

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE						
2 - Applied Research	0602270A - Electronic Warfare Technology						
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total Program Element (PE) Cost	30458	30013	16611	16822	16954	17331	17722
442 TACTICAL EW TECHNOLOGY	11272	9342	9506	9620	9693	9909	10132
475 ELECTRONIC WARFARE COMPONENT TECHNOLOGIES (CA)	11717	13709					
906 TAC EW TECHNIQUES	7469	6962	7105	7202	7261	7422	7590

A. Mission Description and Budget Item Justification: This program element (PE) designs and develops electronic warfare (EW) component technologies that deny, disrupt, or degrade the enemy's use of the electromagnetic spectrum for offensive or defensive operations, for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This is 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 booby traps. Project 442 funds efforts related to the design, development, and application of electronic warfare technologies to enhance the survivability capabilities of ground combat vehicles, aircraft, and the dismounted Soldier. In addition, this project 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 situational awareness (SA), targeting, and combat identification. Information fusion research addresses sensor correlation, relationship discovery, and management services through use of automated processing, as well as higher level reasoning techniques that support automated combat assessment. Project 906 funds efforts related to research and application of key EW technologies to intercept, locate, and disrupt, 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. 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.

Efforts in this PE are coordinated with PE 0603270A (EW Technology), PE 0602120A (Sensors and Electronic Survivability), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602783A (Computer and Software Technology), and PE 0602784A (Advanced Concepts and Simulation). Project 475 funds congressional special interest efforts. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy and the Army Science and Technology Master Plan. Work is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

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<u>B. Program Change Summary</u>	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	30972	16411	16605
Current BES/President's Budget (FY 2009)	30458	30013	16611
Total Adjustments	-514	13602	6
Congressional Program Reductions		-198	
Congressional Rescissions			
Congressional Increases		13800	
Reprogrammings	33		
SBIR/STTR Transfer	-547		
Adjustments to Budget Years			6

Six FY08 congressional adds totaling \$13800 were added to this PE.

- (\$1600) Battlefield Connectivity, Multi-Level Secure Networks
- (\$1600) Integrated Information Technology Policy Analyses Research
- (\$2000) Electromagnetic Gun Initiative
- (\$2400) Dominant Military Operations on Urbanized Terrain Viewer
- (\$3000) Knowledge Integration and Management
- (\$3200) Silver Fox and Manta Unmanned Aerial Systems

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A - Electronic Warfare Technology					PROJECT 442	
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
442 TACTICAL EW TECHNOLOGY	11272	9342	9506	9620	9693	9909	10132

A. Mission Description and Budget Item Justification: This project designs, develops, and applies electronic warfare technologies to enhance the survivability capabilities of ground combat vehicles, aircraft, and the dismounted Soldier. The survivability approach provides detection avoidance through signature management and hit avoidance using warning receivers and electronic countermeasures. This project applies recent advances in radio frequency (RF), infrared (IR), and electro-optical (EO) sensor and jamming sources to detect, locate, deceive, and jam threats, 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 booby traps is pursued with the goal of embedding the maximum capability in the Current Force, and systems to minimize Future Force vehicle weight, cost, logistics, and fielding. Additionally, this project designs and develops EO technologies and countermeasures technologies against laser-aided and electro-optically directed gun or missile systems. Finally, this project will look at those Electronic Support (ES) technologies used against non-communications signals for targeting and tactical situational awareness.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy and the Army Science and Technology Master Plan. Work is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

<u>Accomplishments/Planned Program:</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Networked Electronic Warfare: This effort provides autonomous detection, classification, correlation, and geo-location capability against modern wireless emitters and other threats in battlefield and urban environments. In FY07, developed adaptive array processors for use in tactical settings to counter problems associated with multipath, co-channel, and co-site interference that plague current systems. In FY08, develop digital wideband receiver capability for the detection and denial across the entire threat band; refine system design and begin integration of complementary capabilities such as time difference of arrival geolocation and electronic attack based on geolocation; integrate wideband antennas into an adaptive array; integrate algorithms into government off the shelf hardware. In FY09, will integrate capabilities into a net-centric solution that combines jamming and detection/location/neutralization capabilities; will complete fabrication of adaptive processing arrays; will complete algorithm development and validation. Related work is also being accomplished under PE/Project: 0602270A/906; 0603270A/K15; 0603270A/K16.	2228	3496	1986
Suite of Sense Through the Wall Systems (STTW) for the Future Force: This effort provides users with the ability to detect visibly obscured targets up to the objective stand off distance, operate on the move, and accurately geo-locate targets in the presence of clutter with an intuitive user interface. In FY07, began development of integrated personnel detection/concealed weapons detection/concealed explosive detection systems with greater standoff capability and increase probability of detection; conducted lab testing of individual STTW sensors against multiple wall types, and formulated techniques for detection of stationary personnel through multiple wall types; and evaluated and tested hand held STTW prototype in the Future Force Warrior demonstration. Related work is also being accomplished under PE/Project: 0603772A/243.	3497		
Fusion Based Technologies: This effort develops an advanced knowledge generation capability to answer warfighting commanders	1474	2214	

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priority intelligence requirements (PIRs) for the Future Force. These answers provide actionable intelligence enabling timely decision-making by commanders and timely action by Soldiers in the execution of operations. In FY07, tested an initial toolset to support the brigade intelligence officer in directly building/editing of knowledge required for analysis and inferencing against multiple PIRs in a realistic scenario; created a subset of modeling and simulation (M&S) capabilities needed to support research, development, and testing of Levels 2-5 fusion technologies required for PIR answering. In FY08, develop expanded set of representations for different types of enemy tactics to handle more complex scenarios including the prediction of locations of specific types of asymmetric attacks using real data; develop and evaluate in a pre-engagement mode, an initial toolset for evaluating and selecting the most capable and relevant collection assets given PIRs and contextual information; develop another increment of M&S software that provides more realistic threat behaviors to support development and testing of representations of threat tactics, plausible explanations of threat activities, and early recognition of threat goals and intentions. Related work is also being accomplished under PE/Project: 0602120A/H15; 0602270A/906; 0603772A/243.				
Next Generation Electronic Warfare Technology for Survivability: This effort develops a low cost aircraft self-protection suite that is effective in detecting, disrupting, and defeating small arms, rocket propelled grenades, and man-portable air defense system threats, typical of urban environments. In FY07, initiated hardware-in-the-loop electro-optic/ infra-red (EO/IR) countermeasure exploitation/evaluation of next generation EO/IR threats; designed and developed photonic gap multiband optical fibers, beam switching, beam steering, and pointing devices. In FY08, integrate/interface Navy's Distributed Aperture Infrared Countermeasures multiband laser prototype with optical fibers and pointing/switching/steering technologies and lab demonstrate against next generation threats; demonstrate next generation countermeasures techniques against advanced EO/IR threats. Related work is also being accomplished under PE/Project: 0603270A/K16.	1943	3432		
Cueing Sensor: This effort develops low cost infrared sensors that detect rocket propelled grenades, anti-tank guided missiles, and tank fired kinetic energy and high energy anti-tank rounds and then cue active protection system for Army vehicles. In FY07, developed and optimized threat classification algorithms and signal processing for the active protection system cueing sensor. In FY08, optimize focal plane arrays design; enhance sensor, electronics, and algorithms for on-the-move (OTM) environment. Related work effort is also being accomplished under PE/Project 0602120A/H15; 0603270A/K16; 0603772A/243.	2130	98		100
Multispectral Threat Warning: This effort develops affordable EO/IR countermeasure system concepts with multispectral detectors, multiband laser, advanced countermeasure architectures, and will exploit next generation threats to develop advanced EO/IR countermeasure techniques that will effectively defeat laser guided munitions, surface-to-air, air-to-air, and anti-tank threats. In FY09, will develop and evaluate new algorithm techniques to exploit signals in background clutter to increase detection, identification, and threat classification capabilities.				4130
Advanced Tactical Electronic Support Measures: This effort supports development of non-communication Electronic Support (ES) components with multi-functional digital receivers, processors, and software tools that reduce the space, weight, and power requirements for future electronic support systems. In FY09, will begin development of an integrated suite of optimal detection, de-interleaving (arranging received signal components in the appropriate order), and tracking techniques with a goal of full spectrum coverage for all waveform classes in a dense signal environment.				2020
Low Cost RF Situational Awareness and Countermeasures: This effort provides the electronic countermeasures signal coherency, power, spectral energy efficiency, and jamming capability to protect friendly airborne and surface platforms from the new wideband threat weapon systems that use advanced radar processing techniques. In FY09, will begin development of new hardware and software modules with the capability to neutralize the enemy's ability to locate, classify, and engage our forces with radar based air defense and targeting radars that will be common to both air and ground platforms				1270

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602270A - Electronic Warfare Technology	PROJECT 442	
Small Business Innovative Research/Small Business Technology Transfer Programs		102	
Total	11272	9342	9506

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BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AND TITLE 0602270A - Electronic Warfare Technology					PROJECT 906	
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
906 TAC EW TECHNIQUES	7469	6962	7105	7202	7261	7422	7590	

A. Mission Description and Budget Item Justification: This project designs, develops, 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 contributes to the commanders ability to see the enemy, both as a unit and as part of a complex, adaptive organization, allowing a "See First, Understand First, Act First" standard of operations. This project investigates radio frequency (RF) collection and mapping technologies 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 enables 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 enable 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 the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy and the Army Science and Technology Master Plan. Work in this program element (PE) is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

<u>Accomplishments/Planned Program:</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Networked Electronic Warfare: This effort provides autonomous detection, classification, correlation, and geo-location capability against modern wireless emitters and other threats in battlefield and urban environments. In FY07, collected target vulnerability data, continued development of adaptive array processors for use in a tactical setting to counter problems associated with multipath, co-channel, and co-site interference and provided a precise geolocation capability; developed more effective techniques using broad range of target focused information operations (IO) algorithms based on individual target transmission parameters rather than brute force techniques; began development of effects based IO deception techniques to influence a potential targets plan of action. In FY08, continue algorithm development for an expanded range of potential targets, as well as software development for data thinning and nodal analysis applications for the purposes of threat identification, classification, and attack technique selection; expand algorithm development for larger range of targets; continue deception and effects algorithm development. In FY09, will investigate and develop techniques to engage emergent communications technologies for inclusion into IO techniques database; will refine IO techniques database for access and use by other users including Joint Service and other members of intelligence community. Related work is also being accomplished under PE/Project: 0602270A/442; 0603270A/K15/K16.	6175	6950	4100
Fusion Based Technologies: This effort develops an advanced knowledge generation capability to answer warfighting commanders priority intelligence requirements (PIR) for the Future Force. These answers provide actionable intelligence enabling timely decision-making by commanders and timely action by Soldiers in the execution of operations. In FY07, developed modeling and simulation tools to support identification and tracking of aggregates, and simpler cases of inferring enemy objectives. In FY09, will develop final set of	1294		3005

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representations for different types of enemy tactics to handle more complex and asymmetric behaviors such as ambushes, vehicle-borne explosive devices, and sniper attacks; will demonstrate capabilities to automatically identify and link human-specified critical entities and activities to PIRs, and reveal emerging actionable intelligence; will develop and demonstrate an intelligence, surveillance, and reconnaissance planning/re-planning toolset with capabilities to function in an operations execution mode for evaluating and selecting the most capable and relevant collection assets given PIRs and contextual information. Related work is also being accomplished under PE/Project: 0602120A/H15; 0602270A/442; and 0603772A/243.			
Small Business Innovative Research/Small Business Technology Transfer Programs		12	
Total		7469	6962
			7105