

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

February 2008

| BUDGET ACTIVITY                                   |                  | PE NUMBER AND TITLE   |                  |                  |                  |                  |                  |
|---|------------------|---|------------------|------------------|------------------|------------------|------------------|
| 3 - Advanced technology development               |                  | 0603772A - Advanced Tactical Computer Science and Sensor Technology |                  |                  |                  |                  |                  |
| COST (In Thousands)                               | FY 2007 Estimate | FY 2008 Estimate  | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
| Total Program Element (PE) Cost                   | 67308            | 74096   | 48236            | 41699            | 29033            | 32964            | 33809            |
| 101 TACTICAL AUTOMATION                           | 13447            | 16033   | 16380            | 13511            | 14633            | 17002            | 17316            |
| 1AA Tactical Computer Science Demonstrations (CA) | 9200             | 9937  |                  |                  |                  |                  |                  |
| 1AB SENSOR DEMONSTRATIONS (CA)                    | 8667             | 9539  |                  |                  |                  |                  |                  |
| 243 SENSORS & SIGNALS PROC                        | 35994            | 38587   | 31856            | 28188            | 14400            | 15962            | 16493            |

**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), and distributed 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 the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is fully coordinated with PE 0602270A (EW Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603008A (Electronic Warfare Advanced Technology), PE 0602120A (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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|---|---|

| <u><b>B. Program Change Summary</b></u>    | FY 2007 | FY 2008 | FY 2009 |
|--|---------|---------|---------|
| Previous President's Budget (FY 2008/2009) | 70248   | 67011   | 34448   |
| Current BES/President's Budget (FY 2009)   | 67308   | 74096   | 48236   |
| Total Adjustments                          | -2940   | 7085    | 13788   |
| Congressional Program Reductions           |         | -12515  |         |
| Congressional Rescissions                  |         |         |         |
| Congressional Increases                    |         | 19600   |         |
| Reprogrammings                             | -1293   |         |         |
| SBIR/STTR Transfer                         | -1647   |         |         |
| Adjustments to Budget Years                |         |         | 13788   |

FY09 funds increased for FOPEN for increased detection of targets of interest and analysis for testing on target UAS platform.

Nine FY08 congressional adds totaling \$19600 were added to this PE.

- (\$800) Advanced Radar Transceiver Integrated Circuits Development
- (\$1200) Sensor Visualization and Data Fusion (SVDF)
- (\$1600) Aviation Responsive Maintenance System
- (\$2000) Software Lifecycle Affordability Management (SLAM)
- (\$2000) X-band Interferometric Radar
- (\$2400) Enhanced Multi-Mission Radar
- (\$3200) 1 Megawatt Molten Carbonate Fuel Cell Demonstrator at 29 Palms
- (\$3200) SharedVision
- (\$3200) HYPERSAR Radar

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

**February 2008**

|  |  |                     |                     |                     |                     |                              |                     |
|--|--|---------------------|---------------------|---------------------|---------------------|------------------------------|---------------------|
| <b>BUDGET ACTIVITY</b><br><b>3 - Advanced technology development</b> | <b>PE NUMBER AND TITLE</b><br><b>0603772A - Advanced Tactical Computer Science and Sensor Technology</b> |                     |                     |                     |                     | <b>PROJECT</b><br><b>101</b> |                     |
| COST (In Thousands)  | FY 2007<br>Estimate  | FY 2008<br>Estimate | FY 2009<br>Estimate | FY 2010<br>Estimate | FY 2011<br>Estimate | FY 2012<br>Estimate          | FY 2013<br>Estimate |
| 101 TACTICAL AUTOMATION  | 13447  | 16033               | 16380               | 13511               | 14633               | 17002                        | 17316               |

**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 battlefield situational awareness (SA) and position/location information; 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 the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army RDECOM, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

| <b><u>Accomplishments/Planned Program:</u></b>   | <b><u>FY 2007</u></b> | <b><u>FY 2008</u></b> | <b><u>FY 2009</u></b> |
|--|-----------------------|-----------------------|-----------------------|
| Network Enabled Battle Command (NEBC): In FY07, demonstrated and transitioned information search and retrieval technology and execution decision support tools into PM Battle Command, Joint Tactical Common Operating Picture Workstation and Maneuver Control System architecture; matured information models to represent blue and red force resources, capabilities, and behaviors. In FY08, mature and demonstrate software to support the interfacing, and information management and exchange between BCT and echelons above brigade C2 software applications; mature and deliver final software products for running estimate, information search and retrieval, and decision support services to PM BC for inclusion in PM Tactical Battle Command Software services baseline.. 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 allow 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 PE/project: 0602782A/779. | 6135                  | 7141                  | 5119                  |

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

**February 2008**

| BUDGET ACTIVITY   | PE NUMBER AND TITLE  | PROJECT      |              |  |
|---|--|--------------|--------------|--|
| <b>3 - Advanced technology development</b>  | <b>0603772A - Advanced Tactical Computer Science and Sensor Technology</b> | <b>101</b>   |              |  |
| Command and Control of Robotic Entities (C2ORE): In FY07, matured and demonstrated tactical battle command services for unmanned aerial systems (UASs); prepared for and executed a live experiment with one live and one simulated unattended ground sensor (UGS) cluster, three unmanned ground vehicles (UGVs), and two UASs; analyzed experimental data to assess and provide software improvements to the tactical battle command services. In FY08, mature and demonstrate tactical battle command services for unmanned ground vehicles; prepare for and participate in experimentations and a C2ORE lab demonstration at Fort Monmouth, NJ; mature air/ground collaboration software services. In FY09, will mature tactical battle command services and air/ground collaboration services to include UGSs, UASs, 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 UASs; will analyze experimental data and provide experimentation and analysis report detailing lessons learned and metrics evaluated; will transition software services to PM FCS. | 7132   | 8704         | 9269         |  |
| 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.  |  |              | 1992         |  |
| Joint Force Projection (JFP) Advanced Concept Technology Demonstration (ACTD): In FY07, matured the Force Projection mission capability package within the next generation Net-Enabled Command Capability (NECC) environment; supported JFP integration into USCENTCOM, USTRANSCOM, and JFCOM exercises; finalized transition of JFP technologies to NECC.  | 180  |              |              |  |
| Small Business Innovative Research/Small Business Technology Transfer Programs  |  |              | 188          |  |
| <b>Total</b>  | <b>13447</b>   | <b>16033</b> | <b>16380</b> |  |

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|--|--|------------------|------------------|------------------|------------------|------------------------------|------------------|
| <b>BUDGET ACTIVITY</b><br><b>3 - Advanced technology development</b> | <b>PE NUMBER AND TITLE</b><br><b>0603772A - Advanced Tactical Computer Science and Sensor Technology</b> |                  |                  |                  |                  | <b>PROJECT</b><br><b>243</b> |                  |
| COST (In Thousands)  | 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   | 35994  | 38587            | 31856            | 28188            | 14400            | 15962                        | 16493            |

**A. Mission Description and Budget Item Justification:** This project matures and demonstrates improved 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 matures techniques for detection of personnel and objects through multiple wall types. 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 matures and demonstrates 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 the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. 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.

| <b><u>Accomplishments/Planned Program:</u></b>  | <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, UASs, 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 FY07, completed integration and testing of expanded 360 degree CTA capability, demonstrated integration with extended-light weight counter mortar radar, demonstrated cueing to external airborne sensor for mobile-shooter location; demonstrated a fully tested 360 degree MMR system and delivered prime item development specifications to Program Manager Radars suitable for moving into a system development and demonstration phase.   | 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 hidden behind walls, doors, and other visible obstructions. In FY07, matured and demonstrated integrated personnel detection/Concealed Weapon Detection (CWD)/Concealed Explosive Detection (CED) systems with greater standoff capability and increased probability of detection; conducted lab testing of individual STTW sensors against multiple wall types; developed techniques for detection of stationary personnel through multiple wall types; demonstrated 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, complete integration of personnel/CWD/CED prototypes; conduct final development testing of integrated STTW CWD/CED technology demonstrators against multiple wall types; conduct additional experiments in urban and complex environments to continue evaluation of new operational concepts/Tactics, Techniques, and Procedures; transition complete suite of STTW | 7062           | 6265           |                |

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| BUDGET ACTIVITY   | PE NUMBER AND TITLE  | PROJECT    |       |
|---|--|------------|-------|
| <b>3 - Advanced technology development</b>  | <b>0603772A - Advanced Tactical Computer Science and Sensor Technology</b> | <b>243</b> |       |
| systems to PEO Solider (Soldier borne) and PM RUS (SUGV/UGV mounted). Work related to this effort is also being accomplished under PE/project: 0602270A/442.  |  |            |       |
| <p>Foliage Penetrating (FOPEN) Radar for Unmanned Aerial Systems (UASs): This effort matures and demonstrates a FOPEN radar capability to meet the size, weight, and power requirements for a Class IV fixed wing UAS. Advancements in both radar and exploitation processing technology enable increased radar performance to include ground and non-metallic building penetration for detection of hidden roadside target/weapons caches. In FY07, designed 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 with lower false alarm rates; developed interface control documents for installation onto the Class IV UAS. In FY08, purchase radar components; begin fabrication of two system demonstrators and spares (specific steps include: lab test of transmitters, antennas, receivers, and processors); begin air worthiness release documentation. In FY09, will complete development of first system (specific steps include: integrate radar components for system level lab test, conduct lab tests for sensitivity/calibration, motion compensation, frequency notching, interface and control, modes, mission planning, built-in-test); will integrate datalink with radar for remote operation and data dissemination; will conduct environmental and ground end to end acceptance tests; will complete air worthiness release documentation and testing for manned platform and begin documentation for unmanned platform; will conduct and complete radar performance flight testing of the first radar on a manned surrogate UAS platform; will mature algorithms for increased detection of targets of interest, will develop specifications and perform required analysis for testing on target UAS platform; will begin radar integration on target UAS.</p> | 12736  | 20499      | 19920 |
| <p>Sensor Fusion: This effort develops and demonstrates automated tools to mitigate 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 FY07, matured fusion service-oriented architecture (SOA)-compliant framework, which provides interoperability via the DCGS-A Integration Backbone (DIB); established a proxy for priority intelligence requirement (PIR) management service with limited functionality; began software development for: multi-INT correlation service, a contextual data mediator service, relationship discovery services, and sensor management service; designed platform installation; characterized baseline multi-INT data set; selected a low-cost, flexible, commercial processing architecture. In FY08, mature initial human intelligence (HUMINT) extraction, multi-INT Correlation (Level 1 Fusion), and contextual data mediator software services; mature and finalize the SOA fusion framework; demonstrate and evaluate initial integrated software services; mature relationship discovery service (Level 2a Fusion). 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: 0602270A/442.</p>                                     | 3340   | 3725       | 3503  |
| <p>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-function compatible with a Class IV rotary wing UAS. 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 UAS size weight and power requirements. In FY07, began radar development; identified and purchased all radar components and test equipment; integrated a suite of tools to include scenario generation, radar modeling, tracker modeling, tracker evaluation, and visualization to provide an integrated modeling environment. In FY08, mature radar model and existing trackers; continue hardware and software development; conduct component testing; assemble radar components; conduct tower testing of the prototype system to support risk reduction and acquire data needed for</p>  | 8478   | 4377       | 4960  |

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|--|--|--------------|--------------|
| <b>3 - Advanced technology development</b>   | <b>0603772A - Advanced Tactical Computer Science and Sensor Technology</b> |              | <b>243</b>   |
| the development of signal processing algorithms; develop MTI exploitation approach; integrate software package into the development environment for evaluation 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 technical 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, evaluate candidate technologies for tagging, tracking and locating, and select the most viable technologies to pursue for near-term demonstration; 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 0602120A/H16. |  | 2702         | 3473         |
| 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 systems for Army vehicles. In FY07, matured and demonstrated dual band focal plane arrays, algorithms, and processing. Work related to this effort is also being accomplished under PE/projects: 0602120A/H15; 0602270A/A442; 0603270A/K16.  | 1497   |              |              |
| Small Business Innovative Research/Small Business Technology Transfer Programs   |  | 1019         |              |
| <b>Total</b>   | <b>35994</b>   | <b>38587</b> | <b>31856</b> |