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

February 2003

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		0	26931	40347	41982	47495	49948	42687	45166
TR1	TAC C4 TECHNOLOGY INT	0	14129	12407	17907	23032	25330	15904	16264
TR2	DIGITAL BATTLEFLD COMM	0	12802	27940	24075	24463	24618	26783	28902

A. Mission Description and Budget Item Justification: An integrated, seamless, mobile network is absolutely critical to enable Army transformation to the Objective Force. The goal of this program element (PE) is to provide the Army's Objective Force with a secure, mobile, wireless network that operates in diverse and complex terrain all the time, in all environments. Technologies will be matured in this PE to address this challenge with distributed, mobile, secure, self-organizing communications networks. Network access, service and speed of delivery are utterly essential. It will demonstrate the capability to seamlessly integrate communications technologies across all network tiers, ranging from unattended networks and sensors, through maneuver elements and airborne/space assets. External communication technologies will be investigated and leveraged, wherever possible. Technology options will be combined in a series of biannual Command, Control, Communications, and Computers Intelligence, Surveillance and Reconnaissance (C4ISR) On-The-Move (OTM) demonstrations to measure the battlefield effectiveness for Future Combat Systems (FCS) and the Objective Force. This PE also provides: protection technologies for tactical wireless networked networks against modern network attacks; smart networking technologies to network and control unmanned networks/sensors 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. Adaptive Joint C4ISR Node (AJCN) Advanced Concept Technology Demonstrations (ACTD) makes significant contribution to this programs 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.

The cited work is consistent with the Army Science and Technology Master Plan and the Army Modernization Plan. Work in this program element is related to, and fully coordinated with, efforts in PE 0602782A (Command, Control and Communications Technology), PE 0203740A (Maneuver Control Network), PE 0203726A (Advanced Field Artillery Tactical Data Network), PE 0602783A (Computer and Software Technology), PE 0602702E (Tactical Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and PE 0603789F (C3I Technology Development). The PE contains no duplication with any effort within the Military Departments. This is not a new effort. Work was previously performed under PE 0603006A. Work is performed by the US Army Communications-Electronics Command, Fort Monmouth, NJ. This program supports the Objective Force transition path of the Army Transformation Campaign Plan.

No Defense Emergency Response Funds were provided to the program.

B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	0	28254	21729	20689
Current Budget (FY 2004/2005 PB)	0	26931	40347	41982
Total Adjustments	0	-1323	18618	21293
Congressional program reductions				
Congressional rescissions		-393		
Congressional increases				
Reprogrammings		-154		
SBIR/STTR Transfer		-776		
Adjustments to Budget Years			18618	21293

Change Summary Explanation: Funding - FY 2004/2005: Funds increased to support the AJCN ACTD and the Battle Command OTM Demos.

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

February 2003

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
TR1	TAC C4 TECHNOLOGY INT	0	14129	12407	17907	23032	25330	15904	16264

A. Mission Description and Budget Item Justification: Networked communications is one of the major enablers of FCS and the Objective Force. This project matures key communications, mobile networking, and information assurance technology for the Dismounted Solder, Future Combat Networks (FCS) and the Objective Force. The project enables the commanders and individual soldiers to survive and fight by providing secure, reliable, mobile communications network solutions that function in complex and diverse terrain. The majority of this project concentrates on the Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC) ATD, a digital networking communication capability for the mounted and dismounted soldiers, and Information Assurance for Tactical Wireless Networks. MOSAIC is the cornerstone ATD that enables battle command mobility through mobile networking and bandwidth management. It matures and demonstrates the core self-organizing, ad hoc, mobile network technologies. It will use an open architecture approach to enable integration of other capabilities and technologies. Other programs that will be integrated into or leverage MOSAIC include On-The-Move (OTM) SATCOM, Advanced Antennas. OTM SATCOM enables mobile satellite communications through the application of blockage mitigation algorithms, thus enabling a robust reachback capability and a reduced in theatre footprint. 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 DARPA Small Unit Operations Situation Awareness Network (SUO SAS) communications technology will be leveraged and matured to provide a JTRS Compliant soldier radio. This effort will addresses the size, weight and power issues for the dismounted soldier. The Tactical Wireless Network Assurance program provides network protection for mobile wireless ad hoc networks and provides safeguards against modern network attacks. DARPA, ARL, and other Service technologies will be leveraged to provide solutions. 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. Management of these critical security components will be provided by the Network Security Agency that will demonstrate centralized remote control and visualization of network security health.

These communications solutions are absolutely essential to enable mission planning and battlefield decision making, execution and targeting. This project supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds were provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
MOSAIC ATD –In FY03, conduct laboratory demonstration of the integration of the bandwidth adapting protocols, voice over Internet Protocol (IP), IP Quality of Service (QoS), mobile networking protocols and communications technologies. Enhance and modify MOSAIC communications and mobile ad-hoc networking protocols to support self organized wireless 15-20 node cluster with QoS (specified by latency, delayed jitter, and bit error rate). Integrate and evaluate enhanced mobile networking protocols and end-to-end quality of service mechanisms in a laboratory/field environment. Demonstrate robust wireless network access controls and detection techniques with validation on three mobile nodes to mitigate wireless intrusions and detect attacks close to 60% of the time. In FY04, demonstrate ad hoc mobility, reduced network initialization and recovery time, 15-20 node wireless OTM network with 56kbps-15Mbps. Perform integration of all MOSAIC networking and QoS technologies. Model and demonstrate the integrated network with an airborne node, space based assets, and terrestrial networks. In FY05, demonstrate 3-dimensional integrated seamless airborne network architecture to include airborne relays and satellite communications. Work in FY02 performed under PE 0603006A.	0	10379	7707	3562
Soldier/Squad-Level Communications: In FY04, leverage DARPA SUO SAS technology and reduce size, weight and power for OFW communications to a two-circuit card assembly configuration. Perform laboratory test and functional design verification. Produce network-on-chip design of a dual channel modem. In FY05, mature a re-programmable ASIC (Network-on-a-Chip) implementation for modem and networking processor components, and integrate in laboratory brassboard environment to demonstrate size, weight, and power consumption reduction for Objective Force Warrior communications.	0	0	1500	8550
OTM SATCOM: In FY03, mature and demonstrate Wideband OTM blockage mitigation protocol, integrate blockage mitigation algorithms and demonstrate them on CECOM/Space and Naval Warfare Systems Command (SPAWAR) Ka-band OTM Terminal. In FY04, integrate Wideband OTM capability into the FY04 MOSAIC ATD demonstration, mature and demonstrate MILSTAR OTM blockage mitigation approach for networks of MILSTAR terminals.	0	2861	2200	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Advanced Antennas - In FY03, mature technologies that will reduce the number of antennas and the visual signature for a ground vehicular Joint Tactical Radio Network Multiband OTM antenna covering the 30 to 2000 MHz frequency band. FY04 - For reconfigurable VHF, demonstrate reduction in Cosite interference and reduce three beam phased array receive antenna signature. In FY05, perform technical evaluation and integration for: (1) Multibeam Phased Array antenna technologies, maintain simultaneous multibeam OTM links over rolling terrain; (2) multiband antennas for rotary wing platforms, reduce range degradation due to cosite interference and platform interactions; (3) body borne helmet and vest antennas (at a 1 to 5 Km range) and perform RF assessment to ensure integration of environmental/ radiation safety; (4) Multiband reconfigurable band switched antenna technologies, tuned IAW JTRS interface operating between 30-450 MHz with reduction in cosite interference; (5) Low Profile antennas on ground and rotary wing platforms with reduced visual signature at 300 ft. Enhance and modify the modeling algorithms for Advanced Antennas to assess the Reconfigurable Band Switched antenna performance and provide communications visualization aids.	0	889	1000	3000
Tactical Wireless Network Assurance (TWNA) - In FY05, mature and test advanced network assurance via Tactical Public Key Infrastructure (PKI) on dynamic wireless ad hoc networks. Expand wireless intrusion detection to detect cyber attacks against distributed mobile hosts and networks that detect attacks that exploit mobile wireless protocols more than 60% of the time. Mature and test database access control and authentication of mobile data elements which restrict unauthorized modification to mobile code. Mature and perform laboratory testing of adaptive security alert correlation, visualization and response to tactical wireless network security events in near-real time.	0	0	0	2795
Totals	0	14129	12407	17907

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February 2003

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
TR2	DIGITAL BATTLEFLD COMM	0	12802	27940	24075	24463	24618	26783	28902

A. Mission Description and Budget Item Justification: This project matures and demonstrates the warfighting value of an integrated C4ISR On-The-Move (OTM)(sensor to shooter) capability for Future Combat Systems (FCS) and the Objective Force. It makes a major contribution to improving the ability of the Army to survive and fight by providing the ability to move large amounts of data over extended ranges with minimal infrastructure, and tying in networks of unattended sensor fields. The efforts here concentrate on two major themes: The first theme, accomplished through the C4ISR OTM demo, provides 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. The second theme is to 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. The second theme is accomplished through three key programs: 1) Adaptive Joint C4ISR Node (AJCN) ACTD for mobile airborne communication nodes; 2) Network Sensors for the Objective force (NSfOF) Communications solution, enabling adaptable, self healing, low power, integrated communication nodes for unmanned sensor networks and 3) Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC), providing mobile protocols and seamless handoff (quality of service addressed in TR-1) capabilities to ensure the right information at the right time at the right place. The C4ISR OTM Demo provides early and continuing demonstrations of enhanced survivability and lethality for the FCS platforms through the effective employment of an integrated C4ISR On-the-Move ATD supported by ISR assets, manned and unmanned sensor networks, and networked fires. It leverages and integrates a variety of S&T, PM, and DARPA technology programs into a cohesive, integrated C4ISR network of networks that will provide decision makers a 'view of the Future' for Objective Force C4ISR mobility and an evolutionary view of integrated C4ISR functionality and its impact on Battlefield Effects. AJCN ACTD makes a significant contribution to providing assured communications for UoA. It provides 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. AJCN also has the capability to perform signals intelligence, information warfare and electronic attack missions simultaneously. AJCN matures technology developed under the DARPA Adaptive C4ISR Node program and leverages Joint Service funds from OSD, DARPA and the Air Force. AJCN starts in FY03 with Army contributions commencing in FY04. The AJCN will host communications waveforms (JTRS compliant) for extended range voice and data and enable interoperation between different types of radio platforms. It also enables data to be relayed between deployed manned/unmanned sensors and decision makers. The NSfOF Communications improves survivability by networking unattended sensors for real time local situation awareness and targeting. Several efforts will be leveraged to enable efficient routing and low power ad-hoc communications for the sensor suite, including the DARPA Small Unit Operations (SUO) and Sensor Information Technology (SensIT) programs as well as technologies developed by the Army Research Laboratory (ARL).The MOSAIC ATD facilitates battle command mobility, by providing multiple wireless solutions and seamless handoff to different networks for user flexibility in varied terrain over wide areas with improved network robustness. This program supports the Objective Force transition path of the TCP. No Defense Emergency Response Funds (DERF) were provided to the project.

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February 2003

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

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
C4ISR OTM Demonstration - In FY03, conduct a series of technology evaluations to demonstrate the ability to do command and control for the Future Combat Networks (FCS) and the Objective Force (OF). Efforts include: modeling and simulation of sensors, networks, and command and control capabilities, to reduce costs of demo, in conjunction with the FCS Lead Network Integrator (LSI) contractor, TRADOC Battlelabs, and RDECs. Demonstrations of communications, ISR, and Command and Control FCS capabilities in an operational environment to demonstrate technology for FCS. Demonstration of battlefield effects (metal on target) enabled by integrated C4ISR. Generation of technical data to the FCS LSI in support of specification development. In FY04, perform a series of increasingly robust and expanded technical evaluations in support of FCS and OF acquisitions to demonstrate: increased maturity of integrated FCS C4ISR technologies in a more rugged operational environment, additional FCS capabilities, assess their maturity level, and collect performance data, modeling and simulation in support of field evaluations in conjunction with the TRADOC Unit of Action Battlelab's Simulation Center. In FY05, evaluate emerging FCS C4ISR architectures in conjunction with the LSI, UofA Battlelab and other RDEC's emphasizing the impact of technologies' contribution to user development of tactics, techniques and procedures (TTP's) for the Objective Force: integration of C4ISR networks into a network centric capability and evaluate the impact on battlefield effects. Impact of evolving software (S/W) defined radios and waveforms on C4ISR FCS networks to assess overall network performance in conjunction with C2, ISR and battlefield effects networks.	0	7592	11789	12948

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
AJCN ATCD – In FY04, design and integrate a multifunction aerial payload capability (increase data throughput from 288 to 900 kbps with range extension form 20 to 30 km) that provides integrated communications relay, signals intelligence, electronic warfare and information operations capabilities. Perform modeling and simulation of payload performance to mitigate risk in development. Integrate MOSAIC ATD networking communications capabilities so that range extension and continuous coverage between disparate units can be achieved. Host software defined radio (JTRS Compatible) waveforms, demonstrating voice and data interoperation between different types of radio platforms (from 3 to 9 waveforms). Enable data to be relayed between deployed manned/unmanned sensors (to include networked fires) and the users of that data. Integrate capability into both Army (2 Hunter with payload of 200lbs or less) and Air Force (2 RC-135) platforms to demonstrate scalability of capability. In FY05, Begin to conduct interim and follow-on joint military demonstration and user assessment of technology. Build and integrate 'drop in upgrades' as required. Conduct technical assessment to verify metrics are met and participate in Joint Force command exercises to demonstrate the capability on the operational platforms in the field environment.	0	0	9824	6866
MOSAIC ATD and NSfOF Comms – MOSAIC ATD consists of 2 projects in this PE. In FY03, integrate and demonstrate automated network management technologies to provide dynamic network control and to minimize manpower. Apply technologies to on-the-move satellite communications and demonstrate integrated capability, mature low cost, JTRS software compliant architecture (SCA) compatible sensor communications breadboard models. In FY 04, demonstrate 50 mobile node and heterogeneous quality of service for FCS Communications, demonstrate 20 node (scalable to 100 node thru simulation) robust, self-healing, jam-resistant, LPI/LPD, energy -efficient (less than 500 mW) networking protocols for internode UGS communications with range of 200m and sensor to gateway connectivity to 3km. In FY 05, integrate and test a 50-node network with advanced sensors providing situational awareness to demonstrate communications range 200-400m and sensor connectivity of 3-10km.	0	5210	6327	4261
Totals	0	12802	27940	24075