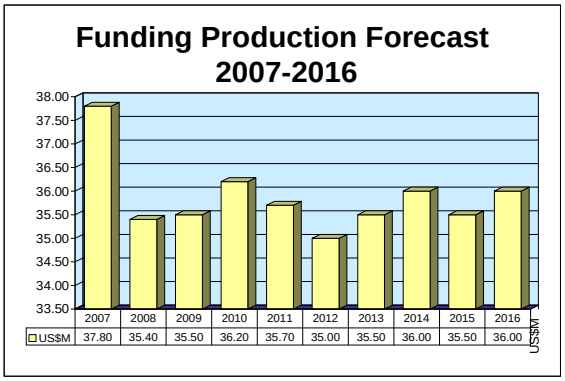
EW Technology (Army) - Archived 02/2008

Outlook

- U.S. Army's EW technology development efforts are split into two separate programs: one focuses on advanced technology development and the other emphasizes applied research
- This program funds ongoing technology development efforts
- Forecast International will split these projects up into separate reports that cover each project



Orientation

Description. This program, which includes PE#0602270A and PE#0603270A, provides funding and support for U.S. Army development of electronic warfare technology that will be used to develop future electronic warfare systems.

Status. Technology-based development.

Application. To develop an electronic warfare technology base.

Sponsor

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Contractors

Contractors(s) not selected. Contractors may vary as projects change.

Technical Data

These program elements provide the technology base for the development of future counter-countermeasures against advanced electronic warfare threats. The goal is to improve the survivability of Army air defense, command and control, and communications systems. The end products will enable the Army to gather

intelligence from enemy systems and/or disrupt their operation.

PE#0602270A. This Program Element funds research into and investigation of electronic warfare technologies to improve the Army's battlespace survivability, enemy targeting capability, and situational awareness for use in the Future Force. Where feasible, it exploits opportunities to enhance Current Force capabilities. This program will investigate electronic support measures (ESM) and countermeasures against munitions, missiles, improvised explosive devices, and target acquisition sensors. The effort will provide deployed Future Force elements with information dominance and increased force protection.

The intent is to deny, disrupt, or degrade the enemy's use of the electromagnetic spectrum for offensive or defensive operations. The focus is on detecting threat emitters associated with weapon guidance systems, targeting systems and command, control, communications, computers, and intelligence (C^4I) systems, and networks. Work covers the spectrum in the radio frequency (RF), infrared (IR), electro-optical (EO), and ultra-violet (UV) ranges. It seeks to improve EW sensors and ECM systems to 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 onboard and offboard situational awareness, targeting, and combat identification.

Finally, this PE will research automated intelligence fusion and automated battlefield assessment management tools. These include Warfighter Electronic Collection and Mapping, Electronic Support for the Future Force, Advanced Radar Deception and Countermeasures, Advanced EW Sensors, EO/IR Countermeasures, Sensor Countermeasures, Fusion Based Knowledge, Networked Sensors, Information Operations, and Joint Intelligence and Surveillance and Reconnaissance (JISR).

PE#0603270A. This Program Element matures and demonstrates multi-intelligence remote sensor technologies and EW survivability systems to significantly enhance the Future Force's ability to conduct offensive operations and, where feasible, exploits opportunities to enhance Current Force capabilities. It addresses the need to locate, disrupt, or destroy the enemy's command, control and communications (C^3) systems and infrastructure; tactical radar surveillance and radio frequency homing; guided and directed munitions; and missile systems.

Communications countermeasures and communications counter-countermeasures applications are matured to deny the enemy the use of their sensors while protecting U.S. Army sensors from enemy deception and jamming. This PE also supports demonstrations of automatic/automated fusion of intelligence, information, and data from multiple sources to provide a unit of action/unit of employment Common Operating Picture (COP).

This PE's non-communication ECM technology demonstration project K16 is developing techniques for self-protection from radar, EO, and IR-guided anti-aircraft artillery, surface-to-surface missiles, artillery, and top attack weapons. It also aims to develop ways to acquire precise targeting information on non-communications emitters.

Technologies matured as part of this PE will be demonstrated in the integrated situational awareness and targeting Advanced Technology Demonstration (ATD), and under the integrated countermeasures platform survivability effort. Deception and jamming of the enemy through long-range netted sensor webs will assist in neutralizing the enemy's ability to see, understand, decide, and shoot first. RF-based detection and jamming techniques will be matured, in coordination with ongoing IR sensor research, to protect ground forces against command and sensor-initiated booby-trap improvised explosive devices (IEDs).

Program Review

Enhancing Vehicles, Aircraft, and Dismounted Trooops

Project A442 – Tactical Electronic Attack Technology. This project investigates and applies electronic warfare technologies to enhance the ability of ground combat vehicles, aircraft, and the dismounted soldier to survive. This project will apply recent advances in RF, IR, and EO sensors and jammers to detect, locate, deceive, and jam improvised explosive devices, 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 IEDs will be researched with the goal of embedding the maximum capability in projected Future Force systems to minimize vehicle weight, cost, logistics, and fielding.

Additionally, this project will research how EO and countermeasures technologies can be applied against laser-aided and electro-optically-directed gun or missile systems. The Electronic Support for the Future Force effort will design and evaluate a lightweight, low-cost ESM capability for unmanned aerial vehicles (UAVs) and unattended ground sensors (UGSs), enabling the collection, identification, location, and tracking of "hard-to-detect" communications and radar emitters not addressed by space, airborne, or ground-based intelligence systems.

This project encompasses several programs. The Tactical Aircraft Self-Defense program seeks to develop new EW technology that can be used to deceive an enemy's radar-based sensors and neutralize their ability to locate, target, and guide weapons against early-entry forces and the Future Force. Cost-effective sensors for use in missile warning systems (MWS) will be investigated with the goal of protecting Army ground combat vehicles and aircraft from gunfire, rocket-propelled grenades (RPGs), SAMs, top attack weapons, and anti-tank guided missiles (ATGMs).

Multi-Function on-the-move Capability

The Electro-optic and Infrared (EO/IR) Countermeasures program seeks to develop active and passive devices to protect aircraft and ground vehicles with conventional and suppressed signatures from EO- and IR-guided threats. The Sensor Countermeasures for the Future Force effort will conduct research into a multifunctional 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 and by the Electronic Warfare Systems Panel, and through cost sharing under project arrangements between the U.K. and Australia. This program will look at those electronic support technologies used against non-communications signals for targeting and tactical situational awareness.

The following subprojects are part of this PE.

Electronic Support of the Future Force: This effort researches technologies that can be applied toward the collection, identification, location, and tracking of hard-to-detect communications emitters on the battlefield.

In FY04, the Army integrated and tested multi-path mitigation software, transitioned modulation recognition software to the testbed, and evaluated field test results. In addition, it pursued advanced simulation capabilities to define the utility of UGV and UAV sensors.

In FY05, the Army developed an advanced simulation capability that was used to refine the operational utility of UGV and UAV signals intelligence sensors in the Mounted Maneuver Battlespace Lab at Fort Knox.

UAV and UGS Electronic Support

Plans for FY06 call for evaluating UAV and UGS electronic support measures in a warfighter operational environment.

Advanced Radar Deception and Countermeasures: In FY03, laboratory and controlled field-testing was conducted of new techniques that counter frequency-hopping air defense radars and top attack munitions. At the same time, work progressed toward the development of an enhanced ground vehicle and aircraft protection suite that simultaneously counters multiple advanced RF threats. Finally, a counter booby trap Quick Reaction Capability was developed against a specific RF threat in support of Operation Enduring Freedom and Operation Iraqi Freedom to increase the survivability of warfighters in those areas of operation.

In FY04, countermeasure techniques were tested against low-probability-of-intercept (LPI) and battlefield surveillance radars in the laboratory and in a controlled field environment. These techniques attempt to jam top attack munitions and artillery and anti-aircraft artillery fuzes, causing pre-detonation of the round.

Electro-Optical/Infrared Countermeasures and Advanced Radar Deception and Countermeasures: This effort researches and investigates technologies that could be applied to EO/IR countermeasures and advanced electronic warfare sensors. In FY03, IR jamming techniques were improved to better defeat advanced anti-tank guided missiles (ATGMs), and the ability of a multi-spectral mid-IR laser to defeat advanced IR SAMs and IR imaging missiles was evaluated. In addition, a system of new low-cost sensor and warning algorithms for protection of air and ground platforms against missiles was explored, and field measurements were taken of IR and UV signatures of SAMs, ATGMs, and "manmade false alarm sources." Finally, better ways to detect,

identify, and classify "background clutter" signals were investigated.

Sensor Countermeasures for the Future

Sensor Countermeasures for the Future Force: In FY03, planners characterized the emerging threat from IEDs/booby traps and investigated key sensor component technologies (highly sensitive RF receivers and antennas that quickly scan multiple threats simultaneously, including those threats operating at very low transmit power). They developed countermeasure techniques and proposed a design architecture for the modular, multi-spectral (RF/UV/EO/IR) sensor required for multiple Future Force systems.

In FY04, lab testing of detection and jamming algorithms began. Specifically, the simulation and controlled field-testing of detection, location, deception, and countermeasure techniques against threat sensors and booby traps was conducted.

In FY05 and FY06, project managers are collaborating with other U.S. and foreign government agencies on the development of threat and countermeasure techniques. Specifically being evaluated is the potential for embedding countermeasure capabilities in near-term systems.

In FY07, planners will conduct field-testing to demonstrate countermeasure effectiveness against enemy sensors.

Project A906 – Tactical Electronic Warfare Techniques. This project researches and applies key electronic warfare technologies to locate and intercept current and emerging threat communications and non-communications emitters to provide vital combat information directly to users in a timely manner. These technologies are developed in accordance with the concepts for Future Force intelligence operations.

See First, Understand First, Act First

This project will contribute to the commander's ability to see the enemy, allowing a "See First, Understand First, Act First" standard of operations. This project will mature radio frequency collection and mapping technologies into integrated multifunction devices for the real-time detection, location, and identification of emitters. Work under this project will include adding an autonomous RF collection capability and algorithms to tactical software-defined radios for the detection, location, and display of enemy RF emissions.

The project will also evolve electronic attack components into smaller, lower power, lightweight, common modules that counter modern threat C^4I systems. In addition, it will develop a remote capability for the disruption or destruction of threat communication signals.

Finally, this project will involve the fusion (automated assimilation and synthesis) of battlefield intelligence data for better interpretation of current and future enemy activities. Ultimately, of course, this will enable forces to act preemptively and decisively.

Among current efforts, the Information Operations for the Future Force program provides a Unit of Action on-the-move capability for precise detection and location of commercially available wired and wireless telecommunications and computers in an urban environment. The Electronic Support for the Future Force effort will evaluate a lightweight, low-cost ESM capability for UAVs and UGSs, enabling them to collect, identify, locate, and track "hard-to-detect" communications and radar emitters not addressed by space, airborne, or ground-based intelligence systems.

The Fusion Based Knowledge for the Future Force effort under Project A906 will investigate the capability to answer warfighting commanders' priority intelligence requirements.

Below are details on some of these related efforts.

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, engineers designed a compact RF receiver architecture that made possible the deployment of remote, unmanned ESM/SIGINT (Electronic Support Measures)/Signals Intelligence) sensors, enhancing the effectiveness of the Future Force warrior.

In FY05, Army developers researched ESM/SIGINT system capabilities that could operate in unmanned networked environments to detect tactical RF transmissions. The project also investigated the ability to integrate the unmanned ESM/SIGINT sensor systems with Networked Sensors for the Future Force Advanced Technology Development (ATD) communications equipment.

In FY06, developers will test UAV and UGS ESM in an operational environment.

Information Operations: In FY04, the Army developed urban characterization hardware and completed an initial representative signals environment survey. It also began signal and traffic analysis work, demonstrated an unintentional radiation detection capability, successfully demonstrated the ability to detect and distinguish target traffic in a lab

environment, and identified receiver technology to support future geolocation efforts as well as for potential use in force protection.

In FY05, network analysis and data recognition techniques were identified and tested "for RF emission, geolocation, and virtual address locations in a lab environment," according to government documents.

In FY06, the Army will demonstrate the capability to precisely detect and locate emitters in a lab environment.

Fusion-Based Knowledge for the Future Force

Starting in FY06, engineers will demonstrate software architectures that can rapidly develop and maintain multiple interpretations with sufficient confidence to answer commanders' priority intelligence requirements. According to government documents, plans also call for "identifying requirements and constructing initial information agents to support intelligence retrieval of information from diverse data sources."

In FY07, the development of software architecture capabilities will be finalized, and their ability to meet the intelligence requirements of commanders will be assessed.

Future Communications Signal Detection, Location & Classification & Modern C^2 Attack: This effort will focus on the detection of communications systems that use advanced technologies to enable operations against threat systems in extremely dense signal environments. It is scheduled to begin in FY07 and will research the use of modern high-capacity modulation methods, frequency reutilization capabilities, low-probability-of- intercept techniques, and the technologies that are driving threat systems. Methods of attacking these capabilities to achieve spectrum dominance will then be developed.

PE#0603270A – EW Technology Development

There were five congressional adds to this PE in FY04 and FY05. They were:

VVR-1(V) Laser Warning Receiver, Project K12: The purpose of the add was to complete the qualification of the VVR-3(V), procure prototype systems, and perform a demonstration on a combat vehicle. Funding was set at $960,000 in FY04 and $595,000 in FY06.

U.S. Army Tactical ELINT for Ground Maneuver Forces, Project K12: The purpose of this congressional add was to investigate the application of emitter identification techniques in meeting Army ELINT mission requirements. Funding was set at $4.282 million in FY04 and $2.397 million in FY05.

Rapidly Develop Weather Sensors

WX Intelligence Sensor System, Project K12: The purpose of this congressional add was to investigate and rapidly develop a prototype of an unattended, localized weather sensor system for demonstration purposes. The system was to be network-compatible with remote sensor systems (Silent Warrior). Funding was $959,000 in FY04.

Multifunction Intelligence and Remote Sensor System – Block 1, Project K19: The purpose of this congressional add was to provide air delivery capability and functions for automatic detection, tracking, classification, and location. Funding for this add would also be used to incorporate power management algorithms and to investigate the application of sensor technology to UGVs. Funding totaled $4.865 million in FY04 and $958,000 in FY05.

Shortstop Electronic Protection System, Project K20: The purpose of this congressional add was to perform threat analysis and architecture analysis; and develop prototype hardware and software in order to expand the use of Shortstop Electronic Protection System technology. These efforts would ultimately lead to the development of technology that would be used to selectively disrupt modern communications devices. It was funded at $4.865 million in FY04 and $2.397 million in FY05.

Project K15 – Advanced Communications Electronics Countermeasures Demonstration. This project matures and demonstrates the ability to locate and identify modern tactical battlefield enemy and "blue force" radio frequency communications and radars. The technology ultimately developed under this project will enable the Future Force to conduct uninterrupted air- and ground-based intelligence collection and long-range targeting operations in a hostile electromagnetic environment. The goal of the project is to develop flexible, modern systems in order to achieve information dominance, protect the force, and shape the battlespace.

Providing Warfighters with the Ability to Locate RF Emitters

This project encompasses several programs. The goal of its Warfighter Electronic Collection and Mapping program is to provide the warfighter at the unit level with the ability to locate enemy RF emitters. The

Electronic Support for the Future Force (ESFF) program will develop lightweight, low-cost UAV and UGS electronic support measures for the detection and location of modern signals.

The project's Joint Intelligence, Surveillance, and Reconnaissance (JISR) ACTD (advanced concept technology demonstration) will develop tools that will enable the warfighter, at all echelons, to have comprehensive near-real-time ISR information based on both traditional and selected non-traditional sensors to enhance situational awareness. The Information Operations for the Future Force program explores communications countermeasures and counter-countermeasures that could be used to intercept, identify, and locate tactical communications and then manipulate threat computer networks and their components.

Further details follow.

Information Operations: In FY05, techniques that could be used to cross cue/correlate RF emission geolocations and Internet Protocol (IP) virtual address locations in a lab environment were to be identified and tested. A related effort would seek to refine precision direction-finding capabilities toward the ultimate goal of being able to determine the 3-D coordinates of potential targets. This effort was budgeted at $336,000.

In FY06, designers will integrate an initial set of techniques into a hardware suite and test it at the component level, assessing its performance against previously collected field data.

In FY07, designers will mature existing techniques and integrate remaining techniques into an objective hardware suite. They will then test them in the laboratory/chamber environment against representative targets, as well as conducting a demonstration of an integrated capability in an operationally relevant environment.

Electronic Support for the Future Force (ESFF): This effort matures and demonstrates technologies that enable tactical signal intercept and jamming.

In FY04, ESM sensors were simulated and then integrated to the Mounted Maneuver Battlespace Lab at Ft. Knox for use in further studies.

Tests of Networked RF ESM Sensor

In FY05, designers performed laboratory and field tests of the networked radio frequency electronic support measure (ESM) sensor architecture for unmanned ground and air vehicle applications for the Unit of Action. They integrated and demonstrated unattended ground and air RF ESM sensors with the network radio links that had been matured by the Networked Sensors for the Future Force Advanced Technology Demonstration program and other UA efforts.

In FY06, planners will test UAV and UGS ESM in a warfighter operational environment, demonstrating real-time collection, ID, and Location with sensor data fusion.

In FY07, designers will test UAV and UGS as an integrated ES system in high-emitter-density suburban and urban environments. They then plan to transition the resulting electronic support measures to the Tactical Signals Intelligence Payload and Future Combat Systems effort.

Single Integrated Ground Picture (SIGP): SIGP is the ground component of the Joint Battle Management Command and Control ($JBMC^2$) initiative aimed at enhancing situational awareness on the battlefield. In FY04, current warfighter capabilities were being baselined in order to access, fuse, and filter information from multiple sources. An operational and systems engineering analysis was then conducted to identify interoperability gaps in the flow of information and to develop joint standards, architectures, and system requirements for the Current and Future Forces. Funding for this effort totaled $3.744 million in FY04. No funding was programmed for FY05 or beyond.

Project K16 – Non-Communication Electronics Countermeasures Technology Demonstrations. This project matures and demonstrates non-communications countermeasures aimed at enhancing the survivability of ground combat vehicles and the dismounted forces. This effort seeks to enhance the survivability of vehicles by applying signature management and hit avoidance techniques (warning receivers and countermeasures) to prevent them from being detected. Under this project, recent advances in the ability of RF, IR, and EO sensors and jammers to detect, locate, deceive, and jam booby traps, radar-directed target acquisition systems, target-tracking sensors, SAMs, AAMs, and top-attack and fuzed munitions are demonstrated.

This project will also work to enhance the military's capability to neutralize IEDs. Additionally, this project will demonstrate EO and countermeasure technologies against laser-aided and electro-optically-directed gun or missile systems.

Efforts are focused on developing ways to detect, identify and geolocate emitters from an effective standoff distance, and to provide near-real-time situational awareness updates to the Unit of Action commander. In this regard, the project's Warfighter

Electronic Collection and Mapping (WECM) program is aimed at providing the unit level with the capability to locate enemy tactical RF emitters. This effort will involve non-traditional uses of software-defined radios to detect threat emissions at short ranges.

Details on the various efforts under this project follow.

Sensor Countermeasures for the Future Force: This effort matures and demonstrates an organic, multifunctional, on-the-move force protection capability to detect and neutralize enemy sensors, communications, and remotely controlled weapons datalinks, providing a level of survivability to dismounted light and medium forces not currently available.

In FY04, deception and jamming techniques were developed and simulated, and prototype hardware and software was developed and then tested against remote-control weapons.

In FY05, ECM techniques using receivers, antennas, and jamming sources were developed in a laboratory environment. Ultimately, algorithms and radio frequency receivers would be field-tested against weapon control links to neutralize remote-control weapons.

Detect, Locate, and Jam Enemy Netted Sensors

In FY06, planners would demonstrate the ability to detect, locate, and jam enemy netted sensors, and demonstrate countermeasures against multi-spectral sensor networks (including RF, EO, acoustic, and magnetic sensors).

Integrated Countermeasures and Integrated Survivability: This effort matures and demonstrates technologies that enhance vehicle survivability.

In FY04, ground vehicle missile-warning sensors with IR jammers were in development for use against ATGMs. In FY05, live-fire demonstrations of missile warning and IR countermeasures on a moving platform were demonstrated.

In FY05, the Army demonstrated an added capability, maturing hardware modules and software algorithms to enable UV and IR missile warning sensors to detect muzzle flash from small arms.

Fusion-Based Knowledge for the Future Force: In FY04, this project developed "fusion tools" that could be applied to better understand enemy intent and prepare a course of action. Specifically, the Topographic Engineering Center's Battlespace Terrain Reasoning and Awareness module was integrated with the fusion tools, and concepts for a Physical Damage Assessment (PDA) experiment using automated planning tools were advanced.

In FY05, efforts proceeded toward the development of a "Knowledge Infrastructure" and a pilot experiment with a PDA module was conducted to assess PDA/battle damage assessment tools.

In FY06, engineers will integrate software elements for answering commanders' intelligence requirements and conduct experiments on the resulting system.

Additional Data and Software

In FY07, additional data sources, supporting software, and applications will be introduced. Also, experiments will be conducted to evaluate a fully integrated set of software assets to assess their utility in reducing the information overload of reports that analysts will need to review and interpret to provide fast and high-quality answers to commanders in the Future Force's Unit of Action.

Funding

U.S. FUNDING

	FY05 QTY	FY05 AMT	FY06 QTY	FY06 AMT	FY07 QTY	FY07 AMT	FY08 QTY	FY08 AMT
RDT&E (U.S. Army) PE#0602270A Applied Research	-	19.7	-	29.3	-	19.2	-	16.5
RDT&E (U.S. Army) PE#0603270A Advanced Tech Development	-	36.3	-	22.3	-	18.6	-	18.9

EW Technology (Army)

	FY09 QTY	FY09 AMT	FY10 QTY	FY10 AMT	FY11 QTY	FY11 AMT	FY12 QTY	FY12 AMT
RDT&E (U.S. Army) PE#0602270A Applied Research	-	16.6	-	16.8	-	16.9	-	TBD
RDT&E (U.S. Army) PE#0603270A Advanced Tech Development	-	18.9	-	19.4	-	18.8	-	TBD

All $ are in millions.

Source: FY2007 U.S. Budget Documents

Worldwide Distribution/Inventories

This is a **United States Army** program.

Forecast Rationale

The U.S. Army's EW technology development efforts are split into two separate programs, one that focuses on advanced technology development and the other that focuses on applied research. Each of these programs is in turn divided into sub-projects, each with its own funding line. In the future, Forecast International will split these projects up, focusing on individual projects in each report. This will be more specific and a more accurate representation of the market. Thus, this report will be archived in 2008.

Funds for U.S. Army EW Technology

For now, the EW Technology programs combined will cost the Army $358.6 million over the next 10 years. This effort funds the development of the underlying technology for U.S. Army battlefield electronic warfare to take advantage of rapid innovations in component and data processing technology. Some projects in these PEs will transition into follow-on equipment development. The overall effort will remain active as new efforts are incorporated and the developments are phased into other programs.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR RDT&E FUNDING (in millions US$)												
Designation or Program	**High Confidence**					**Good Confidence**			**Speculative**			
	Thru 2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Total**
MFR Varies												
EW TECHNOLOGY United States Army												
	486.11	37.80	35.40	35.50	36.20	35.70	35.00	35.50	36.00	35.50	36.00	358.60
Total	486.11	37.80	35.40	35.50	36.20	35.70	35.00	35.50	36.00	35.50	36.00	358.60