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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602270A - EW 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	16427	17303	17029	17923	20803	20636	16341	16675
442	TACTICAL EW TECHNOLOGY	9440	9889	10692	11621	13150	13358	9534	9718
906	TAC EW TECHNIQUES	6987	7414	6337	6302	7653	7278	6807	6957

A. Mission Description and Budget Item Justification: This Program Element (PE) researches and investigates electronic warfare (EW) technologies to improve the Army's Objective Force battlespace survivability, enemy targeting capability and situational awareness (SA). This will be accomplished through the investigation of electronic support measures (ESM), threat warning and countermeasures against munitions, missiles, booby traps, missiles and target acquisition sensors. It will provide deployed Objective 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 the 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. Science and Technology Objectives (STOs) covered by this PE include Warfighter Electronic Collection and Mapping, Electronic Support for the Objective Force, Advanced Radar Deception and Countermeasures, Advance EW Sensors, EO/IR Countermeasures, Tactical Command and Control (C2) Protect Advanced Technology Demonstration, Sensor Countermeasures for the Objective Force, Fusion Based Knowledge for the Objective Force, Networked Sensors for the Objective Force, Information Operations for the Objective Force and Joint Intelligence, and Surveillance and Reconnaissance (JISR). 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). The work cited is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The PE contains no duplication with any effort within the Military Departments. Work is performed by the US Army Communications-Electronics Command, Fort Monmouth, NJ. This program supports the Objective Force transition path to the 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)	17292	19584	20448	21257
Current Budget (FY 2004/2005 PB)	16427	17303	17029	17923
Total Adjustments	-865	-2281	-3419	-3334
Congressional program reductions				
Congressional rescissions		-2054		
Congressional increases				
Reprogrammings	-723	-100		
SBIR/STTR Transfer	-142	-127		
Adjustments to Budget Years			-3419	-3334

Change Summary Explanation:
Significant Changes:
Funding - FY 2004/2005: Funds realigned to higher priority investments.

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602270A - EW TECHNOLOGY**	**442**

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
442	TACTICAL EW TECHNOLOGY	9440	9889	10692	11621	13150	13358	9534	9718

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 booby traps, 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 booby trap improvised explosive devices (IEDs) will be researched with the goal of embedding the maximum capability in projected FCS/Objective 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 Warfighter Electronic Collection and Mapping (WECM) program will provide the unit level warfighter the ability to locate enemy tactical RF emitters. The Electronic Support for the Objective Force (ESOF) effort will demonstrate a light weight, low cost Unmanned Ariel Vehicle (UAV) and Unattended Ground Sensor (UGS) Electronic Support Measure (ESM) capability enabling them to collect, identify, locate and tract "hard-to-detect" communications and radar emitter 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 Objective Force. It also investigate cost—effective sensors for use in missile warning systems (MWS) for protecting 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 fro EO and IR guided threats. The Sensor Countermeasures for the Objective Force (SCOF) 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). This project supports the Objective transition path of the Transformation Campaign Plan (TCP).

No Defense Emergency Response Funds (DERF) were provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
This effort researches technologies that enable battlefield electronic collection and mapping, and electronics support for the objective force. In FY 02, researched techniques to detect, identify, and locate enemy tactical radio frequency emitters and conducted multiple evaluations of signal processing algorithms for signal detection identification and geolocation. In FY03, research and investigate new design concepts for a Signals Intelligence (SIGINT) sensor that will provide the capability to detect the emerging low probability of detection (LPD)/low probability of intercept (LPI) communications waveforms that will threaten the Objective Force. In FY04, pursue advanced simulation capabilities to define the utility of unattended ground and air vehicle sensors. Investigate designs that integrate digital receivers into antenna elements to reduce sensor size and weight and still increase dynamic range and instantaneous bandwidth of the receivers. In FY05, provide advanced simulation capability to refine the operational utility of unattended ground and air vehicle SIGINT sensors in the Mounted Maneuver Battlespace Lab at Fort Knox and continue sensor, antenna and receiver design efforts.	1498	1566	2723	3329
Tactical Aircraft Self Defense: In FY02, researched techniques against frequency hopping air defense radars and top attack munitions. Conducted Systems Integration Lab (SIL) testing of countermeasures against artillery top attack fuzes. In FY03, conduct lab and controlled field testing on new techniques to counter frequency hopping air defense radars and top attack munitions. Establish techniques for an enhanced ground vehicle and aircraft protection suite to simultaneously counter multiple advanced RF threats. 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.	3260	2582	2711	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
This effort researches and investigates technologies that enable Electro-optic (EO)/Infrared (IR) Countermeasures and Advanced Electronic Warfare using Sensors. In FY02, Researched multispectral laser to defeat advanced IR surface-to-air and imaging missiles, transitioned warning algorithms for two-colored, antitank guided missile (ATGM) focal plane array (FPA) missile warning program to an on-going integrated countermeasure program in PE 0603270A. Demonstrated in laboratory environment IR countermeasure techniques for advanced ATGMs and emerging surface-to-air and air-to-air missiles, including FPA imaging missiles. Tested and evaluated cooperative jamming and decoy/flare techniques to support integrated countermeasure technology demonstration, and established threat and clutter signature database for algorithm investigation. In FY03, improve IR jamming techniques to defeat advanced ATGMs, and evaluate the capability of an IR jamming system to defeat ATGMs, evaluate the ability of a multispectral mid-IR laser to defeat advanced IR SAMs and IR imaging missiles, integrate and test a system of new low cost sensor and warning algorithms for protection of air and ground platforms against missiles. Conduct field measurements of IR and UV signatures of SAMs, ATGMs, background and manmade point false alarm sources. Research new techniques to increase detection, identification and classification of “background clutter” signals.	4682	4840	1834	2699
Sensor Countermeasures for the Objective Force (SCOF): In FY03, Characterize the emerging threat from Improvised Explosive Devices (IEDs)/booby traps and investigate key sensor component technologies (highly sensitive RF receivers and antennas that can quickly scan multiple octaves) in support of a modular, multi-spectral UV/IR sensor required for multiple Objective Force systems. In FY04, pursue acquisition of 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, collaborate with other US and foreign government agencies on threat and countermeasure techniques. Conduct deception and jamming technique research, investigate model hardware and software. Expand investigation and conducting field testing of against RF and IR IED links.	0	901	3424	5593
Totals	9440	9889	10692	11621

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

February 2003

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

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
906	TAC EW TECHNIQUES	6987	7414	6337	6302	7653	7278	6807	6957

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 Objective 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, and brigade level joint intelligence, surveillance and reconnaissance (JISR) assets to provide useful information to the Unit of Action (UA) without overloading the operator with non-essential details. Fusion and dissemination efforts will integrate data from traditional intelligence sensors and non-traditional sources, such as target acquisition systems, to provide ground force commanders unprecedented battlefield awareness and dominance of the electro-magnetic spectrum. The Tactical C2 Protect ATD will investigate, integrate, validate and demonstrate hardware and software that protects the systems and networks of the First Digitized Division and Future Combat Systems from modern network attacks. The Warfighter Electronic Collection and Mapping (WECM) program will provide the warfighter at the unit level the ability to locate enemy tactical RF emitters. The Joint Intelligence, Surveillance and Reconnaissance (JISR) program will 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. Investigate a new generation of low cost distributed unmanned networked sensor systems organic to the RSTA team. The Information Operations for the Objective Force effort provides a Unit of Action (UA) an 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 Objective Force (ESOF) STO will demonstrate a light weight, low cost UA V and UGS Electronic Support Measure (ESM) capability enabling them to collect, identify, locate and tract “hard-to-detect” communications and radar emitter not addressed by space, airborne or ground based intelligence systems. The Fusion Based Knowledge for the Objective Force (FbKOF) STO 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 Objective Force. This system supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

No Defense Emergency Response Funds (DERF) were provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Joint Intelligence, Surveillance and Reconnaissance (JISR): In FY02, completed software to integrate existing joint and national intelligence sensors into a common format for JISR ACTD. Assessed improved JISR system performance and military utility in several tactical field exercises. In FY03, conduct experiment with high fidelity modeling and simulation of all-source sensor correlation that uses advanced data mining web applications to minimize volume of network data traffic. Conduct experiment with military operators to optimize user interfaces in support of JISR ACTD. Demonstrate Initial Operational Capability (IOC) and begin transition to the objective system. Additional funding for this program is contained in PE 0603270A.	2000	1458	0	0
- Information Operations for the Objective Force (IOOF): In FY02, Completed limited RF radio control strategy. In FY03, determine/characterize 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.	500	2941	1818	2482
This effort researches and investigates EW sensors and electronics signal processing technologies. In FY02, completed modeled emitter identification and geolocation software for Future Combat Systems software radio. Refined algorithm design based on test performance. Simulated sensor function embedded in vehicle radio in Future Combat Systems experiments at Mounted Maneuver Battlespace Lab at Ft. Knox, completed limited RF controller/radio control strategy. In FY03, investigate software algorithms for unmanned Electronic Support Measures (ESM) signals intelligence (SIGINT) sensor systems that include 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 Objective 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 Objective Force ATD communications equipment.	4487	2044	4519	3820
- Fusion Based Knowledge for the Objective Force (FbKOF): In FY03, 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 Objective Force.	0	971	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Totals	6987	7414	6337	6302