OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 4	**0603709D8Z - Joint Robotics Program**

Cost ($ in Millions)		FY 2006 Actual	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Total Program Element (PE) Cost		30.688	22.978	11.860	11.867	12.119	12.389	12.711	13.041
P709	Joint Ground Robotics Enterprise (JGRE) ACD&P	30.688	22.978	11.860	11.867	12.119	12.389	12.711	13.041

A. Mission Description and Budget Item Justification: (U) This Program Element (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. Technologies in the PE support the continued development of technologies in Budget Activity 3 (PE 0603711D8Z) to continue to make technology transition and transformation for closing the warfighter requirement to capability gap. The program ensures coordination between the Services and places emphasis on interoperability and commonality among unmanned ground systems. This PE continues the effort to overcome technology barriers in the thrust areas of unmanned ground system technologies to include Autonomous & Tactical Behaviors, Manipulation Technologies, Collaborative Operations, Interoperability, Man-portable Unmanned Ground System Technologies, and Technology Transition/Transformation. The purpose is to further the fielding of 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. This PE supports the need to integrate technologies into representative models or prototype systems in a high fidelity and realistic operating environment and expedite technology transition from the laboratory to operational use. Emphasis is on proving component and subsystem maturity prior to integration in major and complex systems and may involve risk reduction initiatives. Within this PE, funded projects will continue the delivery of responses to advanced technology needs directed at enhancing the warfighter's capabilities identified during concept development, operational assessments and field feedback of current unmanned systems.

B. Program Change Summary	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	27.264	12.210	12.219	12.300
Current BES/President's Budget (FY 2008/2009)	30.688	22.978	11.860	11.867
Total Adjustments	3.424	10.768	-0.359	-0.433
Congressional Program Reductions				
Congressional Rescissions				
Congressional Increases	4.200	10.900		
Reprogrammings				
SBIR/STTR Transfer	-0.776			
Other		-0.132	-0.359	-0.433

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C. Other Program Funding Summary: Not Applicable.

D. Acquisition Strategy: Not Applicable.

E. Performance Metrics:

FY	Strategic Goals Supported	Existing Baseline	Planned Performance Improvement / Requirement Goal	Actual Performance Improvement	Planned Performance Metric / Methods of Measurement	Actual Performance Metric / Methods of Measurement
08						

Comment: Metrics for the Joint Ground Robotics Enterprise (JGRE) funded RDT&E are articulated in individual project plans used to form the basis of funding justification and program assessment. These decisions are supported by the JGRE Technology Advisory Board (TAB). The TAB provides technology to capability matrix assessments to inform funding decisions, provide inputs to unmanned system (UMS) roadmaps and ensure technology transitions. In all document sets, project descriptions include task schedules with associated milestones, against which progress toward end goals can be measured. At the level of the performer, efforts are tracked using project technical and management milestones that have been appropriately defined and agreed upon in the project plans. At the enterprise level, the JGRE management structure and process tracks deliverables and examines the transition of technologies and ideas from the performer to DoD programs. The JGRE management structure and process includes a mid-year in progress review (IPR), annual funding justification and prioritization, technology assessments, a senior Military Council and a Senior Steering Group (SSG) overview. These DoD participant reviews include cost, schedule and technical progress assessment against the project milestones. Metric evaluations for the funded actions include, where appropriate, controlled trials, demonstrations, quasi-experimental evaluations, and direct/indirect analysis.

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Cost ($ in Millions)		FY 2006 Actual	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
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B. Accomplishments/Planned Program:

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
(U) Autonomous & Tactical Behaviors	4.869	2.840	2.051	1.892

FY 2006 Accomplishments:
- Refined, maintained for and began transition of documentation for Joint Architecture for Unmanned Systems (JAUS) to a Society of Automotive Engineers (SAE) standard.
- Maintained and refined JAUS Compliance Tools Suite.
- Integrated JAUS into Simulation Systems for experimentation/validation.
- Demonstrated and validated support for network-based systems.
- Demonstrated and validated support for all unmanned system types.
- Revised the Under Vehicle Mobile Inspection/Search Unmanned Ground Vehicle (Omni-Directional Inspection System - ODIS) platform design to include changes suggested from testing and user input in theater.
- Initiated Mission Essential Modules Integration program (under Commercial off-the-shelf)
- Producing second-generation Automatically Deployable Communications Relays (ADCR) systems.
- Completed ADCR Deployed system; Finalized design and perform electrical and mechanical testing.

FY 2007, 2008 and 2009 Plans: Support the development of vehicle onboard intelligence and tactical behaviors to allow the fielding of advanced autonomous unmanned systems. Baseline user identified

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mission scenarios to develop operational behaviors enabling unmanned operations within the conduct of mission tasks. Increase the warfighter's capability by transferring and developing technologies that will have an immediate impact on the autonomy and functional capabilities of current and future robotic systems. Enable transitioning of technologies appropriate for small robots from the technology transfer program to fielded systems.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
(U) Manipulation Technologies	2.984	1.935	0.780	0.741

FY 2006 Accomplishments:
- Supported development via the Joint Architecture for Unmanned Systems (JAUS) development process.
- Revised the Under Vehicle Mobile Inspection/Search Unmanned Ground Vehicle (Omni-Directional Inspection System (ODIS) platform design to include changes suggested from testing and user input in theater.
- Continued development of prototype ODIS platform variants based on user requests and inputs.
- For field use and development purposes, procured off-the-shelf small robots for loan to government agencies, laboratories, and universities for the purpose of accelerating the spiral development process, more quickly improving future robotic platforms for the joint warfighter.
- Supported limited objective experiments, feasibility demonstrations, and concept exploration projects.
- Continued robotic payload development.

FY 2007, 2008 and 2009 Plans: Incorporate existing technologies into systems representative to those in use, demonstrate ease of robotic manipulation, support the development of mobile manipulation, expedite the transition and integration of corresponding robotic technologies to enhance the current fielded systems with more functionalities, autonomy and state-of-the-art behavior with interface methods from the RTD&E environment.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
(U) Collaborative Operations	5.379	5.256	2.190	2.034

FY 2006 Accomplishments:
- Refined, maintained for and began transition of documentation for Joint Architecture for Unmanned Systems (JAUS) to a Society of Automotive Engineers (SAE) standard.
- Demonstrated and validated support for network-based systems.
- Demonstrate and validate support for all unmanned system types.
- Integrated JAUS into Simulation Systems for experimentation/validation.
- Initiated efforts to determine and identify Mission Essential Modules to improve COTS system multi-mission capability.

FY 2007, 2008 and 2009 Plans: Integrate communication, mission planning, interface technologies, and advanced intelligence capabilities to support collaborative operations between manned and unmanned systems. Develop and assess several strategies to enhance tele-operation of current UGVs and collaborative UAV teams. Collaborative and tactical behaviors include system convoying, teamed obstacle avoidance, area perception and relative position information sharing.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
(U) Interoperability	5.234	4.897	3.075	3.008

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FY 2006 Accomplishments:
- Refined, maintained for and began transition of documentation for Joint Architecture for Unmanned Systems (JAUS) to a Society of Automotive Engineers (SAE) standard.
- Developed interface for Net-Centric systems for mission level data.
- Completed first version of the compliance tool suite (JAUS).
- Began Risk Reduction effort for USMC Gladiator program.
- Initiated redesign of the Compact Ad Hoc Networking Radio (CANR) card for dual military/commercial frequencies.
- Initiated implementation plan for rigorous network security protocols.
- Under the Automatically Deployable Communications Relays (ADCR) effort, performed final testing on complete system (deployer and six relay bricks), targeted for a Man-Portable Robotic System (MPRS).

FY 2007, 2008 and 2009 Plans: Promote and guide technology development to meet joint requirements and promote ground as well as air unmanned systems interoperability. Support the bridging of currently incompatible robots and controllers from various manufacturers, using different communications channels and hardware. Optimize best features of prior/ongoing research efforts into a maturing, standardized system that can be easily ported to robotic platforms used DoD-wide.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
(U) Man-Portable Unmanned Ground System Technologies	6.582	4.286	2.108	2.476

FY 2006 Accomplishments:
- Initiated Next Generation Explosive Ordnance Disposal Remote Control Vehicle (NGEODRCV) Level Development.
- Began the transition of technologies from the NGEODRCV Project.
- Conducted Final Demonstrations and Approvals of Remote Ordnance Neutralization System (RONS) Continuous Improvement Program (CIP) Projects.
- Initiated EOD Cooperative Robotics Project.
- Under the Automatically Deployable Communications Relays (ADCR) effort, performed final testing on complete system (deployer and six relay bricks), targeted for a Man-Portable Robotic System (MPRS).
- Supported development, fielding and life cycle development of systems deployed for IED defeat missions.

FY 2007, 2008 and 2009 Plans: Increase the warfighter's capability by transferring and developing technologies that will have an immediate impact on the functional capabilities of man-portable robotic systems. Enable transitioning of technologies appropriate for small robots from the technology transfer program to fielded systems. Specific technologies include obstacle detection/obstacle avoidance (ODOA) and collaborative behaviors for small vehicles.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
(U) Technology Transition/Transformation	5.640	3.764	1.656	1.716

FY 2006 Accomplishments:
- Transition Technologies from the NGEODRCV Project
- Integrated University of Michigan's gyro-enhanced dead reckoning.
- Refined optimization of Simultaneous Localization and Mapping (SLAM) capabilities for outdoor applications in GPS-denied areas.
- Integrated thermal vision tracking with ladar-based intruder detection algorithm for enhanced human presence detection.

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- Accomplished Type Classification testing for Robotic Combat Support System (RCSS) Program.
- Continued to support fielding and support of RCSS COTS systems to War on Terrorism forces.
- Provided support to determine and identify Mission Essential Modules to improve COTS system multi-mission capability.
- Refined, maintained for and began transition of documentation for Joint Architecture for Unmanned Systems (JAUS) to a Society of Automotive Engineers (SAE) standard.
- Under Automated Perimeter Security (APS), developed additional scout capabilities and performed a 30 day experiment at Air Force base.
- Integrated additional JAUS-compatible sensor modules to scout platforms.
- Incorporated UAV aerial video ordnance discrimination capabilities integrated into standoff munitions disruption (SMUD) capabilities.
- Under Active Range Clearance, planned integrated experiment of ground and aerial platforms, continued development of automated ground targeting system and continued development of image feature extraction algorithms for UXO detection.

FY 2007, 2008 and 2009 Plans: Facilitate integration of and ensure the ultimate transfer or transformation of technologies to ongoing programs. Exploit the best features of past and on-going efforts while supporting the development of technologies that have low risk to transition. Technologies of interest include: Interface Technologies (Human Robot Interaction), Autonomous Operations (Information Fusion, Perception, and Navigation), Autonomous Technologies (Positioning), and Platform Technologies.

C. Other Program Funding Summary	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	To Compl	Total Cost
PE 0603711D8Z (BA3) Joint Robotics/Autonomous Systems	0.000	7.700	11.256	14.202	14.626	14.825	15.019	15.231	0.000	92.859
PE 0604709D8Z (BA5) Joint Ground Robotics Enterprise (JGRE) SDD	20.795	6.004	2.911	0.000	0.000	0.000	0.000	0.000	0.000	29.710

Comment:

D. Acquisition Strategy The Joint Ground Robotics Enterprise (JGRE) utilizes several contracting strategies to achieve its program objectives. JGR has established relationships with the several agencies to include the National Center for Defense Robotics to support the rapid acquisition and evaluation of promising unmanned system technologies. Funding is provided to Joint Service lab partners and other developers to promote common technology solutions across platforms and Services.

E. Major Performers

Category	Name	Location	Type of Work and Description	Award Date
Labs				
	Air Force Research Laboratory (AFRL)	Tyndall AFB, FL	Program Management	

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	AMRDEC	Redstone Arsenal, AL	Program Management. U.S. Army Aviation and Missile Research, Engineering, and Development Center (AMRDEC).	
	TARDEC	Detroit, MI	Program Management. U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC).	
Contractors				
	National Center for Defense Robotics (NCDR)	Pittsburg, PA	Program Management.	
Others				
	Program Manager Force Protection Systems (PM FPS)	Fort Belvoir, VA	Program Management.	
	Naval Explosive Ordnance Disposal Technology Div	Indian Head, MD	OSD Executive Agent for joint service EOD R&D. Program Management. Naval Explosive Ordnance Disposal Technology Division (NAVEODTECH).	
	Robotic Systems Joint Project Office (RS JPO)	Redstone Arsenal, AL	Joint Office Program Management.	
	SPAWAR	San Diego, CA	Program Management. Space and Naval Warfare [SPAWAR] Systems Center, San Diego (SSC San Diego).	

OSD RDT&E COST ANALYSIS (R3)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY
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I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2007 Cost	FY 2007 Award Date	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Idaho National Lab			680	0		0		0		0	680	0
Air Force			5570	5500	1-4Q	0		0		0	11070	0
Navy			3845	11609	1-4Q	0		0		0	15454	0
Army			0	4270	1-4Q	0		0		0	4270	0
Subtotal:			10095	21379		0		0		0	31474	0

II. Support Costs	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2007 Cost	FY 2007 Award Date	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Program Support			20243	0		0		0		0	20243	0
Subtotal:			20243	0		0		0		0	20243	0

III. Test And Evaluation	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2007 Cost	FY 2007 Award Date	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	Cost To Complete	Total Cost	Target Value of Contract
DT			500	0		0		0		0	0	0
IOT&E			0	0		0		0		0	0	0
Subtotal:			500	0		0		0		0	0	0

IV. Management Services	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2007 Cost	FY 2007 Award Date	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	Cost To Complete	Total Cost	Target Value of Contract

OSD RDT&E COST ANALYSIS (R3)

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JRP Program Management			350	1599	1-4Q	11860	1-4Q	11867	1-4Q	0	25676	0
Subtotal:			350	1599		11860		11867		0	25676	0
Project Total Cost:			**31188**	**22978**		**11860**		**11867**		**0**	**77393**	**0**

Schedule Profile (R4 Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY
RDT&E/ Defense Wide BA# 4

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0603709D8Z - Joint Robotics Program

PROJECT
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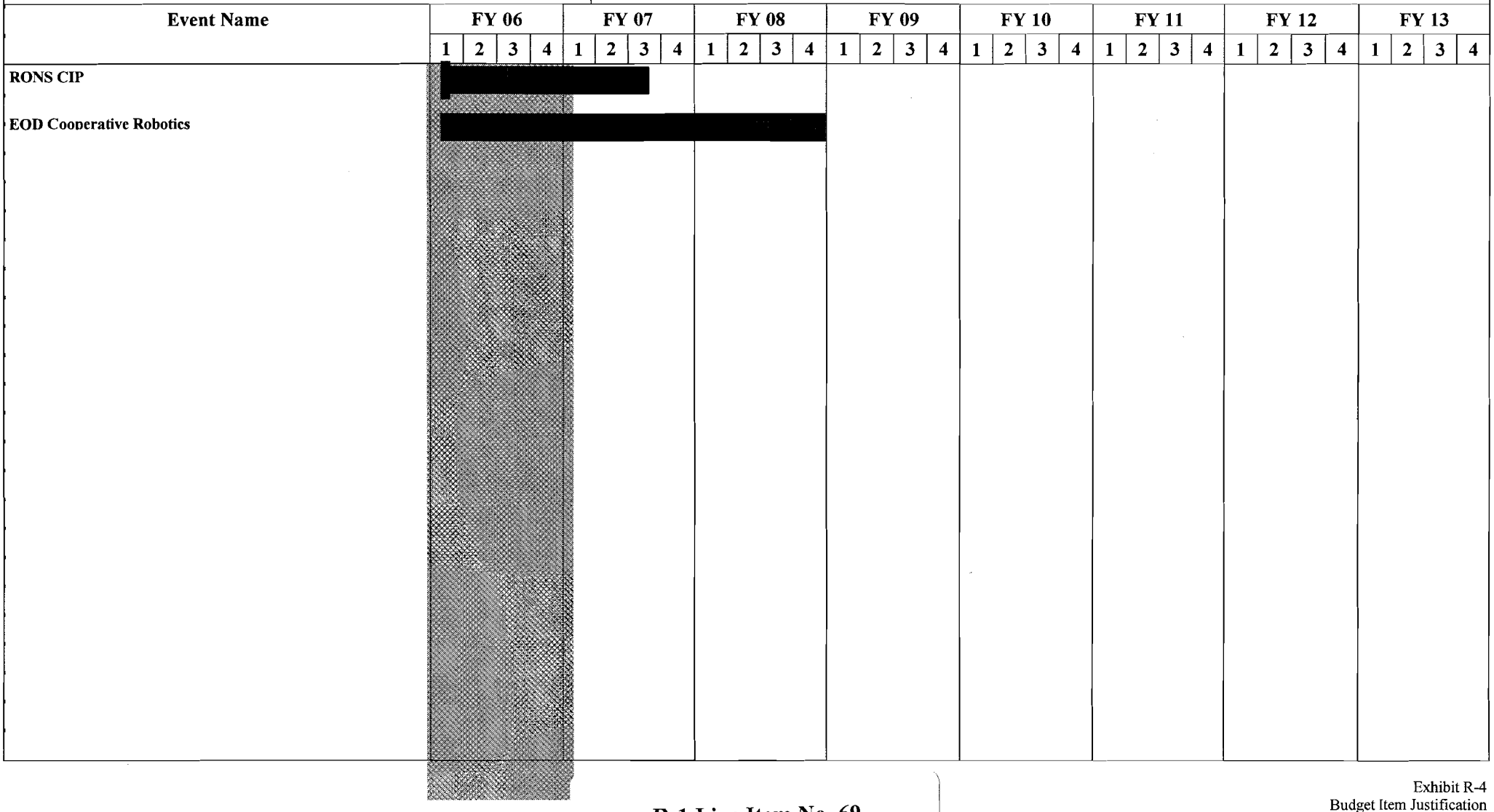

Schedule Detail (R4a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
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Schedule Detail	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
MTRS PSVM T&E	1-4Q	1-4Q	1-4Q					
MTRS PRM T&E	1-4Q	1-4Q	1-4Q					
MTRS AAP PROD DEC	1-4Q	1-4Q	1-4Q					
RONS CIP	1-4Q	1-3Q						
Next Gen EOD RCV	1-4Q	1-4Q	1-4Q	1-4Q				
EOD Cooperative Robotics	1-4Q	1-4Q	1-4Q	1-4Q				

Comment: