

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

| BUDGET ACTIVITY | | PE NUMBER AND TITLE | | | | | | |
|---|-------------------|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 3 - Advanced technology development | | 0603772A - Advanced Tactical Computer Science and Sensor Tech | | | | | | |
| 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 | 40516 | 70248 | 67011 | 34448 | 27856 | 29096 | 33044 | 33875 |
| 101 TACTICAL AUTOMATION | 11136 | 13467 | 16172 | 16407 | 13495 | 14622 | 17002 | 17307 |
| 1AA Tactical Computer Science Demonstrations (CA) | 4884 | 9395 | | | | | | |
| 1AB SENSOR DEMONSTRATIONS (CA) | 5467 | 8851 | | | | | | |
| 243 SENSORS & SIGNALS PROC | 19029 | 38535 | 50839 | 18041 | 14361 | 14474 | 16042 | 16568 |

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates technologies to achieve information dominance in order to accomplish net-centric operations for the Army's Future Force and, where feasible, to enhance the Current Force capabilities. To gain and maintain battlefield dominance, the Warfighter needs to understand, decide, and act more rapidly than his adversaries. Project 101, Tactical Automation, matures and demonstrates technologies that will allow forces to effectively collect, analyze, transfer, and display information in a net-centric battlefield environment. It develops architectures and provides technologies to enable synchronized Command and Control (C2) during rapid, mobile, dispersed, and joint operations. It demonstrates technologies necessary for integrated battlefield situational awareness (SA), force synchronization (to include coordination between manned and unmanned assets), split-based, and On-the-Move (OTM) C2 operations. Project 243, Sensors and Signal Processing, matures signal processing and fusion technologies for Army sensors; matures and demonstrates radio frequency (RF) systems to track and identify enemy forces and personnel; matures and demonstrates multi-sensor control and correlation for improving reconnaissance, surveillance, tracking, and target acquisition. Projects 1AA and 1AB fund 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 contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0602270A (EW Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603008A (Electronic Warfare Advanced Technology), PE 0602120 (Sensors and Electronic Survivability), and PE 0603270A (EW Technology). Work in this PE is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering, Center (CERDEC), Fort Monmouth, NJ.

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| BUDGET ACTIVITY 3 - Advanced technology development | PE NUMBER AND TITLE 0603772A - Advanced Tactical Computer Science and Sensor Tech |
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| <u>B. Program Change Summary</u> | FY 2006 | FY 2007 | FY 2008 | FY 2009 |
|---|---------|---------|---------|---------|
| Previous President's Budget (FY 2007) | 44991 | 64604 | 65657 | 32015 |
| Current BES/President's Budget (FY 2008/2009) | 40516 | 70248 | 67011 | 34448 |
| Total Adjustments | -4475 | 5644 | 1354 | 2433 |
| Congressional Program Reductions | | -12289 | | |
| Congressional Rescissions | | | | |
| Congressional Increases | | 18450 | | |
| Reprogrammings | -4475 | -517 | | |
| SBIR/STTR Transfer | | | | |
| Adjustments to Budget Years | | | 1354 | 2433 |

Ten FY07 congressional adds totaling \$17684 (after adjustment for Congressional Undistributed Reductions) were added to this PE.

- (\$2300) Bi-Directional English-Iraqi Translation System
- (\$959) Hand-held Phraserlator Translation Technology
- (\$959) Aviation Responsive Maintenance System
- (\$3019) Comms Electronics Cost Module (CECM)
- (\$1869) SharedVision
- (\$958) Digital Array Radar Technology Development
- (\$4410) Hyperspectral Imaging & SAR for UAVs
- (\$958) Lgtwt Counter Mortar Radar Base Protection Systems
- (\$1294) Sensor Visualization and Data Fusion
- (\$958) Radar Tag Emitter

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| BUDGET ACTIVITY 3 - Advanced technology development | PE NUMBER AND TITLE 0603772A - Advanced Tactical Computer Science and Sensor Tech | | | | | | PROJECT 101 | |
| 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 |
| 101 TACTICAL AUTOMATION | 11136 | 13467 | 16172 | 16407 | 13495 | 14622 | 17002 | 17307 |

A. Mission Description and Budget Item Justification: This project matures and demonstrates command and control architectures and technologies for Future Force and, where applicable, for Current Force information dominance. For the Army Future Force, a critical advancement in battle command is in the use of automated information technologies embedded throughout its warfighting units that enable them to use information as an element of combat power. This project supplies the tools to provide commanders at all echelons more timely and effective information and allows them to command from anywhere on the battlefield. This will allow Future Force commanders to understand, decide, and act faster than their adversaries, resulting in increased OPTEMPO, improved force synchronization, and reduced fratricide. This project matures advanced computer science and technology solutions addressing: information storage and retrieval, digital transfer, and display of horizontal battlefield situational awareness (SA) and position/location; a common view of the battlefield; synchronization of combined and joint force operations; and Command and Control (C2) On-the-Move (OTM). It matures key technologies in the following areas: automated decision support; advanced database design and distribution; dynamic digital display and manipulation; web-based architectures for intelligent software agents and mission execution monitoring; and mobile adaptive computing. Advanced C2 software services for the Current Force, the brigade combat team (BCT) and echelons above brigade are matured and demonstrated, including efforts involving Command and Control of robotic entities which mature and demonstrate software services optimized for unmanned air and ground robotic systems. Joint developer/warfighter experiments will be conducted in coordination with PM FCS BCT, Training and Doctrine Command (TRADOC) and Research, Development, and Engineering Command (RDECOM) partners.

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 project is performed by the Army RDECOM, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

| <u>Accomplishments/Planned Program:</u> | <u>FY 2006</u> | <u>FY 2007</u> | <u>FY 2008</u> | <u>FY 2009</u> |
|---|-----------------------|-----------------------|-----------------------|-----------------------|
| Network Enabled Battle Command (NEBC): In FY06, matured and demonstrated technologies to support the interfacing and information exchange management between the BCT and echelons above brigade (EAB) C2 software applications; matured intelligent search/retrieval technology and blue force predictive analysis tools for execution assessment/adjustment decision support and demonstration at the C4ISR OTM; transitioned decision support services to the Product Manager Global Command and Control System Army Joint Web Common Operating Picture (COP) program. In FY07, demonstrate and transition information search and retrieval technology and execution decision support tools into PM Battle Command, Joint Tactical COP Workstation and Maneuver Control System architecture; mature information models to represent blue and red force resources, capabilities, and behaviors. In FY08, will mature and demonstrate software to support the interfacing, and information management and exchange between BCT and EAB C2 software applications; will mature and deliver final software products for running estimate, information search and retrieval, and decision support services. In FY09, will mature network monitoring service for application in dynamic control of the Global Information Grid from tactical through enterprise level network architectures; will demonstrate network monitoring services that enable other systems to monitor their own throughput and packet loss to enable dynamic adjustment and optimization of network utilization; will demonstrate how quality of service metrics can be utilized to help intelligently manage the resources of distributed C2 service providers. Work related to this effort is also being accomplished under | 4300 | 6100 | 7292 | 5120 |

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| BUDGET ACTIVITY | PE NUMBER AND TITLE | | | PROJECT |
|--|--|--------------|--------------|--------------|
| 3 - Advanced technology development | 0603772A - Advanced Tactical Computer Science and Sensor Tech | | | 101 |
| PE/project: 0602782A/779. | | | | |
| Command and Control of Robotic Entities (C2ORE): In FY06, prepared for and participated in Joint Expeditionary Force Experiment (JEFX06), C4ISR OTM experiment, and FCS Experiment 1.1; designed tactical Battle Command services for Unattended Ground Sensors (UGSs) and a scenario for experimentation with Unit of Action Maneuver Battle Laboratory. In FY07, mature and demonstrate tactical battle command services for unmanned aerial vehicles (UAVs); prepare for and execute a live experiment with up to three UGS clusters, three unmanned ground vehicles (UGVs), and one UAV; analyze experimental data to assess and provide software improvements to the tactical battle command services. In FY08, will mature and demonstrate tactical battle command services for unmanned ground vehicles; will prepare for and participate in experimentations and a C2ORE lab demonstration at Fort Monmouth, NJ; will mature air/ground collaboration software services. In FY09, will mature tactical battle command services and air/ground collaboration services to include UGSs, UAVs, and UGVs and demonstrate all in a relevant environment; will execute a C2ORE capstone demonstration with up to five UGS clusters, five UGVs, and three UAVs; will analyze experimental data and provide experimentation and analysis report detailing lessons learned and metrics evaluated. | 3846 | 7081 | 8880 | 9287 |
| Joint Force Projection (JFP) Advanced Concept Technology Demonstration (ACTD): In FY06, developed and demonstrated an initial Joint Reception, Staging, Onward Movement, and Integration (JRSOI) bridge tool to join strategic and theater deployment and distribution processes that provides combatant commanders with enhanced capabilities to analyze, plan, execute, and assess force projection at the strategic and operational levels; integrate JRSOI into a mission capability package (MCP). In FY07, will mature the Force Projection MCP within the next generation Net-Enabled Command Capability (NECC) environment; will support JFP integration into USCENTCOM, USTRANSCOM, and JFCOM exercises; will finalize transition of JFP technologies to NECC. | 1610 | 180 | | |
| Battle Space Awareness and Positioning: In FY09, will build on the munitions-focused Common Guidance Common Sense Micro-Electro Mechanical System (MEMS) Inertial Measurement Units (IMUs) effort and mature the MEMS IMUs for suitable precision and accuracy for dismounted Soldier and tactical vehicle applications; will evaluate MEMS preliminary design models of gyroscopes in a laboratory environment and develop prototype gyroscopes suitable for integration into a MEMS IMU for evaluation in a relevant environment. Work related to this effort is also being accomplished under PE/project: 0602782A/779. | | | | 2000 |
| Distributed Command and Control On-the-Move: In FY06, demonstrated a multi-echelon battle command construct representing both Current and Future Force battle command systems. The associated experimentation in a relevant on-the-move environment laid the groundwork for the evolution of current force battle command systems to future force capabilities. | 1380 | | | |
| Small Business Innovative Research/Small Business Technology Transfer Programs | | | 106 | |
| Total | 11136 | 13467 | 16172 | 16407 |

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| BUDGET ACTIVITY 3 - Advanced technology development | PE NUMBER AND TITLE 0603772A - Advanced Tactical Computer Science and Sensor Tech | | | | | | PROJECT 243 | | |
| 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 | |
| 243 SENSORS & SIGNALS PROC | 19029 | 38535 | 50839 | 18041 | 14361 | 14474 | 16042 | 16568 | |

A. Mission Description and Budget Item Justification: This project matures and demonstrates improved ground based radar, sensor fusion, and correlation technologies for Future Force information dominance and where feasible exploits opportunities to enhance Current Force capabilities. The Suite of Sense Through the Wall Systems will mature techniques for detection of personnel and objects through multiple wall types. The Multi-Mission Radar (MMR) effort matures Multi-mission HMMWV mounted radar technology to support air defense, counter-battery, and air traffic control missions within a single system to enhance Future Force mobility and agility. MMR will be self-contained to process target data, identify aircraft/unmanned aerial vehicles (UAVs), and classify artillery, mortar, and rockets. All target data will be distributed to relevant units in the battlefield through network centric channels. Sensor fusion efforts demonstrate sensor management and data correlation, link analysis, and relationship discovery fusion services of a multi-INT fusion system. Sensor and simulated sensor candidates may include moving-target-indicator (MTI)/synthetic aperture radar (SAR), electro-optical/infrared (EO/IR), signals intelligence (SIGINT), measurements and signatures intelligence (MASINT), HUMINT, and biometrics technologies. This project will mature and demonstrate technologies for wide area reconnaissance, surveillance, tracking, and targeting of individuals in complex and urban environments and asymmetric warfare. Technologies will be matured with significant leveraging of achievements from industry, Defense Advanced Research Projects Agency (DARPA), and other services.

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 project is performed by the Army Research, Development, and Engineering Command, Communications - Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth NJ.

| <u>Accomplishments/Planned Program:</u> | <u>FY 2006</u> | <u>FY 2007</u> | <u>FY 2008</u> | <u>FY 2009</u> |
|--|----------------|----------------|----------------|----------------|
| Multi-Mission Radar (MMR): MMR demonstrates the ability to deploy a single sensor that can perform multiple missions; air and missile defense (AMD) engagements of rockets, artillery, mortars, UAVs, cruise missiles, and rotary-and fixed-wing aircraft; counter-fire target acquisition (CTA); air defense fire control (ADFC); Air Defense Surveillance (ADS); and air traffic control (ATC). In FY06, performed system and subsystem test; performed two sets of radar 90 degree CTA system tests against dedicated targets to validate performance; conducted system test demonstration of CTA, ADS, ATC, and ADFC capabilities for user community. In FY07, complete integration and test of expanded 360 Degree CTA capability, demonstrate integration with extended-light weight counter mortar radar, demonstrate cueing to external airborne sensor for mobile-shooter location; demonstrate a fully tested 360 degree MMR system and deliver prime item development specifications to Program Manager Radars suitable for moving into a system development and demonstration phase. | 6100 | 2881 | | |
| Suite of Sense Through the Wall (STTW) Systems: STTW matures and demonstrates technologies to provide mounted/dismounted users with the capability to detect, locate, and see personnel with concealed weapons and explosives who are hidden behind walls, doors, and other visible obstructions. In FY06, conducted lab and user testing of STTW prototypes; utilized experiments to characterize urban and complex terrain phenomenology; matured and demonstrated techniques for the detection of stationary personnel through drywall, brick, and mortar materials. In FY07, mature and demonstrate integrated personnel detection/Concealed Weapon Detection (CWD)/Concealed Explosive Detection (CED) systems with greater standoff capability and increased probability of detection; will conduct lab testing of individual STTW sensors against multiple wall types; will develop techniques for detection of stationary personnel through multiple wall | 5861 | 7062 | 6358 | |

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| 3 - Advanced technology development | 0603772A - Advanced Tactical Computer Science and Sensor Tech | 243 | | |
| types; demonstrate handheld and small unmanned ground vehicle STTW during the Air Assault Expeditionary Force (AAEF) Experiment and Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) On-the-Move (OTM) experiment. In FY08, will complete integration of personnel/CWD/CED prototypes; will conduct final development testing of integrated STTW CWD/CED technology demonstrators against multiple wall types; will conduct additional experiments in urban and complex environments to continue evaluation of new operational concepts/Tactics, Techniques, and Procedures; transition complete suite of STTW systems to PEO Solider (Soldier borne) and PM RUS (SUGV/UGV mounted). Work related to this effort is also being accomplished under PE/project: 62270/442. | | | | |
| Foliage Penetrating (FOPEN) Radar for Unmanned Aerial Vehicles (UAV): This effort matures and demonstrates a FOPEN radar capability to meet the size, weight, and power requirements for a Class IV fixed wing UAV. This effort leverages efforts from the FOPEN Advanced Concept Technology Demonstration (ACTD) (FY03-FY06 in program element (PE) 0603750D8Z, and PE/project 0603762E/SGT-04) capability from manned aircraft to Class IV UAV. Advancements in both radar and exploitation processing technology will enable increased radar performance to include ground and non-metallic building penetration for detection of hidden roadside target/weapons caches. In FY06, developed specification for UAV FOPEN radar system and investigated design concepts and approaches. In FY07, design hardware for airborne radar system including transmitter, antenna, receiver, and processor to provide longer standoff range, wider area coverage, higher sensitivity, and higher probability of detection/lower false alarm rate requirements than ACTD system; develop interface control documents for installation onto the Class IV UAV. In FY08, will fabricate system demonstrator and spares (specific steps include: integration and test of transmitters, antennas, receivers, and processors; lab tests for sensitivity/calibration, motion compensation, frequency notching, interface and control, modes, mission planning, built-in-test, and data link functions; and environmental and ground end to end acceptance tests); will complete air worthiness release documentation and testing for manned surrogate UAV platform; will conduct radar performance flight testing on manned surrogate UAV. In FY09, will complete flight test on manned surrogate UAV to include performance testing; will install system on target UAV and will verify radar performance and remote operation via the data link; will quantify and document system performance. | 1000 | 12736 | 32761 | 6041 |
| Sensor Fusion: This effort develops and demonstrates automated tools to solve the fusion, exploitation, and sensor management/cross-cueing problems associated with prosecuting and tracking individuals, recognizing their patterns of association, and thereby, being able to track the organizations they form. This effort allows the commander to target significant individuals and to understand the organizations exerting influence in his area of operation sufficiently to disrupt or attack the organizational infrastructure. In FY06, completed system hardware design and level one fusion algorithms/software for automated data correlation, sensor cross-cueing, and target tracking; selected architecture, integrated SAR/MTI, EO/IR and SIGINT sensors, and conducted limited testing in the C4ISR OTM experiment at Fort Dix. In FY07, mature fusion service-oriented architecture (SOA)-compliant framework, which provides interoperability via the DCGS-A Integration Backbone (DIB); establish a proxy for priority intelligence requirement (PIR) management service with limited functionality; begin software development for: multi-INT correlation service, a contextual data mediator service, relationship discovery services, and sensor management service; design platform installation; characterize baseline multi-INT data set; select a low-cost, flexible, commercial processing architecture. In FY08, will continue development/integration/refinement on all software services and SOA framework; integrate PIR management service; will demonstrate mature software services. In FY09, will finalize services development and integration and test in the integration lab; will demonstrate mature software services in Army or Joint experiments; will conduct final high fidelity lab experiments and demonstrations of fusion automation and demonstrations of fusion automation and answering capabilities. Work related to this effort is also being accomplished under PE/project: 62270/442. | 6068 | 3727 | 3920 | 3500 |
| Ground Moving Target Indicator (GMTI) and Imaging Surveillance Radar: This effort demonstrates an all-weather GMTI and Synthetic Aperture Radar (SAR) for all-terrain (foliated and open) detection and tracking of mounted and dismounted threats in a package form-fit- | | 9604 | 4800 | 5000 |

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| 3 - Advanced technology development | 0603772A - Advanced Tactical Computer Science and Sensor Tech | 243 | | |
| function compatible with a Class IV rotary wing UAV. This effort is maturing DARPA investments in GMTI and synthetic aperture radar and applying lessons learned to build a multi-function radar system that will satisfy Class IV UAV size weight and power requirements. In FY07, begin radar development; identify and purchase all radar components and test equipment in preparation for tower testing in FY08; integrate a suite of tools to include scenario generation, radar modeling, tracker modeling, tracker evaluation, and visualization from the Air Force Research Lab and other Army sources provide an integrated modeling environment. In FY08, will mature radar model and existing trackers; will continue hardware and software development; will conduct component testing; will assemble radar components; will conduct tower testing of the prototype system to support risk reduction and acquire data needed for the development of signal processing algorithms; will develop MTI exploitation approach; will integrate software package into the development environment for evaluation and stressing under varying operating conditions. In FY09, will complete radar development and tower testing; will integrate system onto a manned surrogate platform and initiate flight testing; will collect tower and flight test data to support development of adaptive MTI processing algorithms, advanced motion compensation techniques and advanced exploitation and evaluation tools. | | | | |
| Measurement and Signature Intelligence Technologies (MASINT) for clandestine tagging, tracking, and locating: This effort matures and demonstrates MASINT technologies capable of detecting, tracking, and/or identifying human activities and/or infrastructures. The emphasis is to identify appropriate approaches, demonstrate embedded processing, and mature algorithms for multi-mode fusion of sensor data. Candidate technologies include: fiber optic seismic/magnetic technologies (highly sensitive for detection of walking personnel with/without weapons and/or tunneling detection); air deployable (air droppable) networked sensor system for a jungle environment (integration of seismic/acoustic sensor with jungle canopy relay); human infrastructure detection technologies (algorithms, sensors, etc); radio frequency MASINT detector, ultra-light multi target indicator radar for unattended ground sensors and unmanned air vehicles. In FY08, will evaluate candidate technologies for tagging, tracking and locating, and select the most viable technologies to pursue for near-term demonstration; will demonstrate/test selected technologies for potential spiral transition to the user community. In FY09, will enhance demonstrators and/or evaluate new candidate technologies for near-term prototype development; will integrate selected technologies into a system demonstrator; will demonstrate/test selected technologies for potential spiral transition to the user community. Work related to this effort is coordinated with Army Research Lab efforts in PE/project 0602120/H16. | | | 3000 | 3500 |
| Cueing Sensor: This effort matures and demonstrates 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, mature and demonstrate dual band focal plane arrays, algorithms, and processing. Work related to this effort is also being accomplished under PE/projects: 62120/H15; 62270/A442; 63270/K16. | | | 1497 | |
| Small Business Innovative Research/Small Business Technology Transfer Programs | | | 1028 | |
| Total | | | 19029 | 38535 |
| | | | 50839 | 18041 |