ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2005

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

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		16704	19703	19129	19075	16281	16370	16512	16633
442	TACTICAL EW TECHNOLOGY	10431	11104	11545	11753	9346	9398	9479	9549
475	ELECTRONIC WARFARE COMPONENT TECHNOLOGIES (CA)	0	2109	0	0	0	0	0	0
906	TAC EW TECHNIQUES	6273	6490	7584	7322	6935	6972	7033	7084

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, acquisition of enemy targets, situational awareness (SA) for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Project 442 funds efforts related to research, investigation, and application of electronic warfare technologies to enhance the survivability capabilities of ground combat vehicles, aircraft and the dismounted soldier. Project 906 funds efforts related to research and application of key 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. The intent of the PE is to research and evaluate technologies that will deny, disrupt, or degrade the enemy's use of the electromagnetic spectrum for offensive or defensive operations. This will be accomplished through the investigation of electronic support measures (ESM), countermeasures against communications systems and networks; the development of sensors used to identify and locate threat forces in an asymmetric environment; and threat warning and electronic countermeasures (ECM) against: munitions sensors and targeting capabilities, missile guidance and targeting systems, and improvised explosive devices. The PE will provide deployed Future Force elements with information dominance and increased force protection. Specifically, its technologies focus on detecting threat sensors and emitters associated with weapon 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), ultra-violet (UV), magnetic and acoustic ranges. In addition, this PE offers improvements to Current Force EW sensors, and ECM systems to further protect high-value ground targets, aircraft, and the soldier from threat surveillance and 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. This PE will provide information fusion research that will address sensor data reduction through use of automated processing, as well as higher level reasoning techniques that support automated combat assessment. This PE includes Electronic Support, Sense Through the Wall, Advanced Radar Deception and Countermeasures, Sensor Countermeasures, Fusion processing, Networked Sensors, and Information Operations efforts. Project 475 funds Congressional special interest efforts.

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 is this PE is related to and is fully coordinated with efforts funded in PE 0603270A (EW Technology). Work is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2005)	18034	20806	20663
Current Budget (FY 2006/2007 PB)	19703	19129	19075
Total Adjustments	1669	-1677	-1588
Net of Program/Database Changes			
Congressional Program Reductions	-293		
Congressional Rescissions			
Congressional Increases	2200		
Reprogrammings			
SBIR/STTR Transfer	-238		
Adjustments to Budget Years		-1677	-1588

Change Summary Explanation:

Two FY05 Congressional Adds totaling $2200 were added to this PE.

FY05 Congressional Adds with no R-2A:
($1151) Biometric Signatures Research, Project 475: The purpose of this one year Congressional add is to research the combination of biometric & waveform emissions for identification, tagging, detecting & tracking. No additional funding is required to complete this project.

($959) Subterranean Target ID Program, Project 475: The purpose of this one year Congressional add is to research the detection/classification of underground structures using seismic sensors and processing. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2005

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

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
442	TACTICAL EW TECHNOLOGY	10431	11104	11545	11753	9346	9398	9479	9549

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 survivability approach will provide detection avoidance through signature management and hit avoidance using warning receivers and electronic 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 (IEDs), radar directed target acquisition systems, target-tracking sensors, Surface-to-Air Missiles (SAMs), Air-To-Air Missiles (AAMs), top attack weapons and electronically fuzed munitions. The ability to neutralize IEDs will be researched with the goal of embedding the maximum capability in projected Future Combat Systems (FCS), and 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. 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 is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
- 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 for the Future Force. In FY04, integrated and tested multi-path mitigation software; transitioned modulation recognition software to test bed and evaluated in field test; pursued advanced simulation capabilities to define the utility of Unmanned Ground Vehicle (UGV) and UAV sensors. In FY05, 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. In FY06, will evaluate UAV and UGS electronic support measures in a warfighter operational environment that demonstrates real time collection, ID and location with sensor data fusion.	2700	3300	2000	0
- Sensor Countermeasures for the Future Force: In FY04, developed and demonstrated electronic countermeasures capable of neutralizing remotely detonated booby traps; transitioned this capability to PM Electronic Countermeasures for immediate fielding to US troops. In FY05, collaborate with other U.S. and foreign government agencies on threat and countermeasure techniques; conduct deception and jamming technique research; investigate modeling and simulation hardware and software; expand the investigation and conduct field-testing of countermeasures against RF and IR links for detonation of booby traps; assess potential for embedding the countermeasure capability in near term systems. In FY06, in response to the evolving threat environment, continue collaboration with other U.S. and foreign government agencies on threat and countermeasure techniques; conduct deception and jamming technique research; conduct simulation against potential threats; investigate and conduct field-testing of countermeasures against RF and IR links (and others depending on threat) for detonation of booby traps; assess potential for embedding the countermeasure capability in near term systems. In FY07, will conduct field testing to demonstrate countermeasure effectiveness against enemy sensors.	2700	4105	4860	1457

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
- Suite of Sense Through the Wall Systems (STTW) for the Future Force: 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. In FY04, assessed the feasibility of various technologies (i.e., RADAR, millimeter wave, acoustic, x-ray) for STTW applications; designed 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, continue maturation of the STTW system and the investigation of technologies for concealed weapons detection/concealed explosives detection (CWD/CED); develop and refine techniques for detection of stationary personnel through light construction materials; integrate prototypes with emerging Unit of Action and Future Force Warrior (FFW) network communications architectures to demonstrate transmission of STTW data on a real time basis; evaluate data transmission, dissemination, and software tools; provide STTW performance model for incorporation into Battle Lab and FFW operational modeling & simulation. In FY06, will conduct lab and user testing of STTW prototypes; will utilize experiments to develop tactics, techniques, and procedures (TTPs) and characterize urban and complex terrain phenomenology. In FY07, will begin development of integrated personnel detection/CWD/CED systems with greater standoff capability and increase probability of detection; will conduct lab testing of individual STTW sensors against multiple wall types, and formulate techniques for detection of stationary personnel through multiple wall types; will demonstrate hand held STTW prototype with the FFW ATD.	1631	2699	3685	3911

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
- Fusion Based Knowledge for the Future Force: In FY04, identified and analyzed the full set of cognitive tasks the Future Combat System's Unit of Action analysts must perform to answer commanders' priority intelligence requirements (a set of intelligence fusion tasks); completed a requirements analysis and data models for utilizing several intelligence sources to support data fusion processing; integrated two more data sources (All Source Analysis System-Light, and a meteorological system) into the baseline system needed to handle multiple intelligence and data sources; developed a software prototype multi-dimensional data structure to allow an analyst to direct the search for patterns of interest in the data. In FY05, develop scenarios, construct data sets, and identify metrics, to conduct a pilot experiment for assessing fusion tools needed to answer commander's priority intelligence requirements. In FY06, will use software technologies to represent knowledge needed to logically link multiple, diverse sources of data to answer the commander's priority intelligence requirements. In FY07 will complete process of acquiring knowledge from analysts and implementing in fusion reasoning software, and finalize refinements to software for representing knowledge and reasoning for answering priority intelligence requirements.	700	1000	1000	1000
- Multispectral Laser & Missile Warning and EO/IR Imaging Missile CM: In FY07, will investigate technologies applicable to next generation laser and missile warning systems and develop those technologies which have the greatest potential to increase system performance while reducing the size, weight, power consumption and cost of currently fielded systems; will develop devices and techniques to effectively counter imaging missiles that are proliferating and pose a serious threat to Army platforms; will evaluate techniques to counter laser beam riding missiles.	0	0	0	5385
- Advanced Radar Deception and Countermeasures: In FY04, completed a high speed, wide band, electronic countermeasure testbed; utilized the testbed for evaluation of countermeasure techniques against Low Probability of Intercept and battlefield surveillance radars in the laboratory and in a controlled field environment. These techniques effectively jammed top attack munitions, artillery and anti-aircraft artillery fuzes causing 90% prefunction of all rounds significantly beyond the lethal distance of the round.	2700	0	0	0
Totals	10431	11104	11545	11753

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

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
906	TAC EW TECHNIQUES	6273	6490	7584	7322	6935	6972	7033	7084

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 Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) 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) enabling interpretation of current and future enemy activities and allowing development of Courses of Action in time to act decisively and in a pre-emptive manner.

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 Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
- Electronic Support for the Future Force (ESFF) & Networked Sensors for the Future Force (NSfFF): This effort researches and investigates EW sensors and electronics signal processing technologies. In FY04, designed compact RF receiver architectures that will enable the deployment of remote, unmanned ESM(Electronic Support Measures)/Signals Intelligence (SIGINT) sensors and enhanced 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. In FY06, will test UAV and UGS ESM in a warfighter operational environment that demonstrates real time collection, ID and location with sensor data fusion.	4455	4123	5184	0
- Information Operations: In FY04, developed urban characterization hardware, and completed the first representative signals environment survey; began signal and traffic analysis work; demonstrated unintentional radiation detection capability; successfully demonstrated the ability to detect and distinguish target traffic in a lab environment; identified receiver technology to support future geolocation efforts and for potential use in force protection. In FY05, identify and test network analysis and data recognition techniques for RF emission, geolocation and virtual address locations in a lab environment. In FY06, will mature signal analysis work and cross cueing/correlation capability for RF emission geolocation and virtual address locations and demonstrate the capability to perform precision detection and location of emitters in a lab environment.	1818	2367	1400	0
- Fusion Based Knowledge for the Future Force: In FY06, will conduct experiments and demonstrations to show software architectural capabilities to rapidly develop and maintain multiple interpretations and associated confidence levels to answer commander's priority intelligence requirements; will finalize warfighter directed software for finding interesting patterns (discovering knowledge) in multi-dimensional data supporting intelligence fusion, and identify requirements and construct initial information agents to support intelligence retrieval of information from diverse data sources. In FY07, will finalize development activities of software architecture capabilities and assess its utility to more rapidly develop highly plausible interpretations as answers to commanders' priority intelligence requirements; will finalize development of information agents required for efficient and effective information retrieval in support of intelligence fusion processing.	0	0	1000	1000

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
– Future Comm Signal Detection, Location & Classification & Modern C2 Attack: This effort will focus on the detection of communications systems that utilize advanced technologies to enable operations against threat systems in extremely dense signal environments. In FY07, will research the threat use of modern high capacity modulation methods, frequency reutilization capabilities, low probability of intercept techniques, and the technologies that are driving these systems; will develop methods of attacking these capabilities to achieve spectrum dominance.	0	0	0	6322
Totals	6273	6490	7584	7322