| Exhibit R-2, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| Total PE Cost- | 15.670 | 21.314 | 11.755 | 12.020 | 12.017 | 12.085 | 12.331 | 12.613 |
| ADCR | 0.150 | 0.324 | 0.246 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| TECH TRANSFER | 0.000 | 0.500 | 0.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| USV | 0.000 | 0.900 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MPRS | 0.258 | 0.900 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JOINT SERVICE EOD | 2.500 | 3.300 | 1.810 | 3.150 | 3.150 | 3.150 | 3.150 | 3.150 |
| JAUS | 1.000 | 1.810 | 1.000 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 |
| GLADIATOR | 3.125 | 0.900 | 1.700 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RCSS | 1.058 | 0.000 | 1.000 | 1.500 | 1.250 | 0.000 | 0.000 | 0.000 |
| NUSE 2 | 0.000 | 3.064 | 1.065 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| INTELLIGENT MOBILITY | 1.000 | 4.516 | 1.120 | 1.500 | 1.500 | 1.500 | 1.500 | 1.500 |
| RACS | 4.579 | 1.800 | 3.614 | 1.200 | 1.200 | 1.200 | 1.200 | 1.200 |
| COTS | 2.000 | 0.500 | 0.200 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| CEE | 0.000 | 2.800 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| ROBOTIC TECHNOLOGY ENHANCEMENT | 0.000 | 0.000 | 0.000 | 3.270 | 3.517 | 4.835 | 5.081 | 5.363 |

**A. Mission Description and Budget Item Justification:**

This program is a budget activity level 4 based on the concept/technology development activities ongoing within the program. This PE was established in response to Congressional guidance to consolidate DoD robotic programs on unmanned ground systems and related robotic technologies in order to increase focus of the Services' robotic programs on operational requirements. The program ensures coordination between the Services and provides for interoperability and commonality among unmanned ground systems. The Joint Robotics Program (JRP) will develop and field a family of affordable and effective mobile ground robotic systems; develop and transition technologies necessary to meet evolving user requirements, and serve as a catalyst for insertion of robotic systems and technologies into the force structure. Unmanned Ground Systems are now realizing the often foreseen potential to provide our service men and women with the leap-ahead warfighting capability they need to reduce risk levels to our personnel. The war on terrorism has created urgent and compelling requirements for UGVs. The JRP has responded by deploying unmanned countermine and reconnaissance systems to Bosnia and Kosovo and in support of Operation Enduring Freedom and Operation Iraqi Freedom. The JRP

continues to support UGV deployments around the globe providing the Services with unmanned force protection and countermine capabilities. Increasing Service UGV demand and positive feedback from users in the field have validated the JRP mission.

**Automatically Deployable Communications Relays (ADCR) (0.150)**

The purpose of the Automatically Deployable Communications Relays (ADCR) project is to develop a practical method of extending range of high-bandwidth wireless digital communications and to overcome line-of-sight (LOS) problems for unmanned ground vehicles (UGV). The proposed method provides a universal relay-deploying module that connects to a UGV through a standard Ethernet. The deployer contains several radio "bricks" that are dropped off automatically (transparent to the operator) in order to form a chain of communication relay nodes, thereby extending the effective range between the base station and the UGV. This project is a follow-on to a DARPA-funded research project into autonomous wireless ad hoc network maintenance, and heavily leverages the prior effort. Four systems will be developed in response to requests from other military users, including NAVEODTECHDIV and TARDEC.

FY2005-2006 Plans:

- Develop telescopic antenna system for radio "bricks" to extend range between nodes.
- Develop ruggedized radio units.
- Design a deployer module that can connect to four different UGVs.
- Integrate software and hardware, and perform tests and demonstrations.
- Deliver one system for each of the following ground robots: SSC-SD URBOT, iRobot PackBot, TAGS-DM, Remotec ANDROS Wolverine.

**Technology Transfer (0.500)**

Technology Transfer (TechTXFR) employs a spiral development process to enhance the functionality and autonomy of mobile robot systems in the JRP Robotic Systems Pool by converging existing component technologies onto a transition platform for optimization. The technical approach is to harvest prior and on-going technology developments from disparate players that address the technology needs identified by emergent in-theatre requirements and the users of the JRP Robotic Systems Pool. The component technologies are tested and evaluated on a transition platform to identify the best features of the different approaches, which are then integrated and optimized to work in harmony in a complete solution. TechTXFR has already produced phenomenal results with tremendous savings to the government. TechTXFR does not develop new technologies from scratch; it instead brings in pre-developed proven technologies from the research environment and offers them a transition opportunity as opposed to the technologies stagnating as unutilized laboratory prototypes. TechTXFR has leveraged resources from a wide variety of disparate players, including other government agencies and academia, and equally important has also been leveraged by other government programs. TechTXFR has also teamed with a number of organizations with similar ambitions to synergistically pursue robotic technologies in a spiral

development process, such as the Idaho National Laboratory (DoE). INL has a direct interest to transition autonomous technologies for use in a variety of DoE missions, including homeland defense and critical infrastructure protection. The collaborative work maximizes efficiency by bringing in additional resources (money and personnel) that result in leveraging of even more technologies. The end result is a centralized JRP mechanism that continuously capitalizes on state-of-the-art technologies from the research environment to create a standardized solution that can be easily transitioned to ongoing development programs service-wide.

Plans for FY2005-2007 include:

- Integration of miniature stereo vision sensor system and development of obstacle avoidance software.
- Integration of obstacle avoidance and path following behaviors.
- Development of next generation stereo vision system and integration onto the small robot.
- Development of more robust formation following/convoying behaviors.
- Demonstration of autonomous communications relaying.

**Unmanned Surface Vehicle (USV) (0.900)**

The Unmanned Surface Vehicle (USV) program is developing and transitioning the core technologies required to develop a truly autonomous USV. Much of the technology has been or will be transitioned directly from current Unmanned Ground Vehicle (UGV) programs including GPS waypoint navigation**.** Further development is required for: over the water obstacle avoidance (OA) using commercial marine radar, use of stereo vision for USV OA applications, dynamic mission planning and enhanced multi-vehicle command and control.

Plans for FY2005-2006

- Development and demonstration of obstacle avoidance software.
- Development/transition of stereo vision sensor systems for USV applications.
- Investigation and integration of other obstacle detection sensors including laser and radar.
- Integration of nautical chart data into the obstacle avoidance software.
- Development of cooperative USV behaviors and cooperative behaviors between USVs UAVs, ROVs and UUVs.

**Man-Portable Robotic System (MPRS) (0.900)**

The purpose of the Man-Portable Robotic System (MPRS) program is to increase the autonomous capabilities of small robots by transferring and developing technologies that will have an immediate impact on the autonomy and capability of current man-portable robotic systems. Tele-operated systems have proven to be extremely useful but only in life-threatening situations where the burden of driving the vehicle manually is justified. The MPRS program is focused on adapting technologies that have been developed for larger unmanned ground vehicle systems to the man-portable class of robots. These technologies will increase the autonomy in small robots

and lessen the burden on the operator of manually driving the vehicle. Specific technologies include navigation, obstacle detection/obstacle avoidance (ODOA) and collaborative behaviors for small vehicles. Collaborative behaviors include formation following/convoying, intelligent communications relaying, and marsupial systems.
Plans for FY2005-2006:

- Integration of miniature stereo vision sensor system and development of obstacle avoidance software.
- Integration of obstacle avoidance and path following behaviors.
- Development of next generation stereo vision system and integration onto the small robot.
- Development of more robust formation following/convoying behaviors.
- Demonstration of autonomous communications relaying.

**B. Program Change Summary:**

| | FY 2004 | FY 2005 | FY 2006 | FY2007 |
|---|---|---|---|---|
| Previous President's Budget | 15.784 | 11.771 | 11.907 | 12.145 |
| Current FY 2006 President's Budget Submission | 15.670 | 21.314 | 11.755 | 12.020 |
| Total Adjustments | -0.114 | +9.543 | -0.152 | -0.125 |
| Congressional program reductions | -0.114 | -0.507 | | |
| Congressional rescissions | | | | |
| Congressional increases | | +10.050 | | |
| Reprogrammings | | | | |
| SBIR/STTR Transfer | | | | |
| Other | | | -0.152 | -0.125 |

**C. Other Program Funding Summary:**
Not Applicable

**D. Acquisition Strategy:**
This program's acquisition strategy continues to maintain two tracks: (1) to develop and field first generation UGVs with current technologies, and (2) pursue advanced technologies critical to semi-autonomous mobility that can be inserted into first generation systems in an evolutionary manner.

**E. Performance Metrics:**

The Joint Robotics Program prepares and publishes its JRP Master Plan annually. The Plan contains detailed descriptions of the approximately 8 individual projects under this funding line. Each project description includes a task schedule with associated milestones, whereby progress against end goals can be measured. The cost, schedule and technical progress against these milestones is reviewed by DoD participants at semi-annual JRP Working Group meetings.

| Exhibit R-2a, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| Joint Service EOD | 2.500 | 3.300 | 1.810 | 3.150 | 3.150 | 3.150 | 3.150 | 3.150 |

**A. Mission Description and Budget Item Justification:**

This project supports the lifecycle management of EOD equipment for all four military Services. This project will conduct Concept and Technology Development efforts to determine maturity of existing technology and exploration of new concepts to meet EOD requirements. The Joint Service EOD community needs increased autonomy in its robotic platforms, and cooperative control of the different classes of robots, and these technology needs are addressed in this project.

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | | 3.300 | | |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2004 Accomplishments:

- NGEODRCV Neo-Mover Pre-Production Development and Demonstration
- EOD Operational Analysis
- Extension of the TSWG Common Architecture

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | | | 5.500 | 3.150 |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2005-2006 Plans:

- NGEODRCV System Level Development

- Transition Technologies from the NGEODRCV Project
- Final Demonstrations and Approvals of RONS CIP Projects
- Initiate EOD Cooperative Robotics Project

**C. Other Program Funding Summary:**
Not Applicable

**D. Acquisition Strategy:**
Not Applicable

**E. Major Performers:**
Not Applicable

| **Exhibit R-3 Cost Analysis (page 1)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | Program Element<br>PE 0603709D8Z | | | | | Joint Service EOD | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| Primary Hardware Development | | | | 1.000 | | 1.650 | | 2.400 | | | | |
| Ancilliary Hardware Development | | | | | | | | | | | | |
| Systems Engineering | | | | 0.200 | | 0.500 | | 0.600 | | | | |
| Licenses | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Award Fees | | | | | | | | | | | | |
| Subtotal Product Development | | | | 1.200 | | 2150 | | 3.000 | | | | |
| Remarks: | | | | | | | | | | | | |
| Development Support | | | | 0.100 | | 0.100 | | | | | | |
| Software Development | | | | 0.100 | | 0.300 | | 0.750 | | | | |
| Training Development | | | | 0.100 | | 0.100 | | | | | | |
| Integrated Logistics Support | | | | 0.100 | | 0.100 | | 0.100 | | | | |
| Configuration Management | | | | 0.100 | | 0.100 | | 0.100 | | | | |
| Technical Data | | | | 0.100 | | 0.300 | | 0.500 | | | | |
| GFE | | | | | | | | | | | | |
| Subtotal Support | | | | 0.600 | | 1.000 | | 1.450 | | | | |
| Remarks: | | | | | | | | | | | | |

| **Exhibit R-3 Cost Analysis (page 2)** | | | | | | | | Date: | February 2005 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE | | Program Element | | | | | | Joint Service EOD | | | | |
| BUDGET ACTIVITY 4 | | PE 0603709D8Z | | | | | | | | | | |
| Cost Categories (Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost |
| DT | | | | 0.500 | | 0.500 | | 0.500 | | | |
| IOT&E | | | | | | | | 0.150 | | | |
| Initial Verification Testing | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Subtotal T&E | | | | 0.500 | | 0.500 | | 0.650 | | | |
| Remarks: | | | | | | | | | | | |
| Contractor Engineering Support | | | | 0.100 | | 0.100 | | 0.100 | | | |
| Government Engineering Support | | | | 0.100 | | 0.200 | | 0.200 | | | |
| Program Management Support | | | | | | 0.100 | | 0.100 | | | |
| Program Management Personnel | | | | | | | | | | | |
| Travel | | | | | | | | | | | |
| Labor (Research Personnel) | | | | | | | | | | | |
| Miscellaneous | | | | | | | | | | | |
| Subtotal Management | | | | 0.200 | | 0.400 | | 0.400 | | | |
| Remarks: | | | | | | | | | | | |
| Total Cost | | | | | | 4050 | | 5500 | | | |
| Remarks: | | | | | | | | | | | |

| Exhibit R-4, Schedule Profile | | | Date: February 2005 |
|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | Project Number and Name<br>Joint Service EOD |

| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| MTRS PSVM T&E | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MTRS PRM T&E | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MTRS AAP PROD DEC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RONS CIP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

| Exhibit R-4a, Schedule Detail | | Date: February 2005 |
|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | Program Element Number and Name<br>PE 0603708DZ Joint Robotics Program | Project Number and Name<br>Joint Service EOD |

| | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|---|---|---|---|---|
| MTRS PSVM T&E | | 3-4 Q | 1-2 Q | | | | | |
| MTRS PRM T&E | | | 3-4 Q | 1 Q | | | | |
| MTRS AAP PROD DEC | | | | 1 Q | | | | |
| RONS CIP | | 1-4 Q | 1-4 Q | | | | | |
| Next Gen EOD RCV | | | | 1-4 Q | 1-4 Q | 1-4 Q | | |
| EOD Cooperative Robotics | | | | | 1-4 Q | 1-4 Q | 1-4 Q | 1-4 Q |

R-4a Schedule Profile

| Exhibit R-2a, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| JAUS | 1.000 | 1.810 | 1.000 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 |

**A. Mission Description and Budget Item Justification:**

The intent of this program is to develop common open software architecture to ensure unmanned systems' interoperability and evolution with resultant cost savings. JAUS will specify the logical interfaces between computing modules to allow for rapid technology transfer. Continue to develop JAUS such that it attains clear objectives and maintains a consistent philosophy while promoting JAUS as the domain architecture for Unmanned Systems. We will educate the Unmanned Systems community on JAUS to support acquiring, developing, testing, and manufacturing organizations' incorporation of JAUS into their products and services. JAUS has started the transition to a commercial standards body through the petitioning of the Society of Automotive Engineers, Aerospace Council Avionics Standards Development group. JAUS will migrate to the Committee AS-4, Unmanned Systems.

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 1.000 | | | |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2004 Accomplishments:

- Released Version 1.3 of the JAUS Strategic Plan.
- Released Version 1.0 of the JAUS Compliance Specification.
- Released Version 3.0 and 3.1 of the JAUS Domain Model.
- Released Version 3.1 and 3.2 of the JAUS Reference Architecture Specification.
- Conducted four JAUS Working Group meetings.
- Validated JAUS for Unmanned Ground Systems control.
- Validated JAUS support for mission packages/payloads.
- Developed support mechanism for Ad-Hoc networking of Unmanned Systems.
- Established SAE AS-4 Committee, Unmanned Systems.

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | | 1.810 | 1.000 | 0.400 |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2005-2006 Plans:

- Demonstrate and validate support for network-based systems.
- Demonstrate and validate support for all unmanned system types.
- Integrate JAUS into Simulation Systems for experimentation/validation.
- Develop interface for Net-Centric systems for mission level data.
- Complete first version of the compliance tool suite.
- Release Version 4.0 of the Domain Model.
- Release Version 3.0 of the Compliance Specification.
- Maintain JAUS Documents.
- Maintain JAUS Compliance Tools Suite.

**C. Other Program Funding Summary:**

Internal Research and Development spending on behalf of participating/affiliated organizations (commercial firms, academic institutions, and other Government entities) is ongoing.

**D. Acquisition Strategy:**

JAUS is currently a requirement in a number of unmanned systems acquisitions including Future Combat Systems.

**E. Major Performers:**

Not applicable

| **Exhibit R-3 Cost Analysis (page 1)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | JAUS | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total 2004 Cost | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost | Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| Primary Hardware Development | | | | | | | | | | | | |
| Ancilliary Hardware Development | | | | | | | | | | | | |
| Systems Engineering | | | | | | | | | | | | |
| Licenses | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Award Fees | | | | | | | | | | | | |
| Subtotal Product Development | | | | | | | | | | | | |
| Remarks: | | | | | | | | | | | | |
| Development Support | | | | | | | | | | | | |
| Software Development | | | 0.742 | 0.950 | | 0.250 | | | | | | |
| Training Development | | | | | | | | | | | | |
| Integrated Logistics Support | | | | | | | | | | | | |
| Configuration Management | | | | | | | | | | | | |
| Technical Data | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Subtotal Support | | | 0.742 | 0.750 | | 0.250 | | | | | | |
| Remarks: | | | | | | | | | | | | |

| **Exhibit R-3 Cost Analysis (page 2)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | Program Element<br>PE 0603709D8Z | | | | | JAUS | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total 2004 Cost | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost | Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| DT | | | | | | | | | | | | |
| IOT&E | | | | | | | | | | | | |
| Initial Verification Testing | | | 0.300 | 0.500 | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Subtotal T&E | | | 0.300 | 0.500 | | | | | | | | |
| Remarks: | | | | | | | | | | | | |
| Contractor Engineering Support | | | | | | | | | | | | |
| Government Engineering Support | | | | | | | | | | | | |
| Program Management Support | | | 0.150 | 0.150 | | 0.150 | | | | | | |
| Program Management Personnel | | | 0.050 | 0.050 | | | | | | | | |
| Travel | | | 0.050 | 0.050 | | | | | | | | |
| Labor (Research Personnel) | | | | | | | | | | | | |
| Miscellaneous | | | 0.100 | 0.100 | | | | | | | | |
| Subtotal Management | | | 0.350 | 0.450 | | 0.150 | | | | | | |
| Remarks: | | | | | | | | | | | | |
| Total Cost | | | 1.000 | 1.810 | | 0.400 | | | | | | |
| Remarks: | | | | | | | | | | | | |

| Exhibit R-4, Schedule Profile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Date: February 2005 | | | |
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | | | | | | | | | | | | | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | | | | | | | | | | | | | | | Project Number and Name<br>JAUS | | | | | | | |
| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Acquisition Milestones | | | | | | | | | | | | | | | | V 3.2 | | | | V 4.1 | | | | | | | | | | | | | | | | |
| Reference Architecture Specification | | | | | | | | | | | | | | V 3.1 | | | V 4.0 | | | | | | | | | | | | | | | | | | | |
| Domain Model | | | | | | | | | | | | | V 3.0 | | V 3.1 | | V 4.0 | V 4.1 | | V 4.3 | | | | | | | | | | | | | | | | |
| Compliance Spec Versions | | | | | | | | | | | | | | | V 1.0 | | V 2.0 | | | | | | | | | | | | | | | | | | | |
| Developmental Evaluation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

| **Exhibit R-4a, Schedule Detail** | | Date: February 2005 |
|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | Program Element Number and Name<br>PE 0603708DZ Joint Robotics Program | Project Number and Name<br>JAUS |

| Schedule Profile | FY 2002 | FY 2003 | FY2004 | FY2005 | FY2006 | FY2007 | FY2008 | FY2009 |
|---|---|---|---|---|---|---|---|---|
| RA Versions 3.1; 3.2; 4.0; 4.1 | | | 2Q; 4Q | 1Q; 3Q | | | | |
| DM Versions 3.0; 3.1; 3.2; 3.3; 4.0; 4.1; 4.2; 4.3 | | | 1Q; 3Q; | 1Q; 3Q | | | | |
| Compliance Spec Versions 1.0; 2.0 | | | 3Q | 1Q | | | | |
| Developmental Evaluation | | | Cont. | Cont. | | | | |

R-4a Schedule Profile

| Exhibit R-2a, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| GLADIATOR | 3.125 | 0.900 | 1.700 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**A. Mission Description and Budget Item Justification:**

The Gladiator Program is a USMC initiative based on the Joint Army-Marine Corps Tactical Unmanned Vehicle (TUV) ORD originated by the U.S. Army Infantry School. Mission Need Statement (MNS) INT 12.1.1 (dated 4 November 1993) validated the need for a tactical unmanned ground vehicle system, and the ORD was approved by the Army in August 1995 and by the Marine Corps in May 1996. Changes in Service deficiencies and required capabilities have led both Services to reevaluate the existing ORD and to initiate efforts to revise it or to approve new requirements documents for robotic systems supporting the tactical commander. The Marine Corps has drafted the Gladiator ORD to support the dismounted infantry of the Marine Ground Combat Element (GCE) with the organic unmanned capability to remote combat tasks including scout/surveillance. The system will reduce risk and neutralize threats to Marines across the full spectrum of conflict and military operations. Gladiator formal capabilities document is in final staffing within the Marine Corps. The Gladiator is a teleoperated/semi-autonomous, small-to-medium sized, highly mobile UGV with, initially, the basic capability to conduct scout/surveillance missions and to carry various mission payloads for specific tasks. It will be inherently simple, durable, multi-functional, and easily transported. In the conduct of Operational Maneuver From The Sea (OMFTS), Ship To Objective Maneuver (STOM), Sustained Operations Ashore (SOA), and Operations Other Than War (OOTW), the Gladiator will enhance the ability to accomplish assigned missions. Operating just forward of the GCE units, Gladiator will perform basic scouting/surveillance, obstacle breaching, and NBC reconnaissance tasks while permitting the operator to remain covered or concealed. The basic Marine Corps system will consist of a mobile base unit (MBU), an OCU, and specific mission payload modules (MPMs). Initial MPMs will include Shoulder-launched Multi-purpose Assault Weapon (SMAW), Anti-Personnel Obstacle Breaching System (APOBS), and direct fire (lethal and non-lethal) weapons.

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 3.125 | | | |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY 2004 Accomplishments:
- Program remained in CTD.
- Completed detailed design of Gladiator.
- Completed Future Naval Capability demonstrations.
- Completed System Design and Development (SDD) acquisition documentation.
- Released SDD acquisition package to contractors.
- Successfully competed within the Marine Corps for Gladiator funding in the FY 2006-2011 POM.

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | | 0.900 | 1.700 | 0.000 |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY 2005-2006 Plans:
- Initiate SDD.
- Complete PDR and DRR.
- Complete Developmental Testing.
- Begin preparation of MS C documentation.

**C. Other Program Funding Summary:**
Gladiator is a cooperative program of the Office of Naval Research and the DoD Joint Robotics Program. The ONR is responsible for funding the major portion of the technology demonstration, while the JRP continues to manage the Gladiator program through SDD to production in support of Marine Corps requirements. FNC funding, under Autonomous Operations is:
FY 2002 5.0million
FY 2003 2.5million
FY 2004 1.5million

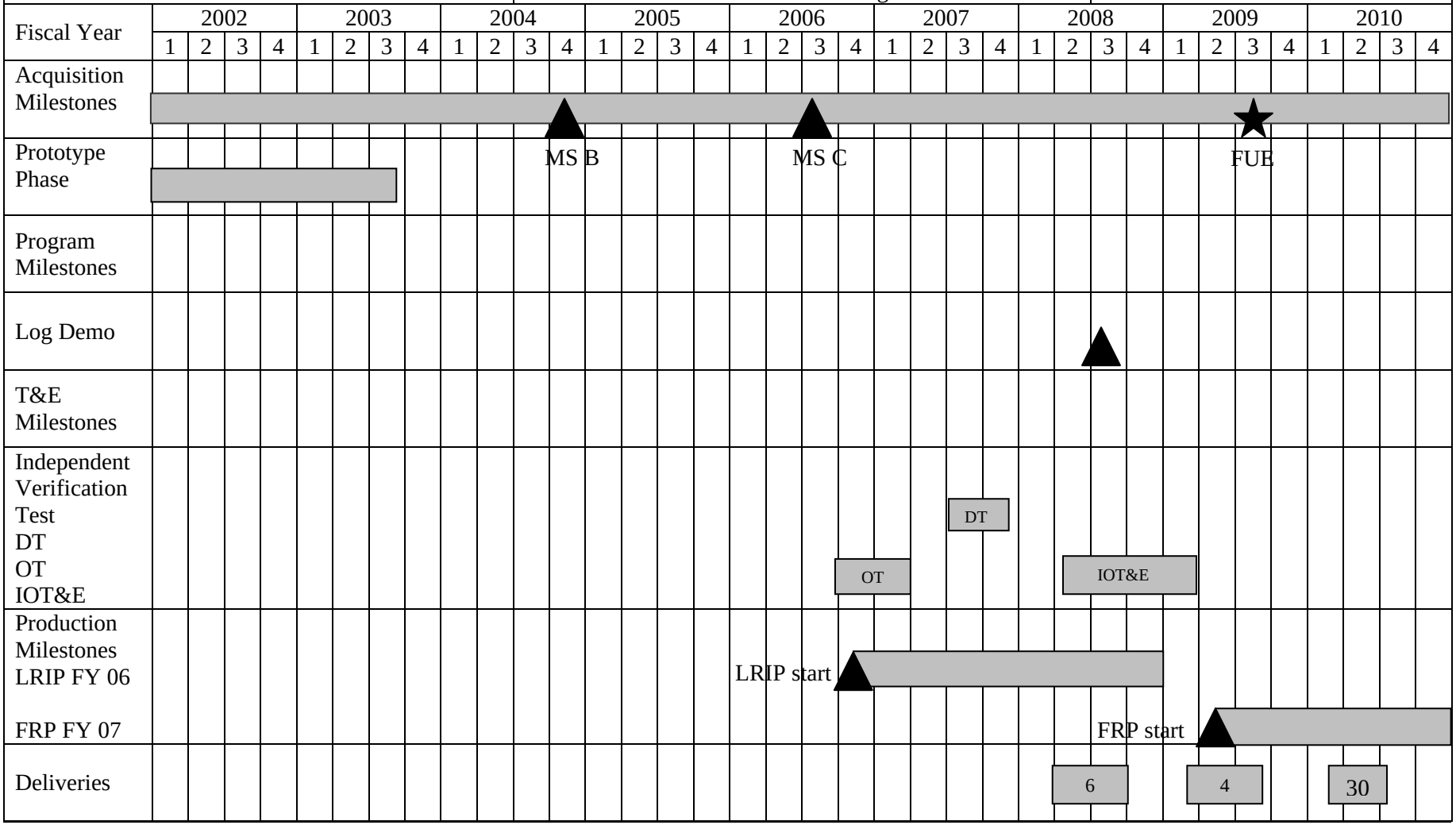
**D. Acquisition Strategy:**
Two contractors were selected for down select competition for Gladiator SDD. These two contractors are Lockheed Martin, Dallas, TX and Carnegie Mellon, Pittsburgh, PA.

**E. Major Performers:**
Not Applicable

| **Exhibit R-3 Cost Analysis (page 1)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | GLADIATOR | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| Primary Hardware Development | | | | 2.335 | | 1.373 | | 0.373 | | | | |
| Ancilliary Hardware Development | | | | | | | | | | | | |
| Systems Engineering | | | | 0.148 | | 0.095 | | 0.095 | | | | |
| Licenses | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Award Fees | | | | | | | | | | | | |
| Subtotal Product Development | | | | 2.483 | | 1.468 | | 0.468 | | | | |
| Remarks: | | | | | | | | | | | | |
| Development Support | | | | 0.040 | | 0.172 | | 0.172 | | | | |
| Software Development | | | | 0.075 | | | | | | | | |
| Training Development | | | | 0.050 | | 0.095 | | 0.095 | | | | |
| Integrated Logistics Support | | | | 0.025 | | | | | | | | |
| Configuration Management | | | | 0.055 | | | | | | | | |
| Technical Data | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Subtotal Support | | | | 0.245 | | 0.267 | | 0.267 | | | | |
| Remarks: | | | | | | | | | | | | |

| **Exhibit R-3 Cost Analysis (page 2)** | | | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | | | GLADIATOR | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract | |
| DT | | | | | | | | | | | | | | |
| IOT&E | | | | | | | | | | | | | | |
| Initial Verification Testing | | | | | 0.130 | | 0.135 | | 0.135 | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Subtotal T&E | | | | | 0.130 | | 0.135 | | 0.135 | | | | | |
| Remarks: | | | | | | | | | | | | | | |
| Contractor Engineering Support | | | | 0.067 | | 0.070 | | | | | | | | |
| Government Engineering Support | | | | 0.120 | | 0.120 | | 0.050 | | | | | | |
| Program Management Support | | | | 0.080 | | 0.080 | | 0.080 | | | | | | |
| Program Management Personnel | | | | | | | | | | | | | | |
| Travel | | | | | | | | | | | | | | |
| Labor (Research Personnel) | | | | | | | | | | | | | | |
| Miscellaneous | | | | | | | | | | | | | | |
| Subtotal Management | | | | | 0.267 | | 0.270 | | 0.130 | | | | | |
| Remarks: | | | | | | | | | | | | | | |
| Total Cost | | | | 3.125 | | 1.140 | | 1.000 | | | | | | |
| Remarks: | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

| Exhibit R-4, Schedule Profile | | | Date: February 2005 |
|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #5 | | Program Element Number and Name<br>PE 0604709D8Z – Joint Robotics Program | Project Number and Name<br>GLADIATOR |




R-4 Schedule Profile

| **Exhibit R-4a, Schedule Detail** | | Date: February 2005 |
|---|---|---|
| Appropriation/Budget Activity<br>Research, Development, Test & Evaluation, Defense-Wide, Budget Activity 5 | Program Element Number and Name<br>PE 0604709D8Z Joint Robotics Program | Project Number and Name<br>Gladiator |

| Schedule Profile | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|---|---|---|---|---|
| Milestone A | | | | | | | | |
| Contract Preparation | 1-2Q | | | | | | | |
| CTD Contract Award | 2Q | | | | | | | |
| CTD | 2-4Q | 1-4Q | | | | | | |
| Milestone B | | | 4Q | | | | | |
| Contract Preparation | | | 2-4Q | | | | | |
| SDD Contract Award | | | | 1 Q | | | | |
| SDD | | | | 1-4Q | 1-4Q | 1-4Q | | |
| Developmental Test | | | | | 3-4Q | | | |
| Log Demo | | | | | | | 3Q | |
| Operational Test | | | | | | | 2-4Q | |
| Milestone C | | | | | | 2Q | | |
| Low Rate Initial Production | | | | | | 3-4Q | 1-4Q | |
| IOT&E | | | | | | | 2-4Q | |
| Full Rate Production | | | | | | | | 2Q |
| First Unit Equipped | | | | | | | | 3Q |

| Exhibit R-2a, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| RCSS | 1.058 | 0.000 | 1.000 | 1.500 | 1.250 | 0.000 | 0.000 | 0.000 |

**A. Mission Description and Budget Item Justification:**

The Robotic Combat Support System (RCSS) Program is an upgrade approach from the Product Improved Mini-Flail (PIMF). The PIMF has proven effective in Bosnia and Kosovo, as well as in current operation in Afghanistan, as a contingency asset. RCSS threshold requirements include anti-personnel mine clearing and neutralization, improved reliability and human-machine interface, Anti-Personnel wire obstacle breaching, remotely deployed smoke and obscurants, and the capability to carry soldier loads. Initial RCSS deployment to Afghanistan occurred during FY 2004 and continues through FY 2006 to deployed forces. P3I requirements include advanced controls, remotely delivered special munitions to support dismounted operations, hands-free control using dismounted soldier leader-follower technology, and mechanical devices that will be used to emplace demolitions and special breeching systems. A Mission Need Statement (MNS) and Operational Requirements Document (ORD) have been approved by Army Training and Doctrine Command (TRADOC). Procurement continues through FY 2006, while system engineering to develop full ORD required capability will be developed and integrated into the operational fleet.

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 1.058 | | | |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2004 Accomplishments:

- Completed evaluation of CTD contract efforts.
- Revised Acquisition Strategy to meet War on Terrorism Urgent Requirements.
- Conducted market survey to determine availability of COTS capability.
- Selected RCSS COTS vendor.
- Initiated RCSS COTS procurement contract.
- Conducted safety testing and obtain safety release.
- Fielded RCSS COTS systems to War on Terrorism operating forces including training and maintenance support.
- Began preparation for Type Classification testing.

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | | 0.000 | 1.000 | 1.500 |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2005-2006 Plans:
- Accomplish Type Classification testing.
- Continue fielding and support of RCSS COTS systems to War on Terrorism forces.
- Obtain Type Classification.
- Determine and identify Mission Essential Modules to improve COTS system multi-mission capability.
- Initiate Mission Essential Modules Integration program

**C. Other Program Funding Summary:**
Army Procurement funding utilized to procure RCSS COTS systems in FY 2004 and FY 2005.

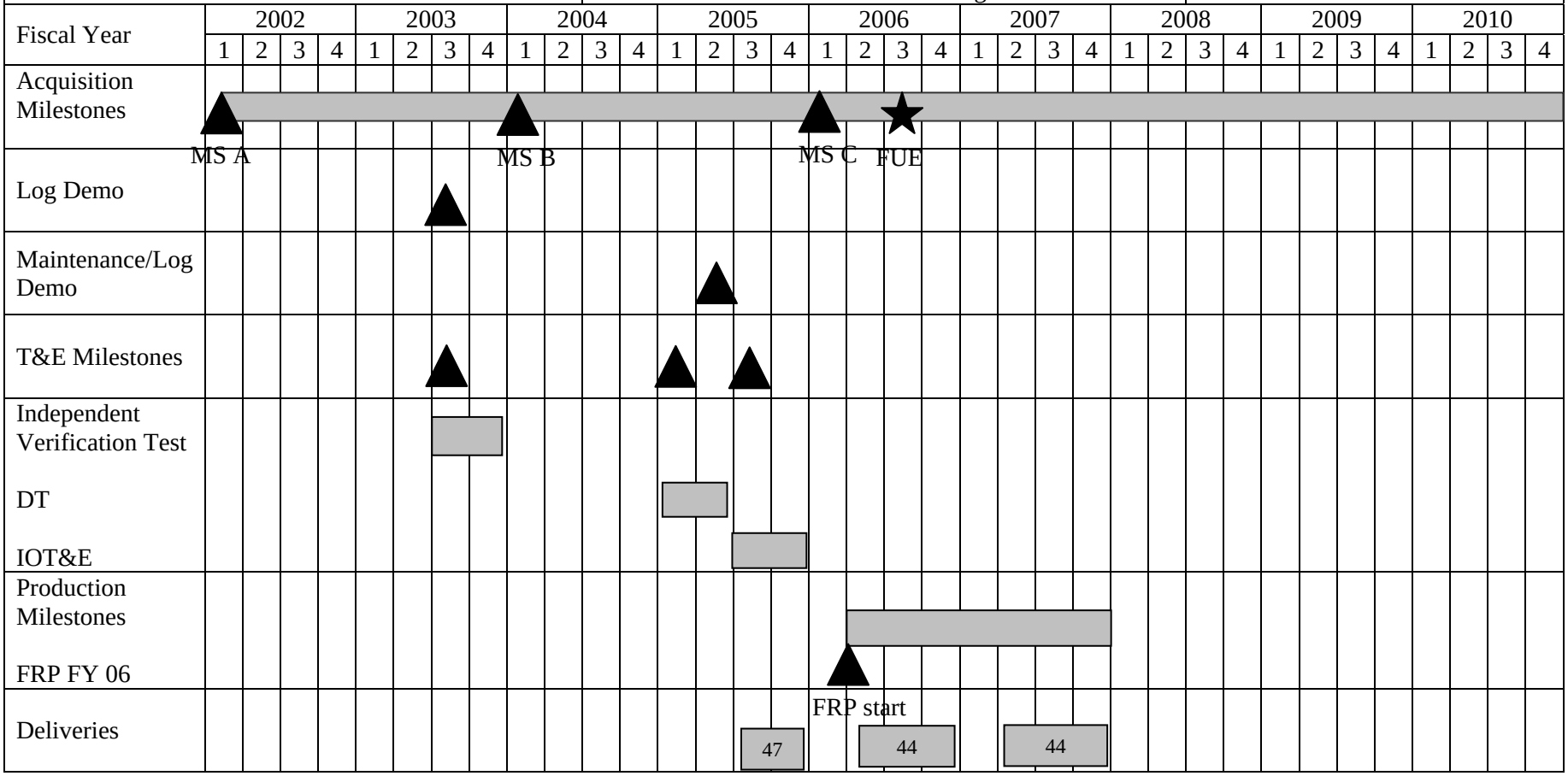
**D. Acquisition Strategy:**
Not Applicable

**E. Major Performers:**
Not Applicable

| **Exhibit R-3 Cost Analysis (page 1)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE | | | Program Element | | | | RCSS | | | | | |
| BUDGET ACTIVITY 4 | | | PE 0603709D8Z | | | | | | | | | |
| Cost Categories (Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| Primary Hardware Development | | | | 0.500 | | 0.284 | | 0.284 | | | | |
| Ancilliary Hardware Development | | | | | | | | | | | | |
| Systems Engineering | | | | 0.438 | | 0.142 | | 0.142 | | | | |
| Licenses | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Award Fees | | | | | | | | | | | | |
| Subtotal Product Development | | | | 0.938 | | 0.426 | | 0.426 | | | | |
| Remarks: | | | | | | | | | | | | |
| Development Support | | | | | | 0.002 | | 0.002 | | | | |
| Software Development | | | | | | 0.062 | | 0.062 | | | | |
| Training Development | | | | | | 0.030 | | 0.030 | | | | |
| Integrated Logistics Support | | | | | | 0.025 | | 0.025 | | | | |
| Configuration Management | | | | | | 0.025 | | 0.025 | | | | |
| Technical Data | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Subtotal Support | | | | 0.000 | | 0.144 | | 0.144 | | | | |
| Remarks: | | | | | | | | | | | | |

| **Exhibit R-3 Cost Analysis (page 2)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | RCSS | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| DT | | | | | | 0.230 | | 0.228 | | | | |
| IOT&E | | | | | | | | | | | | |
| Initial Verification Testing | | | | 0.120 | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Subtotal T&E | | | | 0.120 | | 0.230 | | 0.228 | | | | |
| Remarks: | | | | | | | | | | | | |
| Contractor Engineering Support | | | | | | 0.063 | | 0.065 | | | | |
| Government Engineering Support | | | | | | 0.074 | | 0.074 | | | | |
| Program Management Support | | | | | | 0.063 | | 0.065 | | | | |
| Program Management Personnel | | | | | | | | | | | | |
| Travel | | | | | | | | | | | | |
| Labor (Research Personnel) | | | | | | | | | | | | |
| Miscellaneous | | | | | | | | | | | | |
| Subtotal Management | | | | 0.000 | | 0.200 | | 0.202 | | | | |
| Remarks: | | | | | | | | | | | | |
| Total Cost | | | | 1.058 | | 1.000 | | 1.000 | | | | |
| Remarks: | | | | | | | | | | | | |

| Exhibit R-4, Schedule Profile | | | Date: February 2005 |
|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | Project Number and Name<br>RCSS |




R-4 Schedule Profile

| **Exhibit R-4a, Schedule Detail** | | Date: February 2005 |
|---|---|---|
| Appropriation/Budget Activity<br>Research, Development, Test & Evaluation, Defense-Wide, Budget Activity 4 | Program Element Number and Name<br>PE 0603709D8Z Joint Robotics Program | Project Number and Name<br>Robotic Combat Support System (RCSS) |

| Schedule Profile | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|---|---|---|---|---|
| Milestone A | 1Q | | | | | | | |
| Contract Preparation | 1-4Q | 1-4Q | | | | | | |
| CTD Contract Award | | 1Q | | | | | | |
| CTD | 4Q | 1-4Q | | | | | | |
| Milestone B | | | 1Q | | | | | |
| COTS Contract Preparation | | 4Q | 1Q | | | | | |
| COTS Contract Award | | | 1Q | | | | | |
| Safety Testing | | | 1 | | | | | |
| Safety Certification | | | | 1-4Q | | | | |
| Spiral Fielding initiated | | | | 1-4Q | 1-2Q | | | |
| Type Classification Testing | | | | 3-4Q | 1-4Q | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

R-4a Schedule Profile

| Exhibit R-2a, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| NUSE 2 | 0.000 | 3.064 | 1.065 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**A. Mission Description and Budget Item Justification:**

The National Unmanned Systems Experimentation Environment (NUSE2) is a new Department of Defense/Private sector teaming initiative. This will be a collaborative effort to provide infrastructure and assets for experimenting with all types of Unmanned Systems - air, ground, surface and underwater – that is national in scope. NUSE2 will provide developers/acquirers of Unmanned Systems with dedicated experimentation facilities, ranges, and airspace that would otherwise be hard to schedule and are often expensive. The initiative will begin in FY 2004, starting with some limited objective experiments using Unmanned Ground Vehicles.

NUSE2 will be a consortium of organizations agreeing to form and provide the experimentation capability. The Nation is the true beneficiary of this effort and conveys the coast-to-coast and Alaska and Hawaii, scope of NUSE2. NUSE2 is intended to provide an experimentation base for Unmanned System acquirers over the life cycle. This will include live as well as virtual experiments. NUSE2 will be a valuable asset in the coming years, providing accessible, affordable, RDTE capabilities.

The objectives of NUSE2 are to:

- Assist users in refining capabilities (formerly operational requirements)
- Support acquirers in conducting experiments to reduce technical risk.
- Participate in the evaluation of evolutionary upgrades to Unmanned Systems
- Support experiments associated with Advanced Concept Technology Demonstrations
- Facilitate the evaluation of new technologies and aid the tech transfer process of new capabilities for Unmanned Systems
- Support the developmental, operational, and live fire testing requirements of acquirers
- Aid in the development of advanced integrated architectures as they apply to Unmanned Systems
- Be dual capable, i.e., able to support experimentation and testing in both live and virtual venues

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 0.000 | 3.064 | 1.065 | 0.000 |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2005-2006 Plans:

Technology: The following Technology requirements are being filled by the applicable institution

| | |
|---|---|
| Lightweight, Low Power, Robust means of removing image jitter | University of Wyoming |
| Biometric Vision Sensor | University of Wyoming |
| Ultra Wideband Communication and Positioning Systems | University of Alaska |
| Autonomous data exchange in Multi-Robot Collectives | University of Wyoming |
| JAUS Compatible Mission Planning | University of Florida |
| Integrated Mobile Manipulation Systems | University of Texas – Austin |

Infrastructure: NUSE2 has awarded infrastructure improvements to all sites.

| | |
|---|---|
| High Speed test track | Florida |
| JUTTC improvements | Wyoming |
| Test track upgrade | Alaska |
| Wireless Wide Area Network | Mississippi |
| Site Upgrades | Texas |
| Improved Integration facility | California |

- Formalize NUSE2 strategy, campaign plan, and organize team.
- Formalize technology requirement and fulfillment process.
- Develop statements of work for NUSE2 site infrastructure improvements
- Operate the IPT's (M-IPT, E-IPT, T-IPT).
- Identify and refine standards and metrics for experiments.
- Let contracts to fulfill requirements.
- Verification of technology fulfillment
- Identify and begin planning for follow-on experimentation.
- Continue to identify and acquire infrastructure requirements.
- Continue IPT oversight.
- Continue to identify and refine standards and metrics for experiments.
- Execute FY 2005 multi-year contracts.
- Expand NUSE2 as required.
- Expand NUSE2 capabilities to include unmanned air, surface, and subsurface systems.

**C. Other Program Funding Summary:**
Not Applicable

**D. Acquisition Strategy:**
Not Applicable

**E. Major Performers:**
Not Applicable

| **Exhibit R-3 Cost Analysis (page 1)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | NUSE 2 | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| Primary Hardware Development | | | | | | | | | | | | |
| Ancilliary Hardware Development | | | | | | | | | | | | |
| Systems Engineering | | | | | | | | | | | | |
| Licenses | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Award Fees | | | | | | | | | | | | |
| Subtotal Product Development | | | | 0.000 | | 0.000 | | 0.000 | | | | |
| Remarks: | | | | | | | | | | | | |
| Development Support | | | | | | 1.440 | | | | | | |
| Software Development | | | | | | | | | | | | |
| Training Development | | | | | | | | | | | | |
| Integrated Logistics Support | | | | | | 0.624 | | | | | | |
| Configuration Management | | | | | | | | | | | | |
| Technical Data | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Subtotal Support | | | | 0.000 | | 1.964 | | 0.250 | | | | |
| Remarks: | | | | | | | | | | | | |

| **Exhibit R-3 Cost Analysis (page 2)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | NUSE2 | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| DT | | | | | | | | | | | | |
| IOT&E | | | | | | | | | | | | |
| Initial Verification Testing | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Subtotal T&E | | | | 0.000 | | | | | | | | |
| Remarks: | | | | | | | | | | | | |
| Contractor Engineering Support | | | | | | | | | | | | |
| Government Engineering Support | | | | | | | | 0.750 | | | | |
| Program Management Support | | | | | | 1.000 | | 0.065 | | | | |
| Program Management Personnel | | | | | | | | | | | | |
| Travel | | | | | | | | | | | | |
| Labor (Research Personnel) | | | | | | | | | | | | |
| Miscellaneous | | | | | | | | | | | | |
| Subtotal Management | | | | 0.000 | | 1.000 | | | | | | |
| Remarks: | | | | | | | | | | | | |
| Total Cost | | | | | | 3.064 | | 1.065 | | | | |
| Remarks: | | | | | | | | | | | | |

| Exhibit R-4, Schedule Profile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date: February 2005 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | | | | | | | | | | | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | | | | | | | | | | | | | | | | | Project Number and Name<br>NUSE 2 | | | | | | | |
| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Infrastructure | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Standards Identification | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| UMS Experiments | | | | | | | | | | | | | | | ▲ | | | | ▲ | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

| **Exhibit R-4a, Schedule Detail** | | | | | | | | Date: February 2005 |
|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>Research, Development, Test & Evaluation, Defense-Wide, Budget Activity 4 | Program Element Number and Name<br>PE 0603709D8Z Joint Robotics Program | | | | | | | Project Number and Name<br>NUSE 2 |
| Schedule Profile | FY 2002 | FY 2003 | FY2004 | FY2005 | FY2006 | FY2007 | FY2008 | FY2009 |
| Infrastructure | | | | 3-4Q | 1-4Q | | | |
| Standards Identification | | | | 3-4Q | 1-4Q | | | |
| UMS Experiments | | | | 3Q | 2Q, 4Q | | | |

R-4a Schedule Profile

| Exhibit R-2a, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| Intelligent Mobility Program | 1.000 | 4.516 | 1.120 | 1.500 | 1.500 | 1.500 | 1.500 | 1.500 |

**A. Mission Description and Budget Item Justification:**

The Intelligent Mobility program is an effort under the U.S. Army Research and Development Command Engineering Center (RDECOM-TARDEC) Intelligent Mobility (IM) Program. Mobility Enhancement through the utilization of novel running gear such as reconfigurable shape, Omni-directional drive systems, and improved mobility sensor integration will improve the mobility of small unmanned ground vehicles (UGVs) to operate on both improved surfaces and off-road terrain in support of urban warfare, physical security and force protection missions for military police and engineering operations. Of particular and immediate interest is the Omni-Directional Inspection System, which is a man packable size robot capable of omni-directional locomotion on structured surfaces for the purpose of inspecting vehicles in a force protection role and in an EOD role as an IED disruptor delivery device. There is a current validated urgent need generated by CENTCOM to utilize UGV's for EOD and force protection missions. Twenty three prototype ODIS UGV's are currently deployed to Iraq and Afghanistan in order to collect data, prove out the current prototype system, and simultaneously provide needed UGV functionality to the user in hostile environments. TRML is also working to develop a draft Mission Needs Statement for the ODIS robot with Military Police/Force Protection agencies. We are working with soldiers in Iraq to fulfill requirements delivered in an official needs statement. The next spiral development iteration will produce approximately 40 upgraded ODIS units for deployment. These units will have enhanced mobility, allowing them to operate in rough terrain (1"-2" cobble stone roads), rutted roads/ areas, etc. They will also have the capability to easily accept chemical detectors and other sensors as needed by the soldier.

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 1.000 | | | |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY 2004 Accomplishments:

- Completed a build of 26 production prototype units for experimentation and deployment.
- Deployed 16 units to Iraq (Baghdad area) for use by Force Protection Units.
- Deployed 4 units to Afghanistan for use by Force Protection units.
- Completed first revision and product improvement of ODIS for functional prototype testing.
- Began next spiral of ODIS development which will yield upgraded systems in 3QFY 2005.

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | | 4.516 | 1.120 | 1.500 |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY 2006-2007 Plans :

- Revise the ODIS platform design to include changes suggested from testing and user input in theater.
- Management and planning for building 100 units based on the President's emergency supplemental budget
- Further testing of ODIS at the Port of Los Angeles and Long Beach for data realtive to force protection in a Homeand defense a application
- Continue to deploy ODIS robots and support personnel for ODIS in SWA theater
- Track data from deployment and integrate lessons learned for ODIS and other small robots
- Develop prototype ODIS platform variants based on user request
- Investigate utility and need for ODIS platform variants
- Further improve robot control based on Iraq deployment data
- Improve methods for integrating mission packages
- Investigate other intelligent mobility mechanical concepts for improved functionality

**C. Other Program Funding Summary:**
Not Applicable

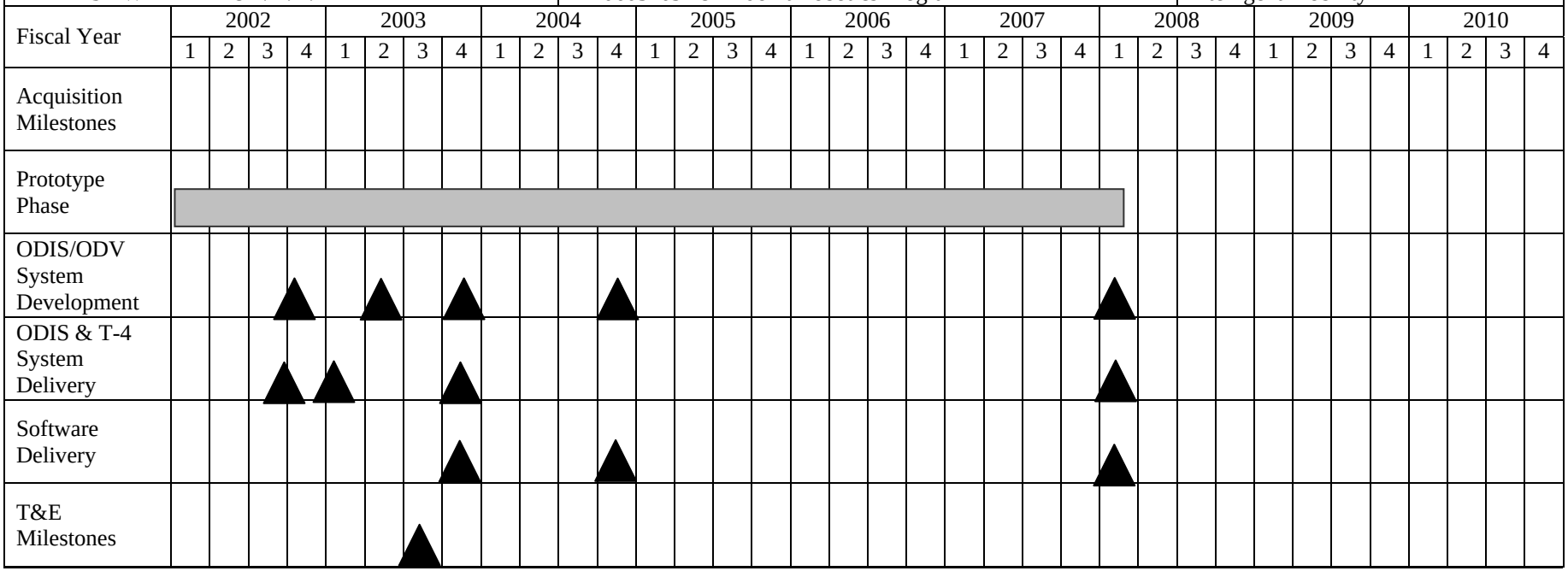
**D. Acquisition Strategy:**
Not Applicable

**E. Major Performers:**
Not Applicable

| **Exhibit R-3 Cost Analysis (page 1)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | Intelligent Mobility | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item<br>Requirements) | Contract<br>Method &<br>Type | Performing<br>Activity &<br>Location | Total<br>PYs<br>Cost | 2004<br>Cost | 2004<br>Award<br>Date | 2005<br>Cost | 2005<br>Award<br>Date | 2006<br>Cost | 2006<br>Award<br>Date | Cost To<br>Complete | Total<br>Cost | Target<br>Value of<br>Contract |
| Primary Hardware Developmer | | | | 0.220 | | 2.200 | | 0.147 | | | | |
| Ancilliary Hardware Developm | | | | 0.047 | | 0.500 | | 0.049 | | | | |
| Systems Engineering | | | | 0.070 | | 0.600 | | 0.033 | | | | |
| Licenses | | | | | | | | | | | | |
| Tooling | | | | | | | | 0.033 | | | | |
| GFE | | | | | | | | | | | | |
| Award Fees | | | | | | | | | | | | |
| Subtotal Product Development | | | | 0.337 | | 3.232 | | 0.262 | | | | |
| Remarks: | | | | | | | | | | | | |
| Development Support | | | | 0.140 | | 0.100 | | 0.065 | | | | |
| Software Development | | | | 0.187 | | 0.150 | | 0.022 | | | | |
| Training Development | | | | 0.047 | | 0.100 | | 0.033 | | | | |
| Integrated Logistics Support | | | | 0.033 | | 0.200 | | 0.033 | | | | |
| Configuration Management | | | | 0.033 | | 0.200 | | 0.065 | | | | |
| Technical Data | | | | | | 0.034 | | 0.131 | | | | |
| GFE | | | | | | | | | | | | |
| Subtotal Support | | | | 0.440 | | 0.784 | | 0.349 | | | | |
| Remarks: | | | | | | | | | | | | |

| **Exhibit R-3 Cost Analysis (page 2)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | Intelligent Mobility | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| DT | | | | | | | | | | | | |
| IOT&E | | | | | | | | | | | | |
| Initial Verification Testing | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Subtotal T&E | | | | 0.000 | | 0.000 | | 0.000 | | | | |
| Remarks: | | | | | | | | | | | | |
| Contractor Engineering Support | | | | | | | | | | | | |
| Government Engineering Support | | | | 0.223 | | 0.500 | | 0.509 | | | | |
| Program Management Support | | | | | | | | | | | | |
| Program Management Personnel | | | | | | | | | | | | |
| Travel | | | | | | | | | | | | |
| Labor (Research Personnel) | | | | | | | | | | | | |
| Miscellaneous | | | | | | | | | | | | |
| Subtotal Management | | | | | | | | | | | | |
| Remarks: | | | | | | | | | | | | |
| Total Cost | | | | 1.000 | | 4.516 | | 1.120 | | | | |

| Appropriation/Budget Activity | Program Element Number and Name | Project Number and Name |
|---|---|---|
| DEFENSE WIDE RDT&E/B.A. #4 | PE 0603709D8Z – Joint Robotics Program | Intelligent Mobility |




R-4 Schedule Profile

| **Exhibit R-4a, Schedule Detail** | | Date: February 2005 |
|---|---|---|
| Appropriation/Budget Activity<br>RDT&E, Defense Wide, Budget Activity 4 | Program Element Number and Name<br>PE 0603709D8Z | Project Number and Name<br>Intelligent Mobility |

| Schedule Profile | FY 2002 | FY 2003 | FY2004 | FY2005 | FY2006 | FY2007 | FY2008 | FY2009 |
|---|---|---|---|---|---|---|---|---|
| Contract Preparation | 1Q | 2Q | 1Q | 1Q | 1Q | 1Q | 1Q | |
| System Development | 2-4Q | 3-4Q | 2-4Q | 3Q | 4Q | 3Q | 3Q | |
| Quality Design and Build | 4Q | 1Q | 4Q | 4Q | 3Q | 4Q | 4Q | |
| Developmental (PD&RR) Technical Testing | | 4Q | 1Q | | 2Q | | 4Q | |
| Developmental Evaluation | | | 1Q | | 3Q | | 4Q | |
| Etc. | | | | | | | | |

R-4a Schedule Profile

| Exhibit R-2a, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| RACS | 4.579 | 1.800 | 3.614 | 3.999 | 3.494 | 2.833 | 2.940 | 2.876 |

**A. Mission Description and Budget Item Justification:**

The Robotics for Agile Combat Support (RACS) is a USAF effort to advance the robotic state-of-the-art capability for counter-terrorism and force protection technologies. RACS programs include the following: Advancements for the All-purpose Remote Transport System (ARTS), Advanced Systems and Control, Active Range Clearance, Force Protection Robotics, and the Next Generation Explosive Ordnance Disposal Remote Control Vehicle (NGEODRCV). The basic platform for the ARTS has been formally transitioned to a Systems Program Office (SPO) for production and sustainment. Future improvements and advancements will enhance the control and payload capabilities for this system. This technology has been applied to Formerly Used Defense Sites (FUDS) and active range clearance for cleanup/disposal.

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 4.579 | 1.800 | 3.614 | 1.200 |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2004-2005 Accomplishments/Planned Program:

- Airborne Engineer – This research effort develop a prototype concept demonstrator that will provide small area ordnance clearance system to allow rapid beddown of RED HORSE personnel. The system includes Power Rake, GPS, New Laptop Operator Control Station, Clam Shell Bucket, and AR-10, 7.62 mm rifle for Stand off Munitions Disruption. The Chief of Staff (CSAF), United States Air Force (USAF) stated that the Air Force requires an Airborne Rapid Engineer Deployable Heavy Operations Repair Squadron, Engineers (RED HORSE) combat engineer capability to "Assess, Prepare and Establish" contingency airbases in remote locations through airdrop, air-insertion, or air-delivery. This requires training some existing RED HORSE personnel as jump-capable and acquiring lighter equipment that is air-droppable, air-insertable, or air-deliverable. It also requires in some cases for Airborne RED HORSE to be augmented by Explosive Ordnance Disposal (EOD), Readiness, and Fire Rescue to meet mission requirements. This Airborne RED HORSE Engineer Concept of Operations (CONOPS) supports the Global Strike Task Force CONOPS: once F-22 and B-2 stealth roll back the enemy offensive threat and uncover basing structure, follow-on forces in the way of Airborne RED HORSE Engineers can deploy to an air base and fix damaged runways for continued offensive operations. Accomplishments include development and transition of three prototypes of the Airborne Engineer ARTS that were airdrop certified (two of which were deployed to Operation Iraqi Freedom). Continued efforts support sling load capabilities for the Airborne Engineer ARTS.

- Enhanced Standoff Munitions Disruption System (E-SMUD) – Sponsored in cooperation with the Office of Special Technology EOD Low Intensity Conflict Office, this effort is for EOD personnel of the Air Force and Marines. This research effort consists of integrating a Telepresent Rapid Aiming Platform (TRAP) from Precision Remotes to the ARTS platform to provide EOD personnel the remote capability of detonating, disrupting, or deflagrating small ordnance at safe distances, thereby taking the EOD technician out of harms way. This effort will provide two prototype systems, one for the USMC that incorporates the Barrett .50 caliber and 7.62 mm Designated Marksmanship Rifle (DMR) and another to the USAF with the Barrett .50 caliber and 5.56 mm rifles. These systems provide remote capability to bring to bear 7.62mm or 0.50 caliber rifle against surface scatterable munitions. Integrating visual optics and current pan/tilt technology, this technology removes the EOD technician out-of-harms way to perform clearance of high threat submunitions currently being validated on CONUS ranges while practice for wartime clearance procedures. A low cost laboratory demonstrator version of an AR-10, 7.62mm rifle has been developed and limited testing performed. Transition planned late FY 2004. Tele-operated Remote Aiming Platform: TRAP is a future $P^3I$ effort that is contained in the CE Readiness Modernization Roadmap and is scheduled to undergo system design and development (SDD) in FY2004 with production to follow in FY2005. Accomplishments include demonstration of a radio controlled TRAP system. Main activity includes not only hardware interface but JAUS compatible weapons message set.
- Robo-Trencher – US Air Force 738 EIS Initiative to provide a standoff capability to perform cable trenching and excavation in hazardous areas. The system need was prompted by 2 separate UXO incidents with manned equipment. Accomplishments included design, build, testing, and delivery of the Robo-Trencher in 90 Days. The integration of production ARTS robotic components to an existing 738$^{th}$ EIS Ditch Witch 7610 Trenching Tractor demonstrated the feasibility of using ARTS robotics system as a robotic kit. The system is currently deployed to support Operation Enduring Freedom. User has requesting conversion of three more systems including potential spiral development for increased capabilities. Currently, AFRL is assisting with development of one additional unit to be delivered in FY 2005.
- Automated Ordnance Excavator (AOE) – This research effort is to develop technologies that can be integrated into an autonomous excavator. To accomplish this goal, technologies must be developed that address the essential mission elements. The development path for this technology is a four-step process: 1. automated digging, 2. independent boom/stick motion, 3. independent machine mobility, and 4. independent work planning and analysis. A contract has been awarded to Caterpillar, Inc. to develop the 1$^{st}$ stage technology, an Auto-dig Mission Planning Module (AMPM) for the AOE. The AMPM is a JAUS compatible electronics module that will take telemetry data from the AOE, process the data to calculate the boom, stick, and bucket motion paths, and return the motion commands to the AOE for execution. Future efforts will concentrate on the completion of stage 2-4 technologies. Accomplishments for this effort include approximately 95% completion of the auto dig mission planning module and hardware upgrade of the AOE.
- J-LONS (Joint Laser Ordnance Neutralization System) – This effort is to develop and validate a remotely operated modular laser system for standoff UXO/IED neutralization capability. Laser technology has been identified as a viable method of clearing areas clear of UXO by rapidly heating the explosive filler to point of detonation. It may also prove to be a method to gain access and disposal to IEDs. Accomplishments include oversight on the international program partner's development of a low power laser system. Due to a slow down in the international program, plans to begin integration of J-LONS onto a mobile unmanned platform are expected in the FY05-06 time frame.

- Advanced Robotics System – The primary effort is to develop common architecture designs for autonomous vehicle technologies that focus on vehicle mobility, speed, and control, as well as multi-vehicle operations and marsupial control. This program seeks to develop and document these modular designs within the evolving JAUS Standards. Specifically the program addresses: (1) vehicle position; (2) sensors; (3) path planning; (4) path execution; (5) vehicle control, and (6) obstacle detection and avoidance. Multi-vehicle and marsupial control technologies will be developed. Technologies being investigated are position/mapping (GPS/INS, Dual antenna GPS, dead-reckoning), Advanced Operator Control Unit (laptop/PDA), obstacle detection and avoidance, mobile communications (droppable repeaters) and support for the OSD Joint Architecture for Unmanned Systems (JAUS).
  Accomplishments include support to the JAUS community, obstacle detection and avoidance simulation, sensor fusion for obstacle detection, and high speed assisted tele-operation algorithm development. Demonstrated JAUS concepts by controlling multiple robotic systems using a single operator control station.
- REDCAR (Remote Detection Challenge and Response system) – REDCAR is an Air Force, Force Protection Battlelab (AFFB) Initiative to demonstrate the benefits of unmanned systems for the security force mission. The program focuses on the application of mobile unmanned ground systems to support and augment security force personnel in the perimeter defense of Air Force installations and forward deployed units. The AFRL REDCAR system will consist of a network of robotic platforms integrated with existing security force sensors and Tactical, Area Security System (TASS). The REDCAR system will have limited simulation and modeling capabilities to interact with the current AFFPB modeling systems. All components and platforms in the REDCAR system will be capable of communication using JAUS (Joint Architecture for Unmanned Systems) for system interoperability and control. Proof of concept demonstration was conducted in June FY 2004. Accomplishments include development and demonstration of the Scout robotic platform at the Force Protection Battlelab exposition for AF/XOF.
- UAV-UGV – This program includes: (1) the development of a dual JAUS / NATO STANAGS-compliant UAV to evaluate JAUS viability in the UAV realm, (2) insertion of Aerial Imagery into OCU for map/model building and situational awareness, aerial Communications Relay to extend the radio range of UGVs, (3) precision UGV marsupial emplacement and recovery using a rotary-wing UAV, and (4) an unmanned helicopter to provide aerial pesticide spraying to mitigate vector-borne disease in deployed operations. Accomplishments included the demonstration of the rotary-wing UAV, training, and transfer of aerial video through JAUS networked system. Accomplishments include application of rotary-wing UAV to the Remotely Controlled Aerial Vehicle for Application of Pesticide (RCAVAP) project.
- Active Range Clearance – The US Army Engineering and Support Center (USAESCH) in Huntsville, Alabama continues its interest in active range clearance. In FY 2004, the center requested AFRL/MLQF Robotics Group to a design and build of a system to remotely pick up range scrap. Accomplishments include preliminary design of a system.
- BomBot – This FY 2004/2005 program investigates low-cost remotely controlled vehicle to deliver an explosive charge to neutralize an Improvised Explosive Device (IED). This will enable a convoy to expediently destroy IEDs remotely through utilization of two alternatives: Non-Recoverable, Recoverable: Non-Recoverable model will be destroyed with the charge and the recoverable model will drop off charge, and then be driven back to the control point. Vehicle is operated using line-of-sight communications. Accomplishments include shipping 4 prototype units to the Marines in Camp Lejeune, 2 prototypes to USMC in Haiti, 5 prototypes to support USAF in Iraqi Freedom, and forming a working group to prioritize requirements for a small low cost robotic system for EOD.

**C. Other Program Funding Summary:**
Not Applicable

**D. Acquisition Strategy:**
Technology transition plans (TTPs) are developed when concept demonstration phases begin. The TTP identifies how and when the technology will transfer from AFRL/MLQ to AAC/YBS (or some other EMD/fielding office). This is the same for every initiative under development. The primary user (typically Air Combat Command) allocates AF POM funding in anticipation/coordination of the TTP for transition to 6.4 and production dollars. Some projects are leveraged with other sponsoring agencies (e.g. Technical Support Working Group) that have their own technology transition office that offers a secondary avenue for an acquisition strategy to reach other federal agencies. A third strategy involves the documentation and drawings that can be offered to industry as a build-to-print option as was the case with the All-purpose Remote Transport System

**E. Major Performers:**
Not Applicable

| **Exhibit R-3 Cost Analysis (page 1)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | RACS | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| Primary Hardware Development | | | | 0.530 | | 0.100 | | 0.300 | | | | |
| Ancilliary Hardware Development | | | | 0.320 | | 0.100 | | 0.300 | | | | |
| Systems Engineering | | | | 0.320 | | 0.100 | | 0.300 | | | | |
| Licenses | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Award Fees | | | | 0.130 | | | | 0.053 | | | | |
| Subtotal Product Development | | | | 1.300 | | 0.300 | | 0.953 | | | | |
| Remarks: | | | | | | | | | | | | |
| Development Support | | | | 0.230 | | 0.100 | | 0.100 | | | | |
| Software Development | | | | 0.230 | | 0.100 | | 0.100 | | | | |
| Training Development | | | | 0.100 | | | | | | | | |
| Integrated Logistics Support | | | | | | | | | | | | |
| Configuration Management | | | | | | | | | | | | |
| Technical Data | | | | 0.220 | | 0.100 | | 0.110 | | | | |
| GFE | | | | | | | | | | | | |
| Subtotal Support | | | | 0.780 | | 0.300 | | 0.310 | | | | |
| Remarks: | | | | | | | | | | | | |

| **Exhibit R-3 Cost Analysis (page 2)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | | Program Element<br>PE 0603709D8Z | | | | RACS | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| DT | | | | 0.449 | | 0.310 | | 0.300 | | | | |
| IOT&E | | | | | | | | | | | | |
| Initial Verification Testing | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Subtotal T&E | | | | 0.449 | | 0.310 | | 0.300 | | | | |
| Remarks: | | | | | | | | | | | | |
| Contractor Engineering Support | | | | 0.110 | | 0.170 | | 0.170 | | | | |
| Government Engineering Support | | | | 0.300 | | 0.100 | | 0.400 | | | | |
| Program Management Support | | | | 0.520 | | 0.050 | | 0.344 | | | | |
| Program Management Personnel | | | | 0.380 | | 0.050 | | 0.375 | | | | |
| Travel | | | | 0.380 | | 0.141 | | 0.400 | | | | |
| Labor (Research Personnel) | | | | 0.180 | | 0.190 | | 0.190 | | | | |
| Miscellaneous | | | | 0.180 | | 0.189 | | 0.172 | | | | |
| Subtotal Management | | | | 2.060 | | 0.890 | | 2.051 | | | | |
| Remarks: | | | | | | | | | | | | |
| Total Cost | | | | 4.579 | | 1.800 | | 3.614 | | | | |
| Remarks: | | | | | | | | | | | | |

| Exhibit R-4, Schedule Profile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date: February 2005 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | | | | | | | | | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | | | | | | | | | | | | | | | Project Number and Name<br>RACS – Advancements for ARTS | | | | | | | | | | | | | | |
| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Acquisition Milestones | | | MS B | | | | MS A | | | | MS B | | | | MS A | | MS C | | | | | | | MS C | | | | | | | | | | | | | |
| Prototype Phase | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| User Evaluation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EMD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

Main Programs in Advancements for ARTS

- Remote Water Cutting System
- Alternate Control System
- Deployed Nozzle
- Articulated Remote Manipulation System

| Exhibit R-4a, Schedule Detail | | | | | | | | Date: February 2005 |
|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E BA #4 | Program Element Number and Name<br>PE 0603709D8Z Joint Robotics Program | | | | Project Number and Name<br>RACS – Advancements for ARTS | | | |
| Schedule Profile | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 |
| Concept Design | | | | | | | | |
| Hardware Procurement | | | | | | | | |
| Quality Design and Build | | | | | | | | |
| Developmental (PD&RR) Technical Testing | | | | | | | | |
| Transition to System Program Office | 4Q | | 4Q | | | | | |
| Developmental (User) Evaluation | 4Q | | 3Q | | | | | |
| EMD | | | 4Q | | | 4Q | | |
| Production | | | | | 1Q | | | |

Main Programs in Advancements for ARTS

- Remote Water Cutting System
- Alternate Control System
- Deployed Nozzle
- Articulated Remote Manipulation System

| **Exhibit R-4, Schedule Profile** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Date: February 2005 | |
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | | | | | | | | | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | | | | | | | | | | | | | | | | | | | Project Number and Name<br>RACS – Active Range Clearance | | | | |
| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Acquisition Milestones | | | | | | | | | | ▲<br>MS A | | | | | | | | | ▲<br>MS B | | | | | | | | | | | | | ▲<br>MS C | | | | | | |
| Prototype Phase | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| User Evaluation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EMD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

Main Programs within Active Range Clearance

- Automated Ordnance Excavator
- Remote Standoff Munitions Disruption System
- Charge Setting System
- Joint Laser Ordnance Neutralization System
- Power Rake

| Exhibit R-4a, Schedule Detail | | | | | | | | Date: February 2005 |
|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E BA #4 | Program Element Number and Name<br>PE 0603709D8Z Joint Robotics Program | | | | Project Number and Name<br>RACS – Active Range Clearance | | | |
| Schedule Profile | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2010 |
| Concept Design | 1Q | | | | | | | |
| Hardware Procurement | 2Q | | | | | | | |
| Quality Design and Build | | 3Q | | | | | | |
| Developmental (PD&RR) Technical Testing | | 4Q | | | | | | |
| Transition to System Program Office | | | 2Q | | | | | |
| Developmental (User) Evaluation | | | 3Q | | | | | |
| EMD | | | | | 3Q | | | |
| Production | | | | | | 3Q | | |

R-4a Schedule Profile

Main Programs within Active Range Clearance

- Automated Ordnance Excavator
- Remote Standoff Munitions Disruption System
- Charge Setting System
- Joint Laser Ordnance Neutralization System
- Power Rake

| Exhibit R-4, Schedule Profile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | | | | | | | | | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | | | | | | | | | | | | | | | | | | | Project Number and Name<br>RACS – Advanced Robotics Systems | | | | | | | |
| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Acquisition Milestones | | | | | | | | | | MS A | | | | | | | | | | | | | | MS B | | | | | | | | | | | | | |
| Prototype Phase | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EMD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

Main Programs include

- Advanced Navigation capabilities
- Object Detection/Avoidance
- Multi-vehicle control
- Marsupial Control
- Path Planning/Execution
- JAUS Compliance, Testing, and Evaluation

| Exhibit R-4a, Schedule Detail | | Date: February 2005 |
|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E BA #4 | Program Element Number and Name<br>PE 0603709D8Z Joint Robotics Program | Project Number and Name<br>RACS – Advanced Robotics Systems |

| Schedule Profile | FY 2002 | FY 2003 | FY2004 | FY2005 | FY2006 | FY2007 | FY2008 | FY2009 |
|---|---|---|---|---|---|---|---|---|
| Concept Design | | | | | | | | |
| Hardware Procurement | | 1Q | | | | | | |
| Quality Design and Build | | | | 1Q | | | | |
| Developmental (PD&RR) Technical Testing | | | | | | 1Q | | |
| Transition to System Program Office | | | | | | | 1Q | |
| EMD | | | | | | | 1Q | |
| Production | | | | | | | | |

R-4a Schedule Profile

Main Programs include

- Advanced Navigation capabilities
- Object Detection/Avoidance
- Multi-vehicle control

Marsupial Control

- Path Planning/Execution
- JAUS Compliance, Testing, and Evaluation

| Exhibit R-4, Schedule Profile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date: February 2005 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | | | | | | | | | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | | | | | | | | | | | | | | | | | | | Project Number and Name<br>RACS – NGEODRCV | | | | | | | |
| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Acquisition Milestones | | | | | | | | | | | | | | | | | | | | MS B | | | | | | | | MS C | | | | | | | | |
| Proto. Phase Evolutionary Development | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EMD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production/ Authorization | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

| **Exhibit R-4a, Schedule Detail** | | Date: February 2005 |
|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E BA #4 | Program Element Number and Name<br>PE 0603709D8Z Joint Robotics Program | Project Number and Name<br>RACS – Next Generation Explosive Ordnance Disposal Remote Control Vehicle (NGEODRCV) |

| Schedule Profile | FY 2002 | FY 2003 | FY2004 | FY2005 | FY2006 | FY2007 | FY2008 | FY2009 |
|---|---|---|---|---|---|---|---|---|
| Concept Design | 1Q | | | | | | | |
| Hardware Procurement | | 1Q | | | | | | |
| Quality Design and Build | | | 1Q | | | | | |
| Developmental (PD&RR) Technical Testing | | | | 1Q | | | | |
| Transition to System Program Office | | | | | 4Q | | | |
| EMD | | | | | | 1Q | | |
| Production | | | | | | | | |

R-4a Schedule Profile

| **Exhibit R-4, Schedule Profile** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Date: February 2005 | |
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | | | | | | | | | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | | | | | | | | | | | | | | | | | | | Project Number and Name<br>RACS – Force Protection Robotics | | | | | | | |
| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Acquisition Milestones | | | | | | | | | | | | | | | MS A | | | | | | | | | | MS B | | | | | | | | | | | |
| Prototype Phase | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EMD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

Main Programs include

REDCAR
DTRA
STORK

| Exhibit R-4a, Schedule Detail | | | | | | | | | Date: February 2005 |
|---|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E BA #4 | Program Element Number and Name<br>PE 0603709D8Z Joint Robotics Program | | | | Project Number and Name<br>RACS – Force Protection Robotics | | | | |
| Schedule Profile | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | |
| Concept Design | 1Q | | | | | | | | |
| Hardware Procurement | | 3Q | | | | | | | |
| Quality Design and Build | | 4Q | | | | | | | |
| Developmental (PD&RR) Technical Testing | 4Q | | 1Q | | | | | | |
| Transition to System Program Office | | | | 4Q | | | | | |
| EMD | | | | | | 3Q | | | |
| Production | | | | | | | | | |

R-4a Schedule Profile

Main Programs include
REDCAR
DTRA
STORK

| Exhibit R-2a, RDT&E Budget Item Justification | | | | | | | Date: February 2005 | |
|---|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM | | | PE 0603709D8Z | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
| COTS | 2.000 | 0.500 | 0.200 | 0.200 | 0.000 | 0.000 | 0.000 | 0.000 |

**A. Mission Description and Budget Item Justification:**

The purpose of the Commercial-off-the-Shelf (COTS) program is to create and maintain a pool of small, mobile robots that will be made available on loan to government agencies, laboratories and universities. The goal of COTS is to assist agencies in defining their requirements, modifying their operational practices, and to make more appropriate acquisitions of unmanned systems. The robots that populate the pool will be COTS systems currently available from several manufacturers. The evaluations and experiments conducted with COTS robots will provide valuable feedback for future small robot developments. In requesting the loan of small robots from COTS, priority will go to Department of Defense, Homeland Security, and Emergency Response users. Where appropriate, COTS systems will be supplemented with unique developmental technologies to address emerging operational and programmatic requirements, for example, extensions to COTS systems in support of OEF/OIF. The COTS robot pool is also a source of contingency assets for operational (war time) needs - in FY 2004, over 20 small robots were supplied to Explosives Ordnance Disposal teams deployed to Iraq for the removal of Improvised Explosive Devices.

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 2.000 | | | |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2004 Accomplishments:

- Procured over 20 man portable robotic systems for use by Explosives Ordnance Disposal (EOD) teams in Iraq for discovery and examination of Improvised Explosive Devices (IED).
- Provided U.S. Navy Reserve forces to Robotic Systems Joint Project Office for deployment to Iraq as part of robot maintenance team under SKISKY effort.
- Provided training to USMC/Navy EOD Technicians in the use of man portable robots for IED inspection and disposal.
- Transitioned chemical/radiation/gas sensor systems to commercial partner (iRobot) for production and deployment on robotic systems deployed to Iraq.
- Developed a common Operator Control Unit (OCU) for use on a multitude of unmanned systems using OSD Joint Architecture for Unmanned Systems protocol.
- Developed/procured a small throwable robot prototype for use as a light-weight (IED) inspection device.

- Collected, organized, and posted user feedback to on-line website. Expanded on-line website to include collaborative data management tools for sharing lessons learned across GOVT agencies.
- Man portable robot loans made to over ten DoD, GOVT, and local/federal agencies.
- Supported research in the areas of unmanned systems radio communications, miniature stereo-based obstacle detection and avoidance, and command and control.

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | | 0.500 | 0.200 | 0.200 |
| RDT&E Articles Quantity * (as applicable) | | | | |

FY2005-2006 Plans:

- Procure off-the-shelf small robots for loan to government agencies, laboratories, and universities. Several configurations will be procured. Payloads that offer additional capabilities to address emerging threats/needs will be pursued.
- Support limited objective experiments, feasibility demonstrations, and concept exploration projects.
- Support requests for contingency assets where feasible.
- Support training and maintenance of assets in the field.
- Collection of performance data to provide feedback to developers for the improvement of COTS systems and technologies.
- Provide advice, maintenance, and training to the requesting agencies.
- Continue maintenance, upgrades, and support as required.

**C. Other Program Funding Summary:**
Not Applicable

**D. Acquisition Strategy:**
Not Applicable

**E. Major Performers:**
Not Applicable

| DEFENSE-WIDE | | | Program Element | | | | COTS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUDGET ACTIVITY 4 | | | PE 0603709D8Z | | | | | | | | | |
| Cost Categories (Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| COTS System Procurement | | | | 2.000 | | 0.300 | | | | | | |
| Ancilliary Hardware Development | | | | | | | | | | | | |
| Systems Engineering | | | | | | | | | | | | |
| Licenses | | | | | | | | | | | | |
| Tooling | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Award Fees | | | | | | | | | | | | |
| Subtotal Product Development | | | | 2.000 | | 0.300 | | 0.000 | | | | |
| Remarks: | | | | | | | | | | | | |
| Development Support | | | | | | | | | | | | |
| Software Development | | | | | | | | | | | | |
| Training Development | | | | | | | | | | | | |
| Integrated Logistics Support | | | | | | 0.200 | | 0.200 | | | | |
| Configuration Management | | | | | | | | | | | | |
| Technical Data | | | | | | | | | | | | |
| GFE | | | | | | | | | | | | |
| Subtotal Support | | | | 0.000 | | 0.200 | | 0.200 | | | | |
| Remarks: | | | | | | | | | | | | |

| **Exhibit R-3 Cost Analysis (page 2)** | | | | | | | Date: | February 2005 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFENSE-WIDE<br>BUDGET ACTIVITY 4 | | Program Element<br>PE 0603709D8Z | | | | | COTS | | | | | |
| Cost Categories<br>(Tailor to WBS, or System/Item Requirements) | Contract Method & Type | Performing Activity & Location | Total PYs Cost | 2004 Cost | 2004 Award Date | 2005 Cost | 2005 Award Date | 2006 Cost | 2006 Award Date | Cost To Complete | Total Cost | Target Value of Contract |
| DT | | | | | | | | | | | | |
| IOT&E | | | | | | | | | | | | |
| Initial Verification Testing | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Subtotal T&E | | | | 0.000 | | 0.000 | | 0.000 | | | | |
| Remarks: | | | | | | | | | | | | |
| Contractor Engineering Support | | | | | | | | | | | | |
| Government Engineering Support | | | | | | | | | | | | |
| Program Management Support | | | | | | | | | | | | |
| Program Management Personnel | | | | | | | | | | | | |
| Travel | | | | | | | | | | | | |
| Labor (Research Personnel) | | | | | | | | | | | | |
| Miscellaneous | | | | | | | | | | | | |
| Subtotal Management | | | | 0.000 | | 0.000 | | 0.000 | | | | |
| Remarks: | | | | | | | | | | | | |

| Exhibit R-4, Schedule Profile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Date: February 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | | | | | | | | | Program Element Number and Name<br>PE 0603709D8Z – Joint Robotics Program | | | | | | | | | | | | | | | | | | | | | | | | Project Number and Name<br>COTS |
| Fiscal Year | 2002 | | | | 2003 | | | | 2004 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Procure COTS Systems | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Perform Maintenance, Training Support & Upgrades | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

R-4 Schedule Profile

| Exhibit R-4a, Schedule Detail | | | | | | | | Date: February 2005 |
|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>DEFENSE WIDE RDT&E/B.A. #4 | Program Element Number and Name<br>PE 0603709DZ Joint Robotics Program | | | | Project Number and Name<br>COTS | | | |
| | FY 2002 | FY 2003 | FY2004 | FY2005 | FY2006 | FY2007 | FY2008 | FY2009 |
| Procure COTS Systems | | | 1-4Q | | | | | |
| Maintenance, Training, Support | | | Cont. | Cont. | Cont. | Cont. | | |

R-4a Schedule Profile

| Exhibit R-2a, RDT&E Budget Item Justification | | | | Date: February 2005 | | | |
|---|---|---|---|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>DEFENSE WIDE RDT&E BA 4 | | | | R-1 ITEM NOMENCLATURE<br>JOINT ROBOTICS PROGRAM PE 0603709D8Z | | | |
| COST ($ in millions) | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 |
| CEE | 0.000 | 2.800 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**A. Mission Description and Budget Item Justification:**

The Autonomous UAV Mission System (AUMS) project and the Collaborative Engagement Experiment (CEE) support the JRP's goal of furthering UGV-UAV collaboration by providing compatible hardware and software interfaces for UAVs and UGVs. The AUMS project is developing a launch/landing/refueling system for Class I/II VTOL UAVs. The AUMS project is developing command and control software for controlling the AUMS hardware and for coordination of the VTOL UAV assets. The AUMS project is also using GPS and vision technologies to develop a precision landing system for use with a UGV. SPAWAR Systems Center San Diego is working with AMRDEC and AFRL to demonstrate UGV-UAV collaboration technologies midway through FY 2006. This demonstration will be part of the CEE program. Lessons learned from this and other CEE experiments will enable advancements in UGV-UAV collaboration and provide value to the warfighter.

**B. Accomplishments/Planned Program**

| | FY 2004 | FY 2005 | FY 2006 |
|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 0.000 | 2.800 | 0.000 |
| RDT&E Articles Quantity * (as applicable) | | | |

Accomplishments for FY2004 include:

- Developed a second generation automated launch/landing/refueling pad for Class I/II UAV’s.
- Developed automated refueling system for UAV launch/landing pad.
- Explored vision/GPS technologies for precision landing system.
- Demonstrated AUMS to the JRP in December 2003.

| | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|
| Accomplishment/Effort/Subtotal Cost | 2.800 | 0.000 | 0.000 |
| RDT&E Articles Quantity * (as applicable) | | | |

Plans for FY2005-2006 include:

- Integrate and test precision landing technologies on VTOL UAVS.

- Complete design of launch/landing/refueling pad to work with several VTOL UAV platforms including the Allied Aerospace iSTAR and small helicopter UAVs.
- Participate in UAV-UGV Collaboration experiments with other JRP organizations including AMRDEC and AFRL.

**C. Other Program Funding Summary:**
Not Applicable

**D. Acquisition Strategy:**
Technologies are transitioned to other government programs or to industry as they become available or are requested.

**E. Major Performers:**
Not Applicable