583	4058	
Tactical Wireless Network Assurance (TWNA): In FY07, matured intrusion detection system framework and integrated with the FCS Automated Intrusion Detection and Response (AIDR) component of System of Systems Common Operating Environment (SoSCOE) by developing and providing an application programming interface to accept Intrusion Detection alerts; matured certificate revocation capability within Tactical Public Key (TPK) framework to reduce impact of security overhead on Mobile Ad Hoc Networks (MANETs), provided demonstration encapsulating matured wireless security capabilities; provided TPK enabling technologies to FCS/WIN-T.	2107			
Wireless Information Assurance (IA): In FY09, will mature and demonstrate IA technologies enabling information exchange across activity domains ensuring survivability of tactical networks and critical information against information warfare attacks; will mature and demonstrate network management/information assurance fault correlation engine that will reduce the software footprint by creating an integrated suite of network operations tools.			3904	
Proactive Integrated Link Selection for Network Robustness: In FY07, matured design of planning mode components based on modeling and simulation (M&S) results; matured system architecture to include design of deployed mode link selection technologies that enhance connectivity and useable capacity of wireless networks to improve end user traffic performance; began M&S of deployed mode link selection algorithms. In FY08, this work is being consolidated in this project from PE/project 0603008A/TR2; continue M&S and design of enhanced implementation of deployed mode link selection algorithms; implement first level integration among link selection algorithms; conduct functional, performance characterization and scalability testing of mature link selection algorithms within laboratory and relevant field environment. In FY09, will complete implementation of deployed mode link selection algorithms; will conduct final architecture, design maturation, and integration of planning and deployed mode link selection algorithms; will conduct performance testing in a relevant field environment of all planning and deployed mode link selection technologies with representative WIN-T hardware.	3183	7752	9070	
Communications Planner for Operational and Simulation Effects with Realism (COMPOSER): In FY07, integrated and tested the communications effects simulator, network visualizer, and spectrum management software modules to support the baseline architecture for Coalition Joint Spectrum Management Planning Tool (CJSMPT) applications. In FY08, integrate and test enhanced COMPOSER technologies in support of the CJSMPT effort.	800	2696		
Dismounted Communications in Urban Terrain: In FY09, will mature communications capabilities for dismounted Soldier operating in highly complex terrain (e.g., urban environments) through the use of space-time adaptive processing, cross layer networking algorithms,			2460	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced technology development	0603008A - Electronic Warfare Advanced Technology	TR1	
and network security features such as employing random noise waveforms and other low probability of intercept, low probability of detection technologies to reduce communications systems vulnerability.			
Applied Communications and Information Networking (ACIN): In FY09, ACIN will mature and demonstrate commercial networking and communications technology in intelligent agents and mobile networking; will provide rapid adaptation of commercial communications equipment for military use through the development of new architectures combining commercial and military unique technologies; and will provide modeling and simulation and planning tools for communications/network planning.			1385
C4ISR On-The-Move (OTM) Experiment: In FY08, this work is being consolidated in this project from PE/project 0603008A/TR2; assess the capability, functionality, and performance of current and emerging radio waveforms from the JTRS Joint Program Office on JTRS HMS and Ground Mobile Radio representative hardware; conduct relevant technical demonstrations in support of PM FCS BCT focused on the interaction of FCS software applications and the transport layer as well as evaluating Spin Out 2 designs; assess the technology readiness level of Army science and technology efforts maturing in the FY08 timeframe in an operationally relevant field environment; assess the performance of the baseline and alternative C4ISR on-the-move architectures and various network configurations to inform the current and future forces; utilize high performance computing (HPC) and non-HPC tools and techniques using the FCS baseline architecture as the starting point to stimulate the live demonstration environment with M&S via distributed connectivity; and employ data collection, reduction and analysis techniques facilitating early assessment of emerging C4ISR technologies in a system of systems construct. In FY09, will assess the capability, functionality, and performance of the FY09 programmed increments of JTRS HMS for dismount Soldiers, unmanned ground sensors, non-line of sight launch system and intelligent munitions systems; will assess WIN-T increment 2 and 3 functionality including enhanced quality of service architecture, information assurance solutions to enable network security across a wide area network using multiple encryption devices with minimal loss of data, and selected network operations management functions; will assess the technology readiness level of Army science and technology efforts maturing in the FY09 timeframe in an operationally relevant field environment; will continue to support FCS technical evaluations to explore FY09 programmed increments of Army Battle Comma		12513	11166
C4ISR Network Mining: Large-scale information technology has been evolving separate transaction and analytical systems, data mining provides the link between the two. Data mining consists of five major elements: extract, transform, and load transaction data onto the data warehouse system; storing, and managing the data in a multidimensional database system; providing data access; analyzing the data by application software; and presenting the data in a useful format. In FY08, this work is being consolidated in this project from PE/project 0603008A/TR2; mature network data mining software analysis to understand the relationships and patterns in stored transaction data based on open-ended user queries; mature analytical software for use in battle command systems including statistical and machine learning. In FY09, will mature network data mining analytical software particularly neural networks for applicability to next generation battle command systems; will conduct demonstrations focused on four types of relationships. 1) Classes: stored data is used to locate data in predetermined groups. 2) Clusters: data items are grouped according to logical relationships or consumer preferences. 3) Associations: data can be mined to identify associations. 4) Sequential patterns: data is mined to anticipate behavior patterns and trends.		4175	5459
Small Business Innovative Research/Small Business Technology Transfer Programs		904	
Total	16176	35623	37502

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603008A - Electronic Warfare Advanced Technology					PROJECT TR2	
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
TR2 DIGITAL BATTLEFLD COMM	23973	13118	13459	12996	14095	14410	14733

A. Mission Description and Budget Item Justification: In FY07 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. C4ISR OTM provides an operationally relevant field experimentation venue complemented by constructive and virtual M&S for the assessment of emerging individual C4ISR technologies, system of systems, and architectures that increase the survivability and lethality of Future Force platforms.

In FY08 and beyond, Theater Effects Based Operations (TEBO) Advanced Capabilities Technology Demonstration (ACTD) provides the United States Forces Korea (USFK) with enhanced capabilities to analyze, plan, execute, and assess operations, at strategic and operational levels, using an effects based approach. TEBO integrates computer-aided decision support tools, concepts, and procedures to provide a more comprehensive understanding of a given adversary and the environment. TEBO helps to identify those actions that can be taken to influence behavior and facilitate the harmonization of all elements of national power to support national objectives. It provides greater responsiveness and adaptability to better manage the rapidly changing situations of today's environment. TEBO conducts a limited military utility assessment to determine the extent to which the TEBO concept has been adopted and incorporated into the staff organization processes. TEBO assessment tools will be incorporated into USFK Theater Architecture.

Since the current program element (PE) 0603008A, project TR2 efforts are complementary to those funded from PE 0603008A, project TR1, all efforts funded and executed from project TR2 in FY07 are being transferred to project TR1 in FY08 and beyond, to reduce administrative burden. In FY08 and beyond, project TR2 will contain only those efforts transferred from PE 0603238 (Global Surveillance/Air/Precision Strike), project 177 (JT ALS PS DEMO) to support the advanced technology demonstration for Program Executive Office, Intelligence, Electronic Warfare, and Sensors (PEO IEW&S) and will be executed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ. In FY08, the Joint Programs Sustainment and Development (JPSD) Project Office, an element of the PEO IEW&S will be disbanded.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. 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.

<u>Accomplishments/Planned Program:</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
C4ISR On-The-Move (OTM) Experiment: In FY07, assessed the capability, functionality, and performance of the programmed increments of: Joint Tactical Radio System (JTRS) Soldier Radio Waveform (SRW) 2.1 running on JTRS Handheld, Manpack, and Small Form Fit (HMS) hardware; WIN-T Network Centric Waveform development; and Joint Network Node (WIN-T increment 1) technology insertion; demonstrated commercial SATCOM, commercial wireless technologies, and protocols, Information Assurance and ISR sensor and sensor fusion in an operationally relevant field environment complimented with virtual and constructive modeling and simulation; conducted the initial experimentation under of the FCS Experiment Phase 2 Campaign to assess the capability, functionality, and performance of FCS Battle Command (1.0), System of Systems Common Operating Environment (SoSCOE) (1.8) and Spin Out 1 and 2	16710		

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced technology development	0603008A - Electronic Warfare Advanced Technology	TR2	
hardware and software; functioned as lead system integrator for Advanced Air Expeditionary Force (AAEF) experiment at Fort Benning Ga. to include supporting data collection and reduction, M&S integration, training, and buildup to support engineering, and integration efforts; supported test design, engineering integration, regression testing, instrumentation and data collection/reduction for the WIN-T Increment 2 technology readiness level 6 demonstration of three technologies: highband networking radios; network operations; and high mobility networking; demonstrated the dual-network utilizing a total of 16 network nodes, 15 running the line of sight Highband Networking Waveform (HNW) and 8 running the SATCOM Network Centric Waveform (NCW) in a WIN-T Increment 2 representative configuration, operating under scripted traffic and mobility conditions. In FY08 and beyond, funding for this effort was transferred to PE/project 0603008A/TR1.			
Adaptive Joint C4ISR Node (AJCN) ACTD: In FY07, completed Extended User Evaluation and sustainment for leave behind equipment.	1060		
Proactive Integrated Link Selection for Network Robustness: In FY07, matured planning mode link selection algorithms that enhance connectivity and useable capacity of wireless networks to improve end user traffic performance; implemented deployed mode link selection algorithms; matured software operations to manage interactions and interfaces among link selection algorithms; matured system architecture to include design of deployed mode link selection technologies that will enhance connectivity and useable capacity of Future Force networks to improve end user traffic performance. In FY08 and beyond, funding for this effort was transferred to PE/project 0603008A/TR1.	1968		
C4ISR Network Mining: Data mining consists of five major elements: extracting, transform, and load transaction data onto the data warehouse system; storing and managing the data in a multidimensional database system; providing data access; analyzing the data by application software; and presenting the data in a useful format. In FY07, assessed the three Services network centric warfare program architectures and identified interoperability issues; provided the Training and Doctrine Command (TRADOC) the results of the analysis to influence requirements updates and support TRADOC campaign of experimentation effort; demonstrated, and transitioned updated data collection tools to the 25th Infantry Division. In FY08 and beyond, funding for this effort was transferred to PE/project 0603008A/TR1.	1934		
Radio Enabling Technologies and Nextgen Applications (RETNA): In FY07, demonstrated functional thermal management approaches compatible with the Joint Tactical Radio Systems HMS; validated performance of thermal management for operational suitability; demonstrated compact wideband power amplifiers for use in JTRS HMS.	1336		
Antenna Technologies: In FY07, completed antenna development and conducted test/demonstration of body wearable antenna prototypes for HMS. In FY08 and beyond, funding for this effort was transferred to PE/project 0603008A/TR1.	965		
Theater Effects Based Operations (TEBO) ACTD: The TEBO ACTD will demonstrate an Effects-based Operations (EBO) process and will provide United States Forces Korea with enhanced capabilities to analyze, plan, execute, and assess effects-based operations at the strategic-theater and operational levels by integrating a framework of processes, tools, and tactics, techniques and procedures. In FY08, this work is being consolidated in this project from PE/project 0603238A/177; mature TEBO software to Spiral V configuration; mature and solidify capabilities demonstrated in spirals I-IV to provide full spectrum support for effects-based operations including semi-automated knowledge acquisition and operational modeling and simulations; mature human interfaces and scalability of the TEBO toolset, demonstrate TEBO capabilities in Joint Forces Command (JFCOM) exercises in coordination with United States Forces Korea. In FY09, will initiate the sixth and final developmental spiral; will participate in the two annual Korean exercises - Key Resolve (2QFY09) and Ulchi Forward Guardian (4QFY09) as well as participate in PACOM's Terminal Fury exercise; will transition activities from the TEBO toolset to Defense Information Systems Agency and Net-Centric Enterprise Services.		12891	13459
Small Business Innovative Research/Small Business Technology Transfer Programs		227	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced technology development

0603008A - Electronic Warfare Advanced Technology

TR2

Total

23973

13118

13459