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

**February 2002**

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

| | COST (In Thousands) | FY 2001 Actual | FY 2002 Estimate | FY 2003 Estimate | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate |
|---|---|---|---|---|---|---|---|---|
| | Total Program Element (PE) Cost | 21624 | 17292 | 19584 | 20448 | 21257 | 21632 | 23389 |
| 442 | TACTICAL EW TECHNOLOGY | 9654 | 10028 | 10874 | 11618 | 12090 | 11921 | 12390 |
| 906 | TAC EW TECHNIQUES | 7259 | 7264 | 8710 | 8830 | 9167 | 9711 | 10999 |
| 91F | MULTIPLE INTEL REMOTED SENSOR SYSTEM - 2ND GEN | 4711 | 0 | 0 | 0 | 0 | 0 | 0 |

**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 situational awareness (SA). It also will provide deployed elements of the Objective Force 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. The cited work is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, the Future Combat Systems and Project Reliance. It adheres to the Tri-Service Reliance Agreements on Intelligence And Electronic Warfare (IEW). It is related to and 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 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 (TCP).

| **B. Program Change Summary** | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|
| Previous President's Budget (FY2002 PB) | 22007 | 17449 | 18333 |
| Appropriated Value | 22210 | 17449 | 0 |
| Adjustments to Appropriated Value | 0 | 0 | 0 |
| a. Congressional General Reductions | 0 | -157 | 0 |
| b. SBIR / STTR | -384 | 0 | 0 |
| c. Omnibus or Other Above Threshold Reductions | 0 | 0 | 0 |
| d. Below Threshold Reprogramming | 0 | 0 | 0 |
| e. Rescissions | -202 | 0 | 0 |
| Adjustments to Budget Years Since FY2002 PB | 0 | 0 | 1251 |
| Current Budget Submit (FY 2003 PB ) | 21624 | 17292 | 19584 |

Change Summary Explanation:

Significant Changes: An FY01 Congressional add of $4900 was received for Multiple Intelligence Remoted Sensor System, Project 91F

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

**February 2002**

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

| COST (In Thousands) | | FY 2001 Actual | FY 2002 Estimate | FY 2003 Estimate | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate |
|---|---|---|---|---|---|---|---|---|
| 442 | TACTICAL EW TECHNOLOGY | 9654 | 10028 | 10874 | 11618 | 12090 | 11921 | 12390 |

**A. Mission Description and Budget Item Justification:** This project researches, investigates and applies technologies to provide self protect capabilities to the Objective Force and Future Combat Systems (FCS). The intent is to use RF, IR and EO technologies to detect, identify, locate, and employ countermeasures against threat systems. Specifically, this project will investigate the use of RF technologies against radar directed target acquisition, target-tracking sensors, Surface-to-Air Missiles (SAMs), Air-To-Air Missiles (AAMs), top attack and fuzed munitions. It also will investigate and apply IR technologies against heat seeking SAMs, AAMs and Anti-Tank Guided Missiles (ATGMs). Additionally, this project will focus on EO 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. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

**FY 2001 Accomplishments:**

- 3420
  - Investigated conformal and low observable, multi-octave antenna technology for upgrades to RF and missile warning systems.
  - Tested System Integration Lab's (SIL) upgraded data links with battle labs and schools for interactive simulations using RF countermeasure systems.
  - Designed RF deception and countermeasure techniques testbed.
  - Conducted additional field-testing of radar countermeasures under technical panels 1 and 2 of the Technical Cooperation Program Electronic Warfare Simulator.
  - Evaluated enhancements in detection and location capabilities through the integration of communications intelligence (COMINT) and electronic intelligence (ELINT).
- 1914
  - Evolved the missile warning applications of low cost sensor and corresponding warning algorithms common to air and ground platforms.
  - Conducted field measurements of IR and UV signatures of SAMs, ATGMs, background and manmade point false alarm sources.
- 2894
  - Investigated warning algorithms for 2-colored ATGMs and evaluated IR countermeasures to advanced ATGMs and emerging SAMs and AAMs including focal plane array (FPA) imaging missiles.
  - Evaluated cooperative jamming and decoy/flare techniques to support a demonstration of integrated countermeasures against ATGMs and SAMs.

**FY 2001 Accomplishments: (Continued)**

- Designed, in coordination with DARPA and Tri-Service Technology Panel for EW (TPEW), a multispectral laser to counter missile seekers and trackers.

• 1426
- Evolved antennas and RF collectors for airborne and ground tactical maneuver vehicles.
- Integrated spread spectrum receiver technology for eventual transition to countermeasure systems.
- Performed research to provide ES technology to intercept, geolocate, and counter emerging hostile non-communications emitters on the battlefield.

- Participated in a Battle Labs distributed simulation demonstration that evolved radio software algorithms to refine their operational concepts and improve signal mapping visualization and analysis tools.
- Evolved advanced antennas, and collection and mapping capabilities of micro electromechanical systems (MEMS) low voltage switch technology.

- Evolved Single Channel Ground and Airborne Radio System (SINCGARS) for radio location sensor.
- Evolved electronic mapping signal intelligence (SIGINT) object model using artificial intelligence algorithms and digital signal processing (DSP) based optimization techniques.

Total 9654

**FY 2002 Planned Program**

• 1500
- Mature & test an advanced wavelet based algorithm for simulation of specific emitter identification (SEI).
- Conduct multi-function electronic collection and mapping system simulation using a combination of field experiments and operational workstation demonstrations.

• 3710
- Research and conduct simulation of innovative RF countermeasures capabilities with SIL and Battle Labs.
- Utilize RF countermeasures testbed to test deception techniques against targeting and air defense radars.
- Research techniques against frequency hopping air defense radars and top attack munitions.
- Conduct SIL testing of countermeasures against artillery top attack fuzes.

• 2844
- Transition warning algorithms for 2-colored ATGMs to FPA missile warning program. Demonstrate IR countermeasures to advanced ATGM's and emerging surface-to-air and air-to-air missiles including FPA imaging missiles.
- Test and evaluate cooperative jamming and decoy/flare techniques to support integrated countermeasure technology demonstration.

**FY 2002 Planned Program (Continued)**

- Research multispectral laser to defeat advanced IR surface-to-air and imaging missiles.
- Mature IR jammer to defeat advanced ATGMs.

• 1974 - Research, mature and test the missile warning applications of low cost sensor and corresponding warning algorithms common to air and ground platforms.

- Conduct field measurements of IR and UV signatures of surface-to-air missiles, ATGMs, background and manmade point false alarm sources.

Total 10028

**FY 2003 Planned Program**

• 2667 - Test, in the laboratory and the field, new techniques against 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.

• 3089 - Evaluate capability of an IR jammer to defeat ATGMs.
- Evaluate ability of a multispectral mid-IR laser to defeat advanced IR SAMs and IR imaging missiles.

• 2562 - Integrate and test a system of new low cost sensor and warning algorithms for protection of air and ground platforms against missiles.

- Continue field measurements of IR and UV signatures of SAMs, ATGMs, background and manmade point false alarm sources.

• 1123 - Begin categorization of Low Probability of Detection (LPD)/Low Probability of Intercept (LPI) radar waveforms.
- Investigate adaptive antenna nulling and commercial modulation schemes in support of a fully integrated ES capability.
- Research multi-functional digital receivers, processor and software tools that will reduce size, weight and operator requirements for future ES systems.

- Investigate detection, deinterleaving and tracking techniques that will provide full coverage against emerging next generation non-communication threat emitters.

• 938 -Investigate key sensor component technologies in support of a modular, multi-spectral (UV/IR) sensor required for multiple Objective Force systems. Sensor component maturation will concentrate on modular design techniques to provide adaptability to a variety of platforms.
- Research new techniques to increase detection, identification and classification of "background clutter" signals.

**FY 2003 Planned Program (Continued)**

- 495 - Test warfighter collection system co-resident on surrogate DSP based radio platform.
  - Show/evaluate linking, processing and dissemination of information as well as visualization of the collected data to all levels of intended users.
  - Design and test a direction-finding antenna and interface to receiver.

Total 10874

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**February 2002**

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

| COST (In Thousands) | | FY 2001 Actual | FY 2002 Estimate | FY 2003 Estimate | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate |
|---|---|---|---|---|---|---|---|---|
| 906 | TAC EW TECHNIQUES | 7259 | 7264 | 8710 | 8830 | 9167 | 9711 | 10999 |

**A. Mission Description and Budget Item Justification:** The project researches and applies key EW technologies to intercept, and locate current and emerging threat communications emitters in accordance with concepts for Objective Force intelligence operations. The results are used for targeting, tactical situation awareness, and disruption/destruction of C4I systems. This project matures 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 internet 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) capability to address operational shortfalls. 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. This system supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

**FY 2001 Accomplishments:**

- 1114 - Demonstrated in a laboratory environment an advanced exploitation and attack methodology against identified vulnerabilities in adversaries emerging communications networks, tactical information systems, and computer based networks.

  - Matured commercial-off-the-shelf (COTS) technologies to exploit and attack tactical internet (TI) network security, to identify and fix significant shortcomings in the Army's TI.

- 1996 - Evolved software products that integrated existing joint and national intelligence sensors to provide a common format for integration of sensor information and provide a common SA of enemy forces for the brigade commander.

  - Identified technologies and techniques to provide next generation tools for intelligence preparation of the battlefield, asset management, and SA.

- 4149 - Generated non-cooperative signal detection and recognition algorithms using digital signal processing (DSP)-based optimization techniques that were sized in processing requirements to be compatible with Joint Tactical Radio System (JTRS) software radio architectures.

  - Designed a functional layout of a multi-function RF collector that would be compatible with radio functions.

**FY 2001 Accomplishments: (Continued)**

- Investigated signal collection, mapping, analysis and visualization tools for autonomous operation and target geolocation for Battle Lab test.

- Participated in a Mounted Maneuver Battle Lab distributed simulation demonstration using force-on-force events to refine RF collection concepts and improved signal mapping visualization and analysis tools for early threat warning and threat situation awareness.

-Integrated electronic mapping of SIGINT object models into workstations.

Total 7259

**FY 2002 Planned Program**

- 530 - Evaluate data requirements for exploitation and attack capabilities against emerging threat commercial based systems.

  - Determine typical information protocols -wireless and wired (Internet -like) used in an urban area that can be exploited by an advanced electronic attack capability.

- 4134 - Design, fabricate and test breadboard RF collector/functional radio to evaluate/test algorithms using radio receiver parameters.

  - Mature RF emission geolocation capability using feature vectors and minimum communications.

  - Conduct a lab based multi-function electronic collection and mapping simulation using a combination of field experiments and operational workstation demonstration.

- 2100 - Complete software to integrate existing joint and national intelligence sensors into a common format for JISR ACTD.

  - Assess improved JISR system performance and military utility in several tactical field exercises.

- 500 - Model JTRS architecture impacts on RF collection design. Initiate RF collector /radio control strategy.

Total 7264

**FY 2003 Planned Program**

- 3982 - Identify and test techniques to cross cue/correlate RF emission geolocations and Internet Protocol (IP) virtual address locations.
  - Investigate methods to use building security and communications and other urban sensors as threat locating aides.
  - Integrate Radio Frequency and Internet Protocol or wire-based attacks on a simulated threat based tactical system.
- 1090 - Modeling and simulation with Training & Doctrine Command (TRADOC) to define threat set. Identify/mature system architecture for advanced ESM capability, initiate design and development of digital receiver, antenna and software algorithms.
- 495 - Complete interface and lab testing of SEI and communications emitter location algorithms with digital receiver testbed. Field test as part of C4ISR demo.
- 1486 - 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.
- 1657 - Interface/correlate multi-intelligence sensor data from the network sensors ATD to all levels of command

Total 8710