

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

**February 2007**

BUDGET ACTIVITY	PE NUMBER AND TITLE							
<b>2 - Applied Research</b>	<b>0602270A - EW TECHNOLOGY</b>							
COST (In Thousands)	FY 2006 Actual	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	28746	30972	16411	16605	16782	16911	17283	17663
442 TACTICAL EW TECHNOLOGY	11110	11476	9404	9515	9614	9685	9898	10116
475 ELECTRONIC WARFARE COMPONENT TECHNOLOGIES (CA)	10160	11966						
906 TAC EW TECHNIQUES	7476	7530	7007	7090	7168	7226	7385	7547

**A. Mission Description and Budget Item Justification:** This program element (PE) researches and investigates electronic warfare (EW) 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 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 booby traps. 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. 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 0603270 (EW Technology), PE 0602120 (Sensors and Electronic Survivability), PE 0603772 (Advanced Tactical Computer Science and Sensor Technology), PE 0602783 (Computer and Software Technology), and PE 0602784 (Advanced Concepts and Simulation). 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 in 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.

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<u><b>B. Program Change Summary</b></u>	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	29305	19218	16539	16635
Current BES/President's Budget (FY 2008/2009)	28746	30972	16411	16605
Total Adjustments	-559	11754	-128	-30
Congressional Program Reductions		-118		
Congressional Rescissions				
Congressional Increases		12100		
Reprogrammings	-559	-228		
SBIR/STTR Transfer				
Adjustments to Budget Years			-128	-30

Five FY07 congressional adds totaling \$11597 (after adjustment for Congressional Undistributed Reductions) were added to this PE.

- (\$3355) Silver Fox Unmanned Aerial Vehicle
- (\$1773) Xenon Light Source for Non-Lethal Deterrence
- (\$1246) Battlefield Connectivity, Multi-Level Secure Network
- (\$3690) Dominant MOUT Viewer (DMV)
- (\$1533) Integrated Information Tech Policy Analyses Resch

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<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602270A - EW TECHNOLOGY</b>						<b>PROJECT</b> <b>442</b>	
COST (In Thousands)	FY 2006 Actual	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	11110	11476	9404	9515	9614	9685	9898	10116

**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 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 researched 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 will research 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 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.

<b><u>Accomplishments/Planned Program:</u></b>	<u>FY 2006</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 FY06, evaluated UAV and UGS electronic support measures in a warfighter operational environment that demonstrated real time collection, identification, and location; developed an improved jamming antenna and algorithms; developed situational awareness, traffic analysis, and electronic attack capabilities. In FY07, develop 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, will develop digital wideband receiver capability for the detection and denial across the entire threat band; will refine system design and begin integration of complementary capabilities; will integrate wideband antennas into an adaptive array; will 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 algorithm development and fabrication of adaptive processing arrays. Related work is also being accomplished under PE/Project: 62270/906; 63270/K15; 63270/K16.	900	728	2092	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, accurately geo-locate targets in the presence of clutter with an intuitive user interface. In FY06, conducted lab and user testing of STTW prototypes; utilized experiments to develop tactics, techniques, and procedures and characterize through demonstration urban and complex terrain phenomenology. In FY07, begin development of integrated personnel detection/CWD/CED systems with greater standoff capability and increase probability of detection; conduct lab testing of individual STTW sensors against multiple wall types, and formulate techniques for detection of stationary personnel through multiple wall types; and devaluate and test hand held STTW prototype in the FFW ATD demonstration. Related work is also being	3586	3397		

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

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BUDGET ACTIVITY	PE NUMBER AND TITLE			PROJECT
<b>2 - Applied Research</b>	<b>0602270A - EW TECHNOLOGY</b>			<b>442</b>
accomplished under PE/Project: 63772/243.				
Fusion Based Technologies: This effort develops an advanced knowledge generation capability to answer warfighting commanders 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 FY06, used software technologies to represent knowledge needed to logically link multiple, diverse sources of data. In FY07, test 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; create 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, will 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; will 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; will develop another increment of M&S software that will provide 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: 62120/H15; 62270/906; 63772/243.	663	3150	3712	
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 FY06, evaluated candidate technologies to provide full dimensional protection from electro-optic/ infrared (EO/IR) guided man-portable weapons systems for ground and airborne platforms; partnered with Navy's Distributed Aperture Infrared Countermeasures (DAIRCM) effort to design, study, and evaluate multiband laser countermeasure; investigated photonic gap multiband optical fibers and multi-wavelength beam switching, beam steering, and pointing devices. In FY07, initiate hardware-in-the-loop EO/IR countermeasure exploitation/evaluation of next generation EO/IR threats; design and develop photonic gap multiband optical fibers, beam switching, beam steering, and pointing devices. In FY08, will integrate/interface DAIRCM multiband laser prototype with optical fibers and pointing/switching/steering technologies and lab demonstrate against next generation threats; will demonstrate next generation countermeasures techniques against advanced EO/IR threats. Related work is also being accomplished under PE/Project: 63270/K16.	2000	1900	3500	
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 FY06, developed and demonstrated software algorithms for hardware implementation of the on-the-move frame registration, clutter suppression, specific threat classification for the active protection system cueing sensor; investigated dual band focal plane arrays (FPA) with required array uniformity, operability, sensitivity in the desired spectral bands. In FY07, will develop and optimize threat classification algorithms and signal processing for the active protection system cueing sensor. In FY08, will optimize FPA design; enhance sensor, electronics, and algorithms for on-the-move (OTM) environment. Related work effort is also being accomplished under PE/Project 62120/H15; 63270/K16; 63772/243.	3961	2130	100	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 new algorithm techniques to exploit signals in background clutter to increase detection, identification, and threat classification capabilities.				4132
Advanced Tactical Electronic Support Measures: This effort supports development of non-communication Electronic Support (ES)				2023

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<b>2 - Applied Research</b>	<b>0602270A - EW TECHNOLOGY</b>			<b>442</b>
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, and tracking techniques with a goal of full spectrum coverage for all waveform classes in a dense signal environment.				
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.				1274
Small Business Innovative Research/Small Business Technology Transfer Programs		171		
<b>Total</b>	<b>11110</b>	<b>11476</b>	<b>9404</b>	<b>9515</b>

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COST (In Thousands)	FY 2006 Actual	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	7476	7530	7007	7090	7168	7226	7385	7547	

**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 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 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 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 2006</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 FY06, developed electronic support for the Future Force sensor model; integrated electronic support measure (ESM)/signals intelligence (SIGINT) algorithms into ground sensor systems; developed and investigated adaptive/smart antenna processing techniques to enhance baseline information operations system; investigated novel radio frequency probing and other techniques for detection, location, and selective neutralization of triggering devices. In FY07, collect target vulnerability data, continue development of adaptive array processors for use in a tactical setting to counter problems associated with multipath, co-channel, and co-site interference, and to provide a precise geolocation capability; develop more effective techniques using broad range of target focused information operations (IO) algorithms based on individual target transmission parameters rather than brute force techniques; begin development of effects based IO deception techniques to influence a potential targets plan of action. In FY08, will continue algorithm development for an expanded range of potential targets, as well as software development for data thinning and nodal analysis applications; will expand algorithms development for larger range of targets; will 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: 62270/442; 63270/K15/K16.	6584	6418	7007	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-	892	1073		2990

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**BUDGET ACTIVITY**  
**2 - Applied Research**

**PE NUMBER AND TITLE**  
**0602270A - EW TECHNOLOGY**

**PROJECT**  
**906**

making by commanders and timely action by Soldiers in the execution of operations. In FY06, conducted experiments and evaluations to show software architectural capabilities to rapidly develop and maintain multiple interpretations and associated confidence levels to answer commander's priority intelligence requirements; identified requirements and construct initial information agents to support intelligence retrieval of information from diverse data sources. In FY07, develop 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 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: 62120/H15; 62270/442; & 63772/243.

Small Business Innovative Research/Small Business Technology Transfer Programs

Total	7476	7530	7007	7090
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