Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Navy										DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602131M: *Marine Corps Lndg Force Tech*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**FY 2011 Base Estimate**	**FY 2011 OCO Estimate**	**FY 2011 Total Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	43.499	45.607	43.776	0.000	43.776	45.099	46.331	47.415	48.429	Continuing	Continuing
3001: *Marine Corps Landing Force Tech*	37.017	39.134	43.776	0.000	43.776	45.099	46.331	47.415	48.429	Continuing	Continuing
9999: *Congressional Adds*	6.482	6.473	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.539

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval Science and Technology (S&T) Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE is organized into nine activities which are represented as seven Expeditionary Warfighting Capability Areas, as well as Future Concepts, Technology Assessment and Roadmapping, and the Littoral Combat/Power Projection (LC/PP) FNC. The primary objective of this PE is to develop and demonstrate the technologies needed to meet the Marine Corps' unique responsibility of training and equipping the Marine Air/Ground Task Force (MAGTF) for Expeditionary Maneuver Warfare. This PE provides the knowledge base to support Advanced Technology Development (6.3) and is the technology base for future expeditionary warfare capabilities. This PE supports the Expeditionary Force Development System of the Marine Corps Combat Development Command (MCCDC) and responds directly to the Marine Corps Science and Technology (S&T) process as well as supporting related Littoral and Expeditionary Maneuver Warfare capabilities developed by the Navy's Mission Capability Program. The Future Naval Capabilities (FNC) process is supported and funds are programmed accordingly. The FNC program explores and demonstrates technologies that enable Sea Strike, Sea Shield, Sea Basing, FORCEnet and Force Health Protection pillars, Space, Naval Expeditionary Maneuver Warfare and the Enterprise and Platform Enablers. The FNC program is composed of Enabling Capabilities (ECs) which develop and deliver quantifiable products (i.e., prototype systems, knowledge products, and technology improvements) in response to validated requirements for insertion into acquisition programs of record after meeting agreed upon exit criteria within five years. The core 6.2 program also supports Discovery and Invention (D&I) and Innovation and Transformation (I&T). Within the Naval Transformation Roadmap, this investment will achieve key transformational capabilities required by the Sea Power 21 Pillars, as well as enable Ship to Objective Maneuver (STOM), Persistent Intelligence, Surveillance and Reconnaissance and Overseas Contingency Operations (OCO).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	42.858	39.308	0.000	0.000	0.000
Current President's Budget	43.499	45.607	43.776	0.000	43.776
Total Adjustments	0.641	6.299	43.776	0.000	43.776
• Congressional General Reductions		-0.190			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.011			
• Congressional Adds		6.500			
• Congressional Directed Transfers		0.000			
• Reprogrammings	1.443	0.000			
• SBIR/STTR Transfer	-0.802	0.000			
• Program Adjustments	0.000	0.000	43.776	0.000	43.776

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Project: 9999: *Congressional Adds*		
Congressional Add: *High Power Ultra Lightweight Zinc-Air Battery*	2.493	1.992
Congressional Add: *Warfighter Rapid Awareness Processing Technologies*	3.989	4.481
Congressional Add Subtotals for Project: 9999	6.482	6.473
Congressional Add Totals for all Projects	6.482	6.473

Change Summary Explanation

Technical: FY 2009 and out reflects funding for a DoD directed integrated capability demonstration supporting the Protection of Ground Forces and Systems to meet the imposing security threats that challenge our Nation, and it may not be adequately postured to take advantage of key scientific and technological opportunities that offer breakthrough advantages to our warfighters. This broad, multi-year (through the FYDP) initiative will expand existing technology integration and increase/spur the application of more fundamental technologies to force and platform protection. The goal is multiple broad phased force protection applications and technologies, with off-ramps for fielding successes; therefore, funding associated with this DoD initiative is reflected throughout the PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Navy	DATE: February 2010
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In FY 2010 preparation efforts continue in areas of technology that are ready for major, integrated technology demonstration. All technical work is being coordinated throughout DoD on these demonstrations. In areas such as vehicle technology demonstrations, the goal is to deliver multiple classes of advanced technology ground vehicle demonstrations leading to new classes of protective, efficient, ground vehicles.

Schedule: Not applicable.

FY11 from previous President's Budget is shown as zero because no FY11-15 data was presented in President's Budget 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602131M: *Marine Corps Lndg Force Tech*	PROJECT 3001: *Marine Corps Landing Force Tech*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
3001: *Marine Corps Landing Force Tech*	37.017	39.134	43.776	0.000	43.776	45.099	46.331	47.415	48.429	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project is organized into nine activities which are represented as seven Expeditionary Warfighting Capability Areas, as well as Future Concepts; Technology Assessment and Roadmapping; and the Littoral Combat/Power Projection (LC/PP) FNC. The seven Expeditionary Warfighting Areas support the Discovery and Invention (D&I) and the Innovation and Transformation (I&T) investment. The LC/PP FNC supports the Exploitation and Deployment (E&D) investment.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTERS (C4)	2.870	3.323	3.851	0.000	3.851
This activity supports S&T investment in Command and Control and is focused in three main areas. (1) Implementing the FORCEnet concept. FORCEnet is the operational construct and architectural framework for naval warfare in the information age that integrates warriors, networks, command and control, and weapons into a networked, distributed, combat force that is scalable across all levels of conflict from the seabed to space and sea to land. The Marine Corps instantiation of FORCEnet is Marine Air Ground Task Force Command and Control (MAGTF C2), with technologies to exchange data and information with and among distributed tactical forces. (2) Developing decision support systems that enable warfighters to take advantage of the FORCEnet and MAGTF C2 and tactically extend Net-Enabled Command and Control (NECC) for shared situational awareness. (3) Providing effective combat identification of enemy combatants, friendly forces, and non-combatants. Activities in this activity provide technologies for secure, robust, self-forming, mobile communications networks distributed computing to support information dissemination to all echelons; and sensors, software and data processing to support formation of appropriate common picture. Marine Corps specific efforts include power management, low detect ability, size and weight constraints, and interoperability within the joint environment.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total

The FY 2009 to FY 2010 increase in funding results from the acceleration of efforts to complete and transition Adaptive Networking Technologies efforts.

The FY 2010 to FY 2011 increase in funding results from accelerating and completing the transition of C4 needs in Adaptable Antennas Technologies, Field Programmable Gate Array Communications Architectures, and Information on Demand programs.

FY 2009 Accomplishments:
- Initiated development of C3 for the Distributed Operations Marine technologies. This includes development of technologies to allow small units to share Position and Location Information (PLI) in GPS-denied or restricted environments thereby enhancing current blue force situational awareness.
- Initiated development of urban/restricted environment communications technologies.
- Initiated new efforts in Over-the-Horizon Communications which include the development of an airborne software-defined communications, networking, Electronic Signals Intelligence (ELINT) and Electronic Warfare (EW) capability.

FY 2010 Plans:
- Continue all efforts of FY 2009.
- Complete Free Space Optical Communications Technologies and Adaptive Networking Technologies efforts.
- Initiate Position Location Technologies.

FY 2011 Base Plans:
- Continue all efforts of FY 2010, less those noted as completed above.
- Complete Adaptable Antennas Technologies, Field Programmable Gate Array Communications Architectures, and Information on Demand efforts. (Relates to FY 2009 plan to initiate new efforts in Over-the-Horizon Communications).

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Initiate Cognitive Networking Technologies, Mobile Security Architecture Technologies, and Small Unit Blue Force tracking/Position Location Information/Combat Identification Technologies efforts.					
FIREPOWER	4.095	3.590	4.314	0.000	4.314
This activity develops technology for application on current and future expeditionary weapons and elements of the kill chain. It includes, but is not limited to, the following technologies: Fuze, fire control, launch/propulsion, lethality, and accuracy. The FY 2009 to FY 2010 decrease in funding results from delays due to obtaining programmatic milestone approvals in the Targeting and Engagement and Precision Target Location efforts. The FY 2010 to FY 2011 increase in funding is due to enhanced E&D efforts for precision urban attack. The efforts address technologies needed to acquire, track, and designate Forward Observer (FO) identified targets, from an Unmanned Aircraft System (UAS) using micro pulse laser designator (MPLD) energy, for urban (and other) terrain attack by mortar rounds with advanced trajectory shaping capabilities. *FY 2009 Accomplishments:* - Continued development of a concept for an insensitive munition propulsion system to enable firing a shoulder launched rocket from an enclosed space. - Continued development of enhanced mortar munitions for more effective fire support. - Continued investigation of the scalability of variable effects conventional munitions technology for improving firepower effectiveness while increasing affordability and decreasing logistical burden in support of expeditionary warfare. - Continued development of collaborative fires coordination technologies. - Continued development of precision fires engagement technologies. - Initiated and continue development of Distributed Operations Precision Engagement collaborative fires coordination technologies.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Initiated expanded efforts in lightweight weapons and ammunition (mortars, crew served weapons, ammunition and packaging). - Initiated Targeting & Engagement and Precision Target Location efforts that include Integrated Day/ Night Sight Technology. - Initiated design and development of lightweight technologies that provide individual Marines enhanced capabilities to detect and identify man-size targets at least out to the maximum effective range of their personal weapons during all conditions (daylight, limited visibility, & darkness) by integrating multiple capabilities into a single system. *FY 2010 Plans:* - Continue all efforts of FY 2009. *FY 2011 Base Plans:* - Continue all efforts of FY 2010. - Complete development of Non-Magnetic Azimuth Sensing technology. - Complete development of eye-safe Micro Pulse Laser Designation technology.					
FORCE PROTECTION This activity supports the Force Protection Thrust's applied research program. Technologies are being developed that focus on the following: Landmine avoidance, detection, and breaching/neutralization; Counter Improvised Explosive Devices; Counter Rocket, Artillery, Mortar, and Sniper; Technologies for improved protection for individuals including Marine Personnel Protective Equipment against blast, ballistic and blunt impact threats and in chemical, radiological, and biological environments; and physical installation and checkpoint security. Beginning in FY 2009, Mine Counter Measure (MCM) efforts are funded within this activity. Force Protection (FP) related technologies, including all MCM and counter Improvised Explosive Device (IED) related technology development are now reflected in this thrust area's submission.	3.701	4.186	4.764	0.000	4.764

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 reflects funding for a DoD directed integrated capability demonstration supporting the Protection of Ground Forces and Systems. This capability demonstration has been directed to be wide ranging and encompass technologies for: - Pre-detonation of IEDs, - Personal protection materials, - Personal power generation, - Micro power sources, and - Augmented reality The integrated demonstration will be a broad, multi-year thrust to both investigate technology integration as well as spur application of more fundamental technologies to force and platform protection. The goal is multiple broad phased force protection applications and technologies, with off-ramps for fielding successes. Technologies being developed by the Force Protection activity are central to the integrated demonstration program. The FY 2009 to FY 2010 increase results from accelerating efforts required to complete a neutralization effort focused on applying passive infrared phenomenology understanding to a capability enabling rapid defeat of Passive InfraRed Sensor (PIR) devices from significant stand-off distances. The FY2010 to FY2011 increase results from accelerated efforts in personal protection - specifically, completion of multi-material fiber level modeling and simulation for ballistic fabric optimization and development. *FY 2009 Accomplishments:* The following efforts transitioned from the Maneuver activity: - Continued development of technologies for stand-off detection and neutralization of mines, IEDs, and Unexploded Ordnance (UXO). (Transitioned from Maneuver activity)					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Continued development of technologies to defeat side/top attack and advanced mine fuzes (seismic, acoustic, and infrared) through advanced signature reduction, duplication, and projection. (Transitioned from Maneuver activity) - Continued spectral signature classification efforts for MCM applications.(Transitioned from Maneuver activity) - Continued development of computational models to scale the effects of small-scale explosives tests to full-scale landmine explosions in order to study mine blast effects on advanced vehicle geometry. - Continued technology development programs to address force protection personal protective equipment capability gaps.(Transitioned from Maneuver activity) - Continued development of technologies to defeat advanced mine fuzes (seismic, acoustic, and infrared). (Transitioned from Maneuver activity) - Completed development of studies into mine signature classification. - Completed development of modeling tools to accurately determine loading and fragmentation effects on targets from mine explosions.(Transitioned from Maneuver activity) - Completed evaluation of low passive inter-modulation narrowband antennas and wideband antennas for potential use in detection methodologies. - Initiated studies of sensor fields to identify and classify mine threats. - Initiated evaluation of active wideband double notch filters for a wide spur-free dynamic range in specific frequencies of interest to cover a variety of threats. - Initiated an Explosive Hazard Defeat for IED Neutralization effort focused on applying passive infrared phenomenology understanding to a capability enabling defeat of PIR devices from significant stand-off distances. - Initiated Counter Rockets, Artillery, Mortars, and Sniper efforts addressing indications and warnings for pre-shot sniper detection and enabling detection of sniper observation and targeting in advance of a ballistic event. *FY 2010 Plans:* - Continue all efforts of FY 2009, less those noted as completed above.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Complete magnetic and seismic portion of development of technologies to defeat side/top attack and advanced mine fuzes. - Complete high-speed syntactic landmine detection algorithm development to support ground penetrating radars. (Relates to FY 2009 plan to continue development of technologies for stand-off detection and neutralization of mines, IEDs, and UXO). - Complete Neutralization effort focused on applying passive infrared phenomenology understanding to a capability enabling defeat of PIR devices from significant stand-off distances. - Complete vulnerability analysis of selected munitions and targets. (Relates to FY 2009 plan to initiate Counter Rockets, Artillery, Mortars, and Sniper efforts). -Initiate technology development efforts to detect and defeat incoming rocket, artillery, and mortar threats via non-kinetic means. - Initiate multi-spectral protection efforts against battlefield directed energy weapons. *FY 2011 Base Plans:* - Continue all efforts of FY 2010, less those noted as completed above. - Complete spectral signature classification efforts for neutralization confirmation. - Complete development of shape charge, safe and arm, and non-energetic launch and delivery technologies to support scaleable explosive neutralization. (Relates to FY 2009 plan to continue development of technologies for stand-off detection and neutralization of mines, IEDs, and UXO). - Complete multi-material fiber level modeling and simulation for ballistic fabric optimization and development. (Relates to FY 2009 plan to continue technology development programs to address force protection personal protective equipment capability gaps). - Initiate studies of sensor fields to identify and classify mine threats.					
FUTURE CONCEPTS, TECHNOLOGY ASSESSMENT, AND ROADMAPPING This activity supports the planning and integration of technology development efforts across the entire PE. In conjunction with the Concepts Based Capabilities System and the Marine Corps Warfighting Laboratory, unique and novel concepts for advanced warfighting are developed and validated.	0.869	1.052	1.116	0.000	1.116

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Effectiveness analyses are conducted to identify the synergistic effects that can be achieved through the integration of emerging technology with innovative tactics, doctrine, and techniques. Technology assessments are conducted to determine the supporting technologies that have the highest impact across the warfare areas, and warrant further investment within this PE. Technology Roadmapping is conducted to help identify opportunities to leverage technology development within the Department of the Navy and the Department of Defense, as well as, with the commercial sector and university communities. The resultant technology investment strategy is developed and used to guide out-year technology development efforts. FY 2009 reflects funding for new assessments in Asymmetric/Irregular Warfare and Distributed Operations; and a DoD directed integrated capability demonstration supporting the Protection of Ground Forces and Systems. This capability demonstration has been directed to be wide ranging and encompass technologies for: - Pre-detonation of IEDs, - Personal protection materials, - Personal power generation, - Micro power sources, and - Augmented reality The integrated demonstration will be a broad, multi-year thrust to both investigate technology integration as well as spur application of more fundamental technologies for force and platform protection. The goal is multiple broad phased force protection applications and technologies, with off-ramps for fielding successes. The FY 2010 to FY 2011 funding increase results from expanded assessments relative to how the Marine Corps supports the National Defense Strategy (NDS) and multinational efforts in Overseas Contingency Operations, the Long War and employment in the full Range Of Military Operations (ROMO).					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: - Continued Technology Assessments associated with the Urban Asymmetric and Expeditionary Warfare Capability Gap. - Continued the integrated planning of concepts and technology development. - Continued development of the Expeditionary Maneuver Warfare Investment Strategy. - Continued Technology Assessments and Roadmapping within Command, Control, Communication, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR); and Firepower Thrust Areas of the PE. - Continued Technology Assessment of the Combating Terrorism portfolio. - Continued assessment of the technical requirements of the Marine Corps Special Operations Command (MARSOC). - Initiated and continue assessments in Lightening the Marine's Load and Enhancing the Capabilities of the Marine Corps Rifle Squad. - Initiated assessments in Asymmetric / Irregular Warfare and Distributed Operations. - Initiated assessments of all new and emerging Counter Sniper Technologies. - Initiated new planning and integration of technology development efforts to meet imposing security threats that challenge our Nation. *FY 2010 Plans:* - Continue all efforts from FY 2009. - Complete the assessment of the technical requirements of the MARSOC. - Complete assessments of all new and emerging Counter Sniper Technologies. - Complete Technology Assessment of the Combating Terrorism portfolio. - Complete Technology Assessments associated with the Urban Asymmetric and Expeditionary Warfare Capability Gap. - Complete the integrated planning of concepts and technology development. - Complete development of the Expeditionary Maneuver Warfare Investment Strategy.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Complete Technology Assessments and Roadmapping within Command, Control, Communication, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR); and Firepower Thrust Areas of the PE. - Initiate an assessment of the S&T impacts of Marine Corps' concept of force employment to meet the need for counterinsurgency and building partnership capacity. How the Marine Corps supports the National Defense Strategy (NDS) and multinational efforts in the Global War on Terrorism/Long War will have long-term S&T impacts. *FY 2011 Base Plans:* - Continue all efforts from FY 2010, less those noted as completed above. - Complete the assessment of the Distributed Operations S&T Strategic Focus Area and portfolios. - Complete the assessment of the DoD directed integrated capability demonstration supporting the Protection of Ground Forces and Systems.					
HUMAN PERFORMANCE, TRAINING AND EDUCATION This activity develops advanced training technology and technologies that enhance neural and cognitive aspects of human performance including cognitive task analysis, tactical decision-making, modeling, simulation, range instrumentation, and synthetic environment generation. The FY 2009 to FY 2010 funding increase results from accelerated efforts to complete and transition research into distributed operations peak neural and cognitive performance. The FY 2010 to FY 2011 funding increase results from accelerated development of squad-level team training mitigation strategies. *FY 2009 Accomplishments:* - Continued research to evaluate the feasibility of integrating augmented reality technologies into current and emerging training systems.	3.350	3.961	4.662	0.000	4.662

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Continued research on combat feeding and hydration. - Continued research on physiological correlates for the strategic corporal assessment. - Continued development into a Marine performance optimization model. - Continued the development of training effectiveness measures and techniques as applied to disparate, multi-platform, multi-mission team training. - Continued research into distributed operations peak neural and cognitive performance. - Continued research into next generation survivability enhancement technologies. - Continued studies into next generation physical performance enhancement methodologies and technologies. - Completed evaluation of tools to support real-time cognitive and behavioral assessment (augmented cognition) and improvement of individuals and teams during training. - Completed research in the area of team training task analyses and training effectiveness evaluation techniques to develop more effective training systems for Military Operations in Urban Terrain (MOUT). - Initiated the development of foundational learning theories extended to complex tasks for a range of expertise levels, training mitigation strategies triggered by neurophysiological markers of learning, cognition and expertise, and principles of expertise development on a continuum of novice to expert. - Initiated development of training mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition and expertise. - Initiated additional Human Performance and Training efforts (Cognitive and physical enhancement, modeling and simulation, and virtual reality squad level training in support of Distributed Operations). - Initiated Distributed Operations training system investigations to perceptual skills enhancement that lead to enhanced cognition and decision making. - Initiated additional efforts to incorporate effects of nutrition and functional fitness into models and simulations in the Distributed Operations Virtual Toolkit. - Initiated Advanced Mobile Assessment and Field Readiness Technologies to improve the capability to assess situational awareness in the field and predict physical performance by developing mobile, rugged tools, algorithms, and models.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Initiated a Mind-Body Integration Systems effort to improve team training by developing and validating Electroencephalogram (EEG) (and other physiological and performance measures) for use in assessing team performance, coordination, and cohesion in training environments. *FY 2010 Plans:* - Continue all efforts of FY 2009, less those noted as completed above. - Complete Distributed Operations training system investigations to perceptual skills enhancement that lead to enhanced cognition and decision making. - Complete research into distributed operations peak neural and cognitive performance. - Initiate evaluations of asymmetric distributed learning techniques for distributed operations, language, and cultural training. - Initiate development of team training mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition, and expertise. - Initiate development of team training/immersive approaches towards language and culture training that incorporate foundational learning theories and other advanced educational methods. *FY 2011 Base Plans:* - Continue all efforts of FY 2010, less those noted as completed above. - Initiate development of squad-level team training mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition, and expertise. - Initiate development of field team performance mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition, and expertise.					
INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR) This activity develops ISR technologies for applications in future intelligence, surveillance, and reconnaissance. Technologies being pursued enhance situational awareness, persistent surveillance, and tactical decision making through automated analysis of data and rapid integration of information and acquired knowledge. Specific technologies in this activity effectively present actionable information	1.912	2.217	2.571	0.000	2.571

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
to decision-makers, especially those at the lower command levels. This includes complete future automation of options and persistent surveillance in support of distributed operations. The increases in funding from FY 2009 to FY 2010, as well as FY 2010 to FY 2011, are due to enhanced ISR Sensor Field efforts. *FY 2009 Accomplishments:* The following efforts transitioned from the C4ISR activity in FY 2009: - Continued development of information fusion technologies to allow automated construction of a common tactical picture from various sources of sensor data. - Continued development of low power consumption urban sensing technologies. - Continued development of tagging, tracking and locating technologies to monitor adversary movement. - Continued development of information on demand technologies to provide warfighter with the right information at the right time. - Continued development of urban sensing technologies to detect weapons at distance. - Continued development of adaptable enemy course of action engine to manipulate adversary decisions. - Continued development of advanced tactical sensor technologies to improve unit awareness. - Initiated and continue development of distributed information architecture technologies. - Initiated and continue the decision prediction, manipulation, stimulation and learning detection capability to add tools that enable the warfighter to operate inside the OODA loop of an irregular actor. The Observe, Orient, Decide, Act (OODA) Loop provides a standard description of decision making cycles that is widely understood and accepted throughout the U.S. military. - Initiated and continue development of a single integrated battlespace picture with tactical and strategic injects that begins to close the gap between ISR and C2. - Initiated and continue Actionable Intelligence for Expeditionary and Irregular Warfare effort which includes real-time methods for Identifying Human Networks.					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Initiated tagging, tracking, and locating technologies development to address development of multi-INT track continuity. - Initiated development of advanced tactical nets to include additional phenomenologies and the netting of C2, Sensors and Analysis nodes. - Initiated efforts addressing "battlespace awareness" of human networks, improving the accuracy of classification decisions and enabling a human network predictive capability. Once a human network sensor can be defined and dynamically observed in a common feature space, predictive capabilities are realized. If one network is observed to be moving towards at risk behavior, a generalized force warning may be enabled addressing the threat associated with all networks with similar human network sensors. When combined, research into human network awareness, network classification and network prediction, will be a powerful tool for warfare against the irregular actor. *FY 2010 Plans:* - Continue all efforts from FY 2009. - Complete development of urban sensing technologies to detect weapons at distance. - Initiate new Sensor Fields efforts such as Nanotechnology Enabled Witness Fields, development of sensors that provide near real time decision support to distributed operations by detecting specific interactions, and nanotechnology efforts which offer the potential to revolutionize tactical sensors. To enable this capability, nanomaterials that change state in the presence of another nanomaterial will be developed. - Initiate efforts to track entities of interest in a high clutter environment via geolocation of optical tags from a UAV platform. - Initiate development of capabilities to integrate socio-cultural models of human behavior with the ability to forecast the processes of decision making through predictive forecasting models. - Initiate development of approach to model and expose enemy networks, actions, and reactions through statistical models with techniques for probabilistic forecasting of behaviors of interest with consideration for open source information and conventional intelligence data sources.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Initiate development of sensors that provide near-real-time decision support to distributed operations by detecting specific interactions utilizing nanotechnology. - Initiate efforts to derive high resolution models of human networks statistically with associated behavior attributes. *FY 2011 Base Plans:* - Continue all efforts from FY 2010, less those noted as completed above. - Complete optical tag geolocation from a UAV effort. - Complete development of advanced tactical sensor technologies to improve unit awareness by demonstrating the feasibility of voice recognition and facial identification from a battery powered processor. - Initiate development of nanomaterials required to support small sensors that can "witness" environments (places and substances) as well as the proximity between specific people and places to verify information. - Initiate work on specific nanomaterial triggers and receptors. - Initiate work on new optical taggants with improved producibility. - Initiate work on influencing, disrupting, and stimulating behavior by fusing high resolution models of decisions with models of human networks.					
LITTORAL COMBAT/POWER PROJECTION This activity is aligned with the Sea Strike, Sea Shield, Sea Basing and FORCEnet and Expeditionary Maneuver Warfare (EMW) pillars as well as Force Health Protection and the Enterprise & Platform Enablers. It provides the capability for the demonstration and transition of technologies developed through the related Marine Corps S&T programs directly to an acquisition program of record. The funding profile reflects the alignment of the FNC program investments into ECs. Funding for each EC is aligned to a 6.2 or 6.3 Budget Activity (BA) as appropriate. The focus of the ECs within this PE will be on technology related to Urban, Asymmetric, Littoral and Expeditionary Operations. The related	11.230	9.750	9.800	0.000	9.800

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
science and technology development is of the highest importance to Marine Corps operations in Iraq, Afghanistan and the OCO. The technologies associated with these gaps are being pursued as part of an overall effort that addresses Sea Strike, Sea Shield, Sea Basing and FORCEnet and Expeditionary Maneuver warfare Capability Gaps. Warfighter Capability Gaps are made up of ECs and supporting products. This activity includes support to the Urban, Asymmetric Operations-related EC's for IED's, Modular Scalable Effects Weapons, Advanced Naval Fires Technology, Dynamic Target Engagement, Position Location Information, Transparent Urban Structures, Hostile Fire Detection and Response, Lightweight Protective Systems, and Lightening the Load of Dismounted Combatants. This activity also funds the Marine Corps participation in the Future Naval Capabilities(FNC) program. The additional funds are for the Expeditionary Fighting Vehicle Obstacle Detection System (EFV ODS) in order to complete prototype testing. *FY 2009 Accomplishments:* - Continued development and began transitioning EFV obstacle detection capability to EFV Direct Reporting Program Manager. - Continued development of integrated vehicle self-defense system to defeat incoming RPGs. - Continued transparent urban structure 'see thru the wall', image and mapping technologies development. - Continued modular scalable effects weapons technologies development. - Continued development of an integrated company level Urban Sensor Suite. (Automated Control of Large Sensor Networks) (Transitions to PE 0602235N.) - Continued detect and identify facilities technology development. (Transparent Urban Structures) - Continued decision aids technology development. (Transparent Urban Structures) - Continued indirect prototype technology development. (Modular Scalable Effects Weapon) - Continued development of Modular Scalable Effects weapons technologies. (Concurrent funding in PE 0603640M.)					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Continued development of counter Improvised Explosive Device (IED) technologies. (Concurrent funding in PE 0603640M.) - Continued development of tactical urban breaching technologies. (FY09 funding in PE 0603640M.) - Completed development of land mine countermeasure insensitive munitions technology. - Completed development of tactical ISR data structures and pattern recognition algorithms. - Completed advanced concept development to alert approaching targets with an unambiguous warning that, if ignored, will clearly demonstrate hostile intent of the approaching target. (Realigned from PE 0602123N.) - Completed efforts to provide urban direction finding of Radio Frequency (RF) emitters from moving platforms. (Concurrent funding in PE 0603640M.) - Completed effort in Distributed Common Ground/Surface System (DCGS) that involves the migration of tactical intelligence systems (sensor networks) to a net-ready architecture and the development of enterprise services that translate this data. - Completed development of target acquisition architecture, information exchange, connectivity and interoperability of target hand-off, fire control, and coordination systems. (Concurrent funding in PE 0603640M.) - Completed design and test of hostile fire detection and counter-fire system (GUNSLINGER). - Completed development of integrated vehicle self-defense system technologies to defeat incoming Rocket Propelled Grenades (RPGs). (Concurrent funding in PE 0602782N.) - Completed development and integration of network monitoring and management tools technology and transition to acquisition. (Concurrent funding in PE 0603782N.) - Completed integration and demonstration of innovative relays Beyond Line Of Sight (BLOS) in the areas of wideband communications and advanced modular systems. (Concurrent funding in PE 0603782N.) - Completed development of algorithms and initiated modifications of hardware and software for use in discriminating between individual single channel RF emitters on the battlefield and determining their locations; provide algorithms to MARCORSYSCOM Program Manager (PM) INTEL. (Concurrent funding in PE 0603782N.)					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Completed Expeditionary Fighting Vehicle (EFV) obstacle detection subsystem design, integrated subsystems and prepared for demonstration. - Initiated development of individual Warfighter protection technologies. (Concurrent funding in PE 0603640M). - Initiated development of advanced survivability and mobility technologies for Marine Corps tactical and combat vehicles. (Concurrent funding in PE 0603640M and 0603236N). *FY 2010 Plans:* - Continue all efforts of FY 2009. - Complete development and transitioning of improved fire control technologies based on small-scale hardened non-magnetic azimuth sensor to improve timeliness and accuracy of mortars/howitzers. (Concurrent funding provided by PE 0602114N.) *FY 2011 Base Plans:* - Continue all efforts of FY 2010, less those noted as complete above. - Complete development of individual warfighter lightweight protective system technologies that will reduce body armor weight, improve survivability, and increase the mobility of the warfighter (concurrent funding provided by PE 0603640M). - Complete development and transition transparent urban structures technologies which will enable tactical units to detect, classify and discriminate between friendly and enemy personnel in urban structures, and to gather ground data to dynamically develop 3D models to map urban areas using an Unmanned Air Vehicle (UAV)/Unmanned Ground Vehicle (UGV)-based system. (Concurrent funding provided by PE 0603640M.) - Initiate development of technologies to lighten the load of warfighters by 1) reducing the weight of and improving the capability of the day/night weapon sight, 2) eliminating battery incompatibility, and 3) providing Graphical User Interface (GUI)-based software for tradeoff analyses based on Military Operational Posture. (Concurrent funding provided by PE 0603640M and PE 0603236N.)					
LOGISTICS	3.268	4.786	5.559	0.000	5.559

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
This activity supports Marine Corps Expeditionary Logistics which is the practical discipline and real world application of the deployment, sustainment, reconstitution, and re-deployment of forces engaged in expeditionary operations. Expeditionary Logistics replaces mass with assured knowledge and speed, is equally capable ashore or afloat in austere environments, and is fully scalable to meet uncertain requirements. Expeditionary Logistics logically divides into five pillars: deployment support, force closure, sustainment, reconstitution/redeployment, and command and control. These pillars are thoroughly integrated and perpetually related in execution. FY 2009 funding reflects efforts in lightweight portable battlefield power sources supporting USMC priorities in lightening the load of the individual Marine and enhancing the Marine Corps rifle squad's overall capabilities; and a DoD directed integrated capability demonstration supporting the Protection of Ground Forces and Systems. This capability demonstration has been directed to be wide ranging and encompass technologies for: - Pre-detonation of IEDs, - Personal protection materials, - Personal power generation, - Micro power sources, and - Augmented reality The integrated demonstration will be a broad, multi-year thrust to both investigate technology integration as well as spur application of more fundamental technologies to force and platform protection. The goal is multiple broad phased force protection applications and technologies, with off-ramps for fielding successes. Technologies being developed by the Logistics activity are central to the integrated demonstration program. The FY 2009 to FY 2010 increase results from initiation of new applied research directed at producing a lightweight device for converting hydrocarbon fuels to electrical energy.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
The FY 2010 to FY 2011 increase results from planned accelerated efforts to transition novel electrochemical capacitors required for meeting the peak power requirements of USMC squad level equipment. *FY 2009 Accomplishments:* - Continued developing and assessing concepts that permit precision delivery of logistics assets while also reducing the logistics footprint ashore. - Continued development of an alternate power source to reduce logistics footprint and increase sustainability of Marine expeditionary forces. - Continued assessment of 20W Stirling Engine for increased efficiency during distributed operations. - Continued assessment of portable, alternative water purification systems. - Continued development of wireless vehicle health diagnosis and reporting. - Continued development of advanced logistics distribution system. - Completed analysis of Personal Power Network for transition to "Lighten the Load" FNC EC beginning in FY 2010. - Initiated advancement of a solid oxide fuel cell capable of directly oxidizing liquid logistic fuels such as JP-8, thus eliminating the necessity for both reforming and sulfur removal pre-processing of the fuel. - Initiated advancement of high specific energy electrochemical capacitors to function as peak electric load-leveling buffers in advanced lightweight portable power applications. - Initiated applications of advanced material surface treatments and coatings for reducing required maintenance and enhancing operational readiness of expeditionary warfare vehicles, machinery, and electrical systems. *FY 2010 Plans:* - Continue all efforts of FY 2009. - Initiate applied research toward producing a light weight device for converting hydrocarbon fuels to electrical energy.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: - Continue all efforts of FY 2010. - Complete applied research in novel electrochemical capacitors for meeting the peak power requirements of USMC squad level equipment. (Relates to FY 2008 accomplishment of continued analysis of Personal Power Network/Centralized Distributed Operations Power Generation System.) - Complete applied research toward the direct oxidation of JP-8 fuel, without prior reforming or sulfur removal, in a solid oxide fuel cell. - Initiate applied research toward an extremely high specific energy metal-air primary battery.					
MANEUVER The Maneuver thrust area focuses on the development, demonstration, and transition of technologies that will increase the warfighting capabilities and effectiveness of the Marine Air-Ground Task Force (MAGTF). This thrust aims at capturing emerging and "leap ahead" technologies in the areas of mobility, materials, propulsion, survivability, durability, signature reduction, modularity, and unmanned systems. Special emphasis on survivability technologies for the defeat of small arms, IEDs, mine blast, and RPGs continue to be incorporated into this thrust area. Efforts also continue in the development of modeling and simulation tools that integrate many different physics based modeling systems with rigorous operational analysis simulations to accurately define a system's performance characteristics. These tools will aid in defining the trade space for emerging technologies and assist in providing the program manager insight and guidance into pursuing future technologies. Finally, this technology thrust area also seeks to develop technologies to enhance combat vehicle crewman effectiveness and situational awareness through the incorporation of advanced autonomous vehicle functions triggered directly by the cognitive state of the operator. Beginning in FY 2009, Mine Counter Measure (MCM) efforts are funded under the Force Protection activity. Force Protection (FP) related technologies, including all MCM and counter Improvised Explosive Device (IED) related technology development are now reflected in that thrust area's submission.	5.722	6.269	7.139	0.000	7.139

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
The increase in funding from FY 2009 to FY 2010 is due to initiation of technology programs to improve/ increase occupant protection within the platform by reducing injury due to the effects of dynamic blast events and accidental vehicle rollover. The increase in funding from FY 2010 to FY 2011 is for initiation of programs to address and enhance maneuver capability gaps in mobility such as a vehicle stability effort to improve/increase vehicle performance characteristics including reducing vehicle rollover tendencies. *FY 2009 Accomplishments:* - Continued lightweight Expeditionary Systems Materials (ESM) efforts to determine feasibility of scaling and producing candidate structural armor. - Continued Cognitive Assessment and Task Management technologies for combat vehicle crewmen (formerly Augmented Cognition effort). - Continued development of Advanced Electromagnetic Armor (E-NERA). - Continued S&T programs to address MAGTF Land MCM Master Plan capability gaps. - Continued development of countermeasures for smart mine sensors. - Continued mobility enhancement development effort for current and future light and medium weight Marine Corps vehicle programs. - Continued and completed development of materials to promote Combat Science and Technology Vehicle (CSTV) survivability. - Continued development of advanced electromagnetic armor for ground vehicle survivability. - Continued development of cognitive assessment and task management concept for CSTV. - Continued integration of CSTV capabilities. - Continued development of fuel efficiency and battlefield power technologies for the CSTV and ground vehicles. - Completed development of scalable explosive neutralization methods. - Initiated efforts addressing survivability and technologies to mitigate acceleration and traumatic brain injuries to vehicle occupants to enhance tactical mobility in support of Distributed Operations.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Initiated efforts addressing advanced suspension systems with ride height adjustment capabilities, adjustable ride quality capabilities, rollover prevention, and load equalizing systems to enhance tactical mobility and survivability in support of Distributed Operations. - Initiated efforts addressing improvements in vehicle fuel efficiency by improvements in drive train efficiencies, engine efficiencies and alternative fuels capabilities to enhance tactical mobility in support of Distributed Operations. - Initiated technology development programs to address maneuver capability gaps in Survivability such as an Advanced Seat Technology effort to improve/increase occupant protection within the platform by reducing injury due to the effects of dynamic blast events and accidental vehicle rollover. - Initiated technology development programs to address maneuver capability gaps in Mobility such as a Vehicle Stability effort to improve/increase vehicle performance characteristics such as reducing vehicle rollover tendencies. Acquisition Workforce Fund: - Funded DoD Acquisition Workforce Fund. *FY 2010 Plans:* - Continue all efforts of FY 2009. *FY 2011 Base Plans:* - Continue all efforts of FY 2010. - Initiate Survivability efforts in Advanced Blast Mitigation to develop solutions that mitigate injuries to vehicle occupants while reducing the weight burden thereby enhancing tactical mobility and survivability in support of Distributed Operations.					
Accomplishments/Planned Programs Subtotals	37.017	39.134	43.776	0.000	43.776

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C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• 0602114N: *POWER PROJECTION APPLIED RESEARCH*	0.000	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.044
• 0603236N: *WARFIGHTER SUSTAINMENT ADVANCED TECHNOLOGY*	0.000	2.042	2.141	0.000	2.141	0.000	0.000	0.000	0.000	0.000	4.183
• 0603640M: *USMC ADVANCED TECHNOLOGY DEMONSTRATION (ATD)*	15.523	15.244	16.030	0.000	16.030	13.142	10.742	6.778	0.000	0.000	77.459

D. Acquisition Strategy

N/A

E. Performance Metrics

The primary objective of this PE is the development of technologies to meet unique Marine Corps needs in conducting Expeditionary Maneuver Warfare and Combating Terrorism. The program consists of a collection of projects categorized by critical warfighting function. Individual project metrics reflect the technical goals of each specific project. Typical metrics include the advancement of related Technology Readiness Levels, the degree to which project investments are leveraged with other performers, reduction in life cycle cost upon application of the technology, and the identification of opportunities to transition technology to higher categories of development.

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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
9999: *Congressional Adds*	6.482	6.473	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.539

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
Congressional Add: High Power Ultra Lightweight Zinc-Air Battery *FY 2009 Accomplishments:* The Marine Corps has multiple Science and Technology Objectives (STOs) stating a need for the Warfighters to carry fewer batteries that are lighter, more powerful and longer lasting and has a power source capable of supporting all ground communications systems with increased mission run time per battery. This FY 2009 Congressional Add supported the STOs by developing an air electrode that provides 60% higher power capability over commercially available air electrodes. *FY 2010 Plans:* This effort supports High Power Ultra Lightweight Zinc-Air Battery research.	2.493	1.992
Congressional Add: Warfighter Rapid Awareness Processing Technologies *FY 2009 Accomplishments:* This add supported Distributed Operations (DO). The USMC Distributed Operations concept posits the distribution of decision making authority across a wide number of junior leaders, who are directly engaged in	3.989	4.481

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
the fight. By moving authority "downward," the Marine Corps intends to dramatically increase the speed of command and action. In the tactical application of the DO concept, it is envisioned that maneuver units will operate in disaggregated fashion, with companies, platoons, and even squads dispersed beyond the normal range of mutually supporting organic direct fires, but linked through a common command and control network. This has tremendous implications across a broad front of S&T efforts. The current focus of the add is on small-unit leader decision making and control of fires. The funding supported the exploration of all aspects of individual cognition and decision-making, physiology and ergonomics, and the technologies needed to integrate these aspects in order to support the development of a Marine who is optimized to perform within an asynchronous/ distributed operational setting. *FY 2010 Plans:* This effort supports Warfighter Rapid Awareness Processing Technologies research.		
Congressional Adds Subtotals	6.482	6.473

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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E. Performance Metrics

Congressional adds.