ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602270A - EW TECHNOLOGY**

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost	17002	16471	18034	20806	20663	16366	16589
442 TACTICAL EW TECHNOLOGY	9717	10342	11449	12918	13119	9395	9524
906 TAC EW TECHNIQUES	7285	6129	6585	7888	7544	6971	7065

A. Mission Description and Budget Item Justification: This Program Element (PE) researches and investigates electronic warfare (EW) technologies to improve the Army's battlespace survivability, enemy targeting capability and situational awareness (SA) for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This will be accomplished through the investigation of electronic support measures (ESM), threat warning and countermeasures against munitions, missiles, improvised explosive devices, missiles and target acquisition sensors. It will provide deployed Future Force elements with information dominance and increased force protection. The intent of the PE is to deny, disrupt, or degrade the enemy's use of the electromagnetic spectrum for offensive or defensive operations. Specifically, its technologies focus on detecting threat emitters associated with weapon guidance systems, targeting systems and command, control, communications, computers, and intelligence (C4I) systems and networks. Work in this PE covers the spectrum in the radio frequency (RF), infrared (IR), electro-optical (EO), and ultra-violet (UV) ranges. In addition, this PE offers improvements to our EW sensors, and electronic countermeasures (ECM) systems to further protect high-value ground targets, aircraft, and the soldier from threat surveillance/tracking systems, imaging systems and advanced RF/EO/IR missiles, artillery, and smart munitions. Improvements to the next generation EW protection sensors augment the classic intelligence, surveillance, and reconnaissance (ISR) sensors by providing multi-functional capabilities for on-board, and off-board SA, targeting, and combat identification. Finally, this PE will research automated intelligence fusion and automated battlefield assessment management tools. This PE includes Warfighter Electronic Collection and Mapping, Electronic Support for the Future Force, Advanced Radar Deception and Countermeasures, Advanced EW Sensors, EO/IR Countermeasures, Sensor Countermeasures, Fusion Based Knowledge, Networked Sensors, Information Operations, and Joint Intelligence and Surveillance and Reconnaissance (JISR).

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). This PE supports and is fully coordinated with efforts in PE 0602782A (Command, Control and Communications (C3) Technology), PE 0602709A (Night Vision and Electronics-Optics Technology), PE 0603789F (C3 Intelligence Technology Development), PE 0603270A (Electronic Warfare Advanced Technology), PE 0604270A (Electronic Warfare Development), and PE 0603745A (Tactical Electronics Support Systems - Advanced Development). Work is performed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	17303	17029	17923
Current Budget (FY 2005 PB)	17002	16471	18034
Total Adjustments	-301	-558	111
Congressional program reductions		-161	
Congressional rescissions			
Congressional increases			
Reprogrammings	-301	-397	
SBIR/STTR Transfer			
Adjustments to Budget Years			111

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
442	TACTICAL EW TECHNOLOGY	9717	10342	11449	12918	13119	9395	9524

A. Mission Description and Budget Item Justification: This project researches, investigates and applies electronic warfare technologies to enhance the survivability capabilities of ground combat vehicles, aircraft and the dismounted soldier. The vehicle survivability approach will provide detection avoidance through signature management and hit avoidance using warning receivers and countermeasures. This project will apply recent advances in radio frequency (RF), infrared (IR) and electro-optical (EO) sensor and jamming sources to detect, locate, deceive and jam improvised explosive devices, radar directed target acquisition systems, target-tracking sensors, Surface-to-Air Missiles (SAMs), Air-To-Air Missiles (AAMs), top attack weapons and fuzed munitions. The ability to neutralize improvised explosive devices (IEDs) will be researched with the goal of embedding the maximum capability in projected FCS/ Future Force systems to minimize vehicle weight, cost, logistics and fielding. Additionally, this project will research EO technologies and countermeasures technologies against laser-aided and electro-optically directed gun or missile systems. The Electronic Support for the Future Force effort will design and evaluate a light weight, low cost Electronic Support Measure (ESM) capability for Unmanned Ariel Vehicles (UAV) and Unattended Ground Sensors (UGS) enabling collection, identification, location and tracking of "hard-to-detect" communications and radar emitters not addressed by space, airborne or ground based intelligence systems. The Tactical Aircraft Self Defense program will investigate new EW technology that will deceive an enemy's radar based sensors and neutralize their ability to locate, target and guide weapons against early entry forces and the Future Force. Cost-effective sensors for use in missile warning systems (MWS) will be investigated to protect Army ground combat vehicles and aircraft from gunfire, rocket propelled grenades (RPGs), SAMs, top attack (TA) weapons and antitank guided missiles (ATGMs). The Electro-optic and Infrared (EO/IR) Countermeasures program investigates active and passive devices to protect aircraft and ground vehicles with conventional and suppressed signatures from EO and IR guided threats. The Sensor Countermeasures for the Future Force effort will investigate a multi-functional on the move (OTM) capability to detect, locate, deceive and jam enemy netted ground and airborne sensors, communications, IEDs, artillery fuzes, and battlefield surveillance radar. A substantial amount of work will be accomplished under The Technical Cooperation Program (TTCP) Electronic Warfare Systems (EWS) Panel and cost sharing under project arrangements with the United Kingdom and Australia. Finally, this project will look at those Electronic Support (ES) technologies used against non-communications signals for targeting and tactical Situation Awareness (SA).

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 is performed by the Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Electronic Support for the Future Force: This effort researches technologies to collect, identify, locate, and track hard to detect communications emitters on the battlefield that are otherwise unavailable through space, airborne, or other assets. This will provide full spectrum electronic collection and mapping, and electronics support for the Future Force. In FY03, transitioned co-channel mitigation techniques to test bed. Expanded the co-channel mitigation techniques to include combat net radios and other narrow band emitters. Established the requirements to embed multi-path mitigation techniques with signal id and geolocation algorithms in UGVs and UAVs. In FY04, integrate multi-path mitigation software and test. Transition modulation recognition software to test bed and evaluate in field test. Pursue advanced simulation capabilities to define the utility of UGV and UAV sensors. In FY05, will develop and provide advanced simulation capability to refine the operational utility of UGV and UAV signals intelligence sensors in the Mounted Maneuver Battlespace Lab at Fort Knox and continue sensor, antenna, and receiver design efforts.	1479	2500	3274
- Advanced Radar Deception and Countermeasures: In FY03, conducted lab and controlled field-testing on new techniques that countered frequency hopping air defense radars and top attack munitions. Established techniques for an enhanced ground vehicle and aircraft protection suite that simultaneously countered multiple advanced RF threats. Provided a counter booby trap Quick Reaction Capability against a specific RF threat in support of Operation Enduring Freedom and Operation Iraqi Freedom to increase the survivability of our warfighters in those Areas of Operation. In FY04, test countermeasure techniques against LPI and battlefield surveillance radars in the laboratory and in a controlled field environment. These techniques will attempt to jam top attack munitions, artillery and anti-aircraft artillery fuzes causing 90% prefunction of all rounds significantly beyond the lethal distance of the round.	2582	2583	0
- Electro-Optical/Infrared Countermeasures and Advanced Radar Deception and Countermeasures: This effort researches and investigates technologies that enable Electro-optic (EO)/Infrared (IR) Countermeasures and Advanced Electronic Warfare using Sensors. In FY03, improved IR jamming techniques to defeat advanced ATGMs, and evaluated the capability of an IR jamming system to defeat ATGMs, evaluated the ability of a multispectral mid-IR laser to defeat advanced IR SAMs and IR imaging missiles, integrated and tested a system of new low cost sensor and warning algorithms for protection of air and ground platforms against missiles. Conducted field measurements of IR and UV signatures of SAMs, ATGMs, background and manmade point false alarm sources. Researched new techniques to increase detection, identification and classification of “background clutter” signals.	4756	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Sensor Countermeasures for the Future Force: In FY03, characterized the emerging threat from Improvised Explosive Devices (IEDs)/booby traps and investigated key sensor component technologies (highly sensitive RF receivers and antennas that quickly scan multiple threats simultaneously including those threats operating at very low transmit power). Developed countermeasure techniques and proposed design architecture for a modular, multi-spectral (RF/UV/EO/IR) sensor required for multiple Future Force systems. In FY04, pursue exploitation techniques for those threat sensors, begin lab testing of detection and jamming algorithms. Conduct modeling and simulation, laboratory and controlled field-testing of detection, location, deception, and countermeasure techniques against threat sensors and booby traps. Assess potential for embedding a capability in existing and near term systems. In FY05, will collaborate with other US and foreign government agencies on threat and countermeasure techniques. Conduct deception and jamming technique research, investigate modeling and simulation hardware and software. Will expand investigation and conduct field-testing of countermeasures against RF and IR IED links.	900	2629	4548

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
- Suite of Sense Through the Wall Systems for the Future Force (STTW): This effort will provide users with the ability to detect visibly obscured targets up to the objective stand off distance, operate on the move, accurately geo-locate targets in the presence of clutter with an intuitive user interface. It will leverage STTW, concealed weapons, and concealed explosives detection programs conducted by the National Institute of Justice, Technical Support Working Group, Air Force Research Lab and Bureau of Customs and Border Protection. In FY04, assess the feasibility of various technologies (i.e., RADAR, millimeter wave, acoustic, x-ray) for STTW applications. Based on this assessment, award one or more contracts for maturation of advanced processing techniques and improved algorithms leading to the next generation STTW system with increased standoff, a user-friendly graphical user interface (GUI), accurate target geo-location, and detection of multiple targets through walls. In FY05, will continue maturation of the STTW system and begin investigation of technologies for concealed weapons/concealed explosives detection (CWD/CED). Will develop and refine techniques for detection of stationary personnel through light construction materials. Will integrate prototypes with emerging FCS and Objective Force Warrior (OFW) network communications architectures to demonstrate transmission of STTW data on a real time basis. Will evaluate data transmission, dissemination, and software tools. Will provide STTW performance model for incorporation into Battle Lab and OFW operational modeling & simulation.	0	1770	2644
- Fusion Based Knowledge for the Future Force: In FY04, develop a Higher Level Fusion Knowledge Infrastructure to facilitate plug-n-play assessment. Conduct a pilot experiment for higher-level fusion tool to develop metrics and scenarios for testing. Conduct a Battle Damage Assessment experiment to assess the problem. Identify technical issues associated with data fusion models for application to an advanced knowledge generation capability to answer time critical priority intelligence reports (PIRs) at a rate supporting tactical agility concepts of the Future Force. In FY05, initiate Physical Damage Assessment (PDA) tools evaluation. Transition the Intelligent Agent work being conducted by Army Research Lab into the Knowledge Infrastructure to increase the efficiency and effectiveness of intelligence gathering, processing, and exploitation to provide higher quality and timelier answers to critical intelligence requirements.	0	700	983
Small Business Innovative Research/Small Business Technology Transfer Programs	0	160	0
Totals	9717	10342	11449

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

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602270A - EW TECHNOLOGY**	**906**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
906	TAC EW TECHNIQUES	7285	6129	6585	7888	7544	6971	7065

A. Mission Description and Budget Item Justification: This project researches and applies key electronic warfare (EW) technologies to intercept and locate, current and emerging threat communications and non-communications emitters to provide vital, quality combat information directly to users in a timely actionable manner in accordance with concepts for Future Force intelligence operations. This project will contribute to the commanders ability to see the enemy, both in whole and as part of a complex, adaptive organization, allowing a "See First, Understand First, Act First" standard of operations. This project matures radio frequency (RF) collection and mapping technologies into integrated multifunction devices, to offer real time emitter detection, location, and identification. Efforts include adding an autonomous RF collection capability and algorithms into tactical software defined radios to detect, locate and display enemy RF emissions. It also evolves electronic attack (EA) components into smaller, lower power, lightweight, common modules that counter modern threat C4I systems. In addition, this project will enable a remote capability to disrupt, deny or destroy threat communication signals. Other research areas include fusion (automated assimilation and synthesis) of battlefield intelligence data to provide tools to the Unit of Action (UA) that will enable interpretation of current and future enemy activities and allow development of Courses of Action in time to act pre-emptively and decisively. The Warfighter Electronic Collection and Mapping (WECM) program provided the warfighter at the unit level the ability to locate enemy tactical RF emitters and investigate a new generation of low cost distributed unmanned networked sensor systems organic to the RSTA team. The Joint Intelligence, Surveillance, and Reconnaissance (JISR) program developed technology to provide the warfighter a comprehensive near-real-time view of ISR information based on both traditional and selected non-traditional sensors to enhance situation awareness at all echelons. The Information Operations for the Future Force effort provides a Unit of Action (UA) on-the-move (OTM) capability for precision detection and location of commercially available wired and wireless telecommunications and computers in an urban environment. The Electronic Support for the Future Force effort will evaluate a light weight, low cost Electronic Support Measure (ESM) capability for UAVs and UGSs enabling them to collect, identify, locate and tract “hard-to-detect” communications and radar emitters not addressed by space, airborne or ground based intelligence systems. The Fusion Based Knowledge for the Future Force effort will investigate an advanced knowledge generation and explanation capability to answer warfighting commanders’ priority intelligence requirements (PIRs), enabling the force to see and understand at a rate supporting tactical agility concepts of the Future Force.

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 is performed by the Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- Joint Intelligence, Surveillance and Reconnaissance (JISR): In FY03, conducted experiment with high fidelity modeling and simulation of all-source sensor correlation that used advanced data mining web applications to minimize volume of network data traffic. Conducted experiment with military operators to optimize user interfaces in support of JISR ACTD. Demonstrated Initial Operational Capability (IOC) and began transition to the future system. Additional funding for this program is contained in PE 0603270A.	1448	0	0
- Information Operations for the Future Force (IOFF): In FY03, determined/characterized typical wireless network protocols and traffic analysis algorithms. In FY04, determine wired digital traffic analyses algorithms. Investigate inadvertent emissions analysis techniques to increase detection range. Provide models of preliminary threat and C4ISR detection systems to battlelabs at Fort Huachuca, Fort Knox, and Fort Leavenworth. In FY05, identify and test techniques to cross cue/correlate RF emission geolocations and Internet Protocol (IP) virtual address locations in lab environment.	2881	1768	2584
- This effort researches and investigates EW sensors and electronics signal processing technologies. In FY03, investigated software algorithms for unmanned Electronic Support Measures (ESM) signals intelligence (SIGINT) sensor systems that included unattended ground and air vehicle applications for the Future Combat Systems and Divisional Tactical SIGINT Payload (DTSP). In FY04, design compact RF receiver architectures that will enable the deployment of remote, unmanned ESM/SIGINT sensors and enhance the effectiveness of the Future Force Warrior. In FY05, research ESM/SIGINT system capabilities that will operate in unmanned networked environments to detect tactical RF transmissions that can support the movements of the Future Combat Systems warfighters. Investigate the ability to integrate the unmanned ESM/SIGINT sensor systems with Networked Sensors for the Future Force ATD communications equipment.	1985	4361	4001
- Fusion Based Knowledge for the Future Force: In FY03, identified technical issues associated with data fusion models for application to an advanced knowledge generation capability to answer time critical priority intelligence reports (PIRs) at a rate supporting tactical agility concepts of the Future Force.	971	0	0
Totals	7285	6129	6585