OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 5	**0604709D8Z - Joint Robotics EMD**

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	17.382	9.947	2.911	0.000	0.000	0.000	0.000	0.000
P609	Joint Ground Robotics Enterprise (JGRE) SDD	17.382	9.947	2.911	0.000	0.000	0.000	0.000	0.000

A. Mission Description and Budget Item Justification: (U) This Program Element (PE), 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 4 (PE 0603709D8Z) in order to continue to make technology transitions and transformations to close 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 vision of this support is for the Joint Ground Robotics Enterprise (JGRE) to support the development and 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. The 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 warfighters' 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)	20.464	6.004	3.004	0.000
Current BES/President's Budget (FY 2008/2009)	17.382	9.947	2.911	0.000
Total Adjustments	-3.082	3.943	-0.093	0.000
Congressional Program Reductions				
Congressional Rescissions	-2.500			
Congressional Increases		4.000		
Reprogrammings				
SBIR/STTR Transfer	-0.582			
Other		-0.057	-0.093	

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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
PE0603711D8Z (BA3) Joint Robotics Program/Autonomous Systems	0.000	7.700	11.256	14.202	14.626	14.825	15.020	15.231	0.000	92.860
PE 0603709D8Z (BA4) Joint Ground Robotics Enterprise (JGRE) ACD&P	27.264	12.210	11.860	11.867	12.119	12.389	12.711	13.041	0.000	113.461

Comment:

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

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
P609	Joint Ground Robotics Enterprise (JGRE) SDD	17.382	9.947	2.911	0.000	0.000	0.000	0.000	0.000

A. Mission Description and Project Justification: U) This Program Element (PE), 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 4 (PE 0603709D8Z)in order to continue to make technology transitions and transformations to close 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 vision of this support is for the Joint Ground Robotics Enterprise (JGRE) to support the development and 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. The 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 warfighters' capabilities identified during concept development, operational assessments and field feedback of current unmanned systems.

B. Accomplishments/Planned Program:

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
(U) Autonomous & Tactical Behaviors	2.572	1.475	0.573	0.000

FY2006 Accomplishments:
* Continued development of MDARS-Expeditionary as the Unmanned Ground Vehicle (UGV) for the Family of Rapid Response Equipment (FIRRE) - provide a semi-autonomous, high speed, cross-country, detection, persistent surveillance and response capability for forward deployed forces.
* MDARS-Expeditionary Capabilities Assessment
* Demonstrated UGV technology maturity for teleoperation, semi-autonomous operation and full autonomous operations for logistics support allowing unmanned on- and off-road reconnaissance, unmanned medical evacuations, or unmanned perimeter patrolling operations.
* Continued development of autonomous unmanned ground robotic vehicles via the 2006 Intelligent Ground Vehicle Competition (IGVC).
* Continued development of advanced mission planning and programming via Robotics for Agile Combat Support.
* Continued development and implementation of JAUS compliance - Integrate JAUS into Simulation Systems for experimentation/validation.

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 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

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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	1.407	1.492	0.364	0.000

FY2006 Accomplishments:
* Continued development of manipulation and navigation maturity via the 2006 IGVC.
* Continued development the Joint Architecture Unmanned System (JAUS) manipulator capability beyond core capabilities to advanced manipulation control support via Robotics for Agile Combat Support.
* Continued development of the Man Transportable Robotic System (MTRS) as an acquisition program of record (ACAT IV-M).
* Continued support for concept exploration and demo, "quick fix" priority for deployed systems, and ongoing technical and operational assessment for systems deployed and in spiral.
* 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	3.760	1.311	0.424	0.000

FY2006 Accomplishments:
* Continued development and implementation of JAUS as a set of standardized messages suitable for controlling all types of unmanned systems, and becoming an Aerospace Standard of the Society of Automotive Engineers (SAE) via the 2006 IGVC.
* Continued development of JAUS-based technologies for collaborative missions using semi-autonomous unmanned assets.
* Integrated JAUS into Simulation Systems for experimentation/validation.
* Demonstrated and validated support for all unmanned system types.

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	2.790	1.267	0.357	0.000

FY2006 Accomplishments:
* Continued JAUS compliance within projects such as Family of Rapid Response Equipment (FIRRE).
* Furthered the integration of future sensors and weapons.

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* Continued research and experimentation of unmanned vehicles, sensors, simulation, training, demonstration, and information distribution.
* Supported refinement of and transition of documentation for Joint Architecture for Unmanned Systems (JAUS) to a Society of Automotive Engineers (SAE) standard.
* Began Risk Reduction effort for USMC Gladiator program.
* Supported final testing on distributed communications system 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	2.855	2.127	0.353	0.000

FY2006 Accomplishments:
* Continued the Analysis of Alternatives (AoA) for a Next Generation EOD Robotic System (NGEODRS) acquisition program - operational effectiveness, suitability, and life-cycle cost of alternatives.
* Continued development of the Man Transportable Robotic System (MTRS) as a acquisition program of record (ACAT IV-M).
* Continued development and implementation of JAUS compliance.
* Supported development, fielding and life cycle development of systems deployed for IED defeat missions.
* Provided support to multiple joint acquisition programs, technology development and assessment programs, and COTS spiral fielding and assessment programs to support current military operations.
* Continued concept exploration and demo, "quick fix" priority for deployed systems, and continuing technical and operational assessment for systems deployed and in spiral.

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	3.998	2.275	0.840	0.000

FY2006 Accomplishments:
* Continued upgrades/improvements that focus on the capabilities of disruption, disposal, and render-safe procedures and nuclear, chemical, and biological agent detection.
* Supported the conduct of research to determine the feasibility of implementing robotics in military logistic systems and to explore potential applications for exploiting agile robotic technologies in military logistics.
* Supported continued development and implementation of JAUS compliance.
* Continued technology development and transition efforts within industry and academia for sensors, artificial intelligence, processors, and human/computer interaction, and defining a strategy for early research and development.
* Continued the establishing of criteria, guidelines, and content for robotics systems engineering education programs at the graduate and post graduate levels.
* Provided support to multiple joint acquisition programs, technology development and assessment programs, and COTS spiral fielding and assessment programs to support current military operations.
* Continued to support fielding and support of RCSS COTS systems to War on Terrorism forces.

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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
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E. Major Performers

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

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	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
RDT&E/ Defense Wide BA# 5

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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
Air Force			2368	4020	1-4Q	0		0		0	6388	0
Navy			1817	1390	1-4Q	0		0		0	3207	0
Army			1180	1464	1-4Q	0		0		0	2644	0
Subtotal:			5365	6874		0		0		0	12239	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
JRP Program Support			10418	0		2911	1-4Q	0		0	13329	0
Subtotal:			10418	0		2911		0		0	13329	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
Subtotal:			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
JRP Management Support			1599	3073	1-4Q	0		0		0	4672	0
Subtotal:			1599	3073		0		0		0	4672	0

OSD RDT&E COST ANALYSIS (R3)

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Project Total Cost:	**17382**	**9947**		**2911**		**0**		**0**	**30240**	**0**

Schedule Detail (R4a Exhibit)

Date: February 2007

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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						
MTRS PRM T&E	1-4Q	1-4Q						
MTRS AAP PROD DEC	1-4Q	1-4Q						
RONS CIP	1-4Q	1-4Q						
Next Gen EOD RCV	1-4Q	1-4Q						
EOD Cooperative Robotics	1-4Q	1-4Q	1-4Q	1-4Q				

Comment: