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

June 2001

BUDGET ACTIVITY
3 - ADV TECHNOLOGY DEV

PE NUMBER AND TITLE
0603006A - Command, Control and Communications Adv Tech

COST (In Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost		27442	28243	31865	0	0	0	0	0	0	0
247	TAC C4 TECHNOLOGY INT	11042	12315	13893	0	0	0	0	0	0	0
257	DIGITAL BATTLEFLD COMM	4630	3778	12780	0	0	0	0	0	0	0
592	SPACE APPLICATION TECH	5088	5215	5192	0	0	0	0	0	0	0
596	FIELD LASER RADAR DEMO	6682	0	0	0	0	0	0	0	0	0
59A	INTELLIGENCE ANALYSIS ADVANCED TOOL SET	0	3963	0	0	0	0	0	0	0	0
59B	BIG CROW PROGRAM OFFICE SUPPORT	0	2972	0	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification:

PLEASE NOTE: This administration has not addressed FY2003-2007 requirements. All FY 2003-2007 budget estimates included in this book are notional only and subject to change.

The goal of this program element (PE) is to provide the Army's Objective Force with the distributed, mobile, secure, fully automated, self organizing communications networks required to ensure the lethality, mobility, agility and deployability of the Objective Force. The capability to seamlessly integrate communication and networks across all layers, including unattended systems and sensor layers, maneuver layers and space layers, will be addressed. This goal will be attained by maturing and demonstrating new and improved command, control, communications, and networking technology. Commercial communication technologies will be continuously investigated and leveraged, whenever possible. The Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC) Advanced Technology Demonstration (ATD) will provide the communications technology foundation that seamlessly and automatically supports high volume, secure multimedia traffic in a dispersed On-The-Move (OTM) fashion. The Tactical Command and Control (C2) Protect ATD will provide protection technologies for tactical networked systems against modern network attacks. The space applications technology project will demonstrate novel applications of space assets for Army missions and support space technology integration. Smart sensor networking technologies will provide the ability to network and control unmanned systems anywhere on the battlefield, providing a timely sensor-decider-engagement linkage to defeat critical targets. Advanced antenna technologies will provide the Objective Force and Joint Tactical Radio System (JTRS) with greater communications mobility, range and throughput. These projects mature technology to integrate communications systems and prototype products to enhance the survivability and efficiency of Army Objective Force tactical Command, Control, Communications and Computer (C4) systems. This program also tests and evaluates networked radio, common user, advanced antenna concepts, and distributed communications equipment and automated network management aids in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the other services. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. Work in this program element is related to, and fully coordinated with, efforts in PE 0602782A (Command, Control and Communications Technology), PE 0203740A (Maneuver Control System), PE 0203726A (Advanced Field Artillery Tactical Data System), 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) in accordance with the ongoing Reliance Joint Planning Process. The PE contains no duplication with any effort within the Military Departments. Work is performed by the US Army Communications-Electronics Command (CECOM), Fort Monmouth, NJ.

B. Program Change Summary	FY 2000	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2001 PB)	27612	21505	23775	0
Appropriated Value	27883	28505	0	
Adjustments to Appropriated Value	0	0	0	
a. Congressional General Reductions	0	0	0	
b. SBIR / STTR	-670	0	0	
c. Omnibus or Other Above Threshold Reductions	-103	0	0	
d. Below Threshold Reprogramming	500	0	0	
e. Rescissions	-168	-262	0	
Adjustments to Budget Years Since FY2001 PB	0	0	8090	
Current Budget Submit (FY 2002/2003 PB)	27442	28243	31865	0

Change Summary Explanation: Funding - FY 2001: Congressional adds were received for Intelligent Analysis Advanced Tool Set for evaluation on all source analysis system(+4000) and Big Crow Program Office Support (+3000).

FY 2002: Additional funds (+8000) were added for command and control on-the-move technical test and demonstration.

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603006A - Command, Control and Communications Adv Tech**	**247**

COST (In Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
247	TAC C4 TECHNOLOGY INT	11042	12315	13893	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project matures network and communications technology options for the Objective Force, leveraging commercial technologies where applicable, to support mission planning and battlefield decision making. This project includes the MOSAIC ATD, with the maturation, adaptation, and integration of communications for mobile operations required for the Objective Force, and is also funded in the D257 Project. The MOSAIC ATD will mature and demonstrate the core self-organizing, ad hoc, mobile network capability. It will use an open architecture approach via application program interfaces to enable integration of other capabilities and technologies. It also will demonstrate the integration of the basic maneuver layer to all other layers. In addition, this project includes the Tactical C2 Protect ATD that provides protection technologies for tactical network command and control information systems, components and data, against modern network attacks. This project performs maturation of OTM ultra-high frequency (UHF), super high frequency (SHF), and extremely high frequency (EHF) satellite communications technology, with the reachback communications capability required to reduce the number of personnel deployed into a theater of operations. Additionally, this project is maturing technologies that are required for a complete JTRS. Finally, the project matures a family of highly efficient, practical, cost effective antennas and subordinate products covering the 30 MHz to 44 GHz frequency range. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

- 4426
  - Investigated and evaluated information protection technologies for the upper Tactical Internet (TI) with focus on network access protection, intrusion detection and host level protection.
  - Integrated and tested C2 protection solutions in a field environment.
- 3680
  - Integrated wideband power amplifier control signal interface within the Wideband Radio Network (WRNT).
  - Conducted initial evaluation of the UHF multiplexer.
  - Investigated and matured an extended frequency wideband power amplifier (EF-WBPA) (400-2000 Mhz).
  - Integrated laboratory testbed equipment within the WRNT.
- 1785
  - Conducted an initial review of existing and proposed (low earth orbit (LEO)/ medium earth orbit (MEO)) wideband commercial satellite communication (SATCOM) technologies and capabilities. Matured a fast recovery modem for EHF OTM narrowband communication.
  - Conducted an initial evaluation of the JTRS multiband OTM antenna prototypes.

FY 2000 Accomplishments (Continued)

- Matured modeling and simulation tools to evaluate performance of multiple antennas on multiple vehicles used in Tactical Operation Centers (TOCs).

• 1151 - Matured, fabricated and tested alternative technologies for phased array antennas with goal of cost reduction.

Total 11042

FY 2001 Planned Program

• 6309 - Expand the investigation and evaluation of information protection technologies for the upper TI to address security management and malicious code detection and eradication.

• 3450 - Integrate very high frequency (VHF)/UHF radio frequency (RF) receiver/transmitter multiplexer into a single unit.

- Conduct performance testing on the Wideband Power Amplifier (WBPA) (30-450MHz).
- Conduct performance testing on the EF-WBPA.
- Demonstrate JTRS compatible OTM antenna.
- Conduct co-site performance test evaluation of UHF multiplexer.

• 2223 - Evolve a fast recovery modem for Ka band LEO/MEO OTM SATCOM wideband communication.

• 333 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 12315

FY 2002 Planned Program

• 7092 - Investigate and evaluate information protection technologies for the upper TI with emphasis on tactical public key infrastructure (PKI) pilot and advanced intrusion detection to include neural networking.

- Investigate and evaluate information protection technologies for the upper TI with emphasis on tactical public key infrastructure (PKI) pilot and advanced intrusion detection to include neural networking. Demonstrate integrated Tactical C2 Protect ATD technologies that provide protection for TI C2 information systems, components and data, against modern network attacks.

• 2459 - Validate OTM link layers protocols, to include recovery from blockages.

- Integrate JTRS OTM multiband ground antennas to improve design and performance.

FY 2002 Planned Program (Continued)

- 4342 - Test and evaluate MOSAIC system model in computer modeling and simulation environment.
  - Integrate MOSAIC communications and networking protocol technologies into MOSAIC mobile testbed.
  - Perform initial MOSAIC limited field demonstration.

Total 13893

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603006A - Command, Control and Communications Adv Tech**	**257**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
257 DIGITAL BATTLEFLD COMM	4630	3778	12780	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Project jointly funds with PE/project 0603006A D247 the Multifunctional On-the-Move Secure Adaptive Integrated Communications (MOSAIC) ATD. The goal of the MOSAIC ATD is to provide the Army's Objective Force with networked communications capability that support short range dispersed wireless elements (less than 1 km), medium range dispersed wireless elements (less than 10 km) and extended range dispersed wireless elements (greater than 10 km). Multiple wireless transmission facilities provide the user flexibility to traverse varied terrain over wide areas, which can improve system robustness and reduce vulnerability. The overall system will provide a scaleable capability so the user has the best wireless communications system available based on current operating conditions. The selection of these multiple wireless systems will be automated to ease the burden on the operator. To provide this highly reliable mobile communications infrastructure, the communications assets will seamlessly assign bandwidth as a function of range and network conditions. In addition, automated reconfiguration of the routing protocols, without operator intervention, will occur. This program will use airborne communications payloads to provide a networked, beyond line of sight, capability and allows maneuver elements to be dispersed in excess of 15 km to support split based operation associated with early entry Objective Force operations. The ability to seamlessly and automatically support multimedia traffic and sensor data over variable range and bandwidth transmission systems while vehicles are in motion will also be demonstrated. Mobile elements will demonstrate minimally interrupted communications, which support data, voice, remote sensor networking, real time multimedia and video teleconference (VTC) services. To show connectivity in this ATD, the communications system will dynamically operate over several different transmission systems, including a wireless local area network (LAN), packet radio, wideband cellular radio, unmanned aerial vehicles (UAVs), and satellites. This project includes Smart Sensor Communications Networks (SSCN), which will provide the Objective Force with the ability to task unmanned sensors and transport data and images from them to data fusion points and tactical commanders using the information sphere. SSCN will leverage a variety of efforts including the DARPA Small Unit Operations (SUO) and Sensor Information Technology (SensIT) programs as well as technologies developed by Army Research Laboratory (ARL). This program supports the Objective Force transition path of the Campaign Plan (TCP).

FY 2000 Accomplishments

- 2014 - Matured a security architecture to consider MOSAIC security issues up front and generated solutions to improve performance and reduce costs.

  - Extended existing communications testbed into a ground mobile testbed to provide an environment to demonstrate the concepts of mobile, seamless communications between the mobile trunking backbone communications and to the subscriber, lower data rate users.

FY 2000 Accomplishments (Continued)

- Evolved capability to enhance communications services (voice, data, video, e-mail, web browsing, video conferencing, etc.) to mobile, wireless tactical user.

• 2616 - Investigated and identified communications technologies to support distributed mobile wireless tactical operations centers.

- Identified and matured key technologies developed under the DARPA Global Mobile (GloMo) program to support networked OTM communications.

-Analyzed and matured communications architecture for the Objective Force.

Total 4630

FY 2001 Planned Program

• 3703 - Integrate networking and link layer technologies for the future generation tactical internet into the MOSAIC mobile testbed.

- Explore methods to achieve guaranteed QoS associated with real-time, IP based, multimedia communications over tactical backbone networks.

- Enhance security of commercial personal communications technology currently being adapted to tactical applications.

- Leverage commercial wireless LAN technology to provide fast Ethernet connectivity for mobile and ad-hoc networks. Adapt ad-hoc protocols to support self-initializing, self-healing, adaptive mobile networks.

- Integrate and mature DARPA program technologies into the MOSAIC mobile testbed that support networked OTM communications.

- Establish modeling and simulation environment of models provided by protocols/mechanisms.

- Evaluate and integrate key extended range networked communications technologies with the MOSAIC mobile testbed.

• 75 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 3778

FY 2002 Planned Program

•	12780	- Adapt and integrate protocols, agents and proxies that perform horizontal and vertical hand-off for optimal network operations.
		- Integrate IP QoS into MOSAIC systems architecture.
		- Integrate ad-hoc network protocols that support self-initializing, self-healing, adaptive, mobile networks.
		- Adapt and integrate initial bandwidth management mechanisms into the MOSAIC systems architecture.
		- Leverage and adapt commercial/government off-the-shelf (COTS/GOTS) mobile addressing mechanisms.
		- Investigate power management protocols suitable for sensor networks and extend the baseline for refined requirements.
		- Integrate hardware and software in surrogate ground and air platforms for technical laboratory and field tests of command and control on the move capability using an ad hoc self-organizing network with 6-10 platforms over short (1km), medium (10km), and extended (50km+) ranges.

Total 12780

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June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603006A - Command, Control and Communications Adv Tech**	**592**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
592 SPACE APPLICATION TECH	5088	5215	5192	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project develops, demonstrates and transitions advanced space technology applications for the Army's Objective Force. It develops space force enhancement applications for intelligence, reconnaissance, surveillance, target acquisition, position/navigation, missile warning, and space control ground-to-space surveillance, negation and battle management/C4 capabilities. Advanced space technologies include electro-optical (EO), infrared (IR), multi/hyperspectral, synthetic aperture radar sensors, ground-to-space radar, directed energy, and advanced data collection, processing and dissemination in real and near real time. Additionally, the project demonstrates, evaluates, and defines Army technical requirements for space platform/sensor development, on orbit sensor data collection and processing, satellite tasking and direct downlink data dissemination to ground/air systems. The project provides algorithms that optimally process space sensor data in real and near real time for integration into battlefield operating systems. Provides space control advanced technology risk reduction capability for ground-to-space radar surveillance and space object negation (disrupt, degrade, deny and destroy) systems development. Also provides an advanced space technology base for the space and missile defense battlelab space exploitation and demonstration program and the Tri-Service Department of Defense (DoD) space test program. This program supports the Objective Force transition path of the Campaign Plan (TCP).

FY 2000 Accomplishments

- 1210 - Demonstrated a hyperspectral sensor in the 1-2.5 micron wavebands, and improved cueing and clutter rejection via polarization using ground test. Initiated Long Wave Infrared (LWIR) Acousto-Optic Tuneable Filter (AOTF) development.
- 3393 - Demonstrated Battlefield Ordnance Awareness (BOA) IR sensor ability to detect artillery and rocket firings; developed software for identification and targeting of simultaneous explosive ordnance events; collected signature data in various tactical environments.
- 485 - Evolved radar phenomenology documentation and completed conceptual space surveillance technology design requirements.

Total 5088

FY 2001 Planned Program

- 986 - Demonstrate on board, near-real time, spectral/polarization data processing, and hyperspectral spatial and temporal signature processing with sensor in tower tests. Complete LWIR AOTF development.
- 3032 - Complete BOA IR signature database development; demonstrate algorithms for near real time processing of ordnance events in airborne tests; develop initial set of Army technical ordnance reporting requirements for integration in intelligence, fire support and DoD space based IR systems.
- 1057 - Complete space surveillance threat database development and evaluate potential image correlation process algorithms for technology demonstration.
- 140 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 5215

FY 2002 Planned Program

- 1094 - Field test an integrated sensor on an aerial platform and measure performance against camouflaged and concealed tactical targets. Assess performance of LWIR AOTF and focal plane array. Define LWIR hyper spectral sensor design for aerospace test platforms.
- 994 - Complete battlefield ordnance technical requirements definition. Transition to intelligence, fire support, and DoD space based IR systems.
- 3104 - Develop formal software coding of algorithms user interface design to demonstrate threat assessment techniques on space surveillance radar.

Total 5192