Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy	Date: May 2017
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603640M *I MC Advanced Technology Demo*

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	0.000	128.386	140.416	154.407	-	154.407	142.368	143.568	142.368	145.215	Continuing	Continuing
2223: *Marine Corps ATD*	0.000	86.525	93.355	94.664	-	94.664	94.925	95.176	93.976	95.855	Continuing	Continuing
2297: *Futures Directorate*	0.000	41.861	47.061	59.743	-	59.743	47.443	48.392	48.392	49.360	Continuing	Continuing

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 (20 January 2015). 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) to include specific Marine Corps objectives defined by the United States Marine Corps (USMC) S&T Strategic Plan. It provides the vision and key objectives for the essential S&T efforts that will enable the continued supremacy of United States 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. Expeditionary Force 21 (EF 21) is the Marine Corps' foundational Capstone Operating Concept that guides capability development, wargaming, and experimentation and this PE. EF 21 aligns with national strategic guidance including the National Security Strategy (NSS), National Military Strategy (NMS), Defense Strategic Guidance (DSG), Quadrennial Defense Review (QDR), and with Naval strategy in the Department of the Navy's Cooperative Strategy for 21st Century Seapower.

EF 21 describes a future Marine Corps ground force that will have cornerstone characteristics of being naval, expeditionary, agile, and lethal. This force will face security environments and threats driven by Complex Terrain (to include informational and human aspects), Technology Proliferation (including precision weapons), Information used as a Weapon, Battles of Electromagnetic Spectrum Signatures, and Increasingly Contested Maritime Domains. The future Marine Corps will be designed to meet those future security environments but needed force characteristics also impose constraints and challenges on required capabilities. An example would be a need to conduct Information Warfare but with systems constrained by size, weight, and power considerations necessary for a naval and expeditionary force. Another example is Marine firepower requirements to be lethal against technologically comparable threat systems but Marine capabilities and weapons constrained by deployment and sustainment challenges of naval shipping and a distributed expeditionary force. These capability constraints and challenges in turn drive unique S&T requirements that define this PE.

S&T projects in this PE enable future force capabilities through advanced technology development to meet Marine needs within the unique constraints described above in the warfighting functional areas of: Command, Control, Communications, Computers (C4); Intelligence, Surveillance, and Reconnaissance (ISR); maneuver and mobility; force protection; logistics and sustainment; human performance, training, and education; firepower; and Expeditionary Cyber. This PE funds advanced technology development, technology demonstrations, assessment of emerging technologies, experimentation in warfighting concepts, and the Future Naval Capability (FNC) process as means to develop unique Marine future capabilities with new S&T.

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

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy					Date: May 2017
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*		**R-1 Program Element (Number/Name)** PE 0603640M *I MC Advanced Technology Demo*			
B. Program Change Summary ($ in Millions)	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	131.490	140.416	142.407	-	142.407
Current President's Budget	128.386	140.416	154.407	-	154.407
Total Adjustments	-3.104	0.000	12.000	-	12.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.104	0.000			
• Program Adjustments	0.000	0.000	12.000	-	12.000

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603640M / *MC Advanced Technology Demo*	Project (Number/Name) 2223 / *Marine Corps ATD*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
2223: *Marine Corps ATD*	0.000	86.525	93.355	94.664	-	94.664	94.925	95.176	93.976	95.855	Continuing	Continuing

A. Mission Description and Budget Item Justification

Critical Marine Corps requirements/imperatives addressed in this Project are: Maneuver; Force Protection; Human Performance, Training and Education; Logistics; Command, Control, Communications and Computers (C4); Intelligence, Surveillance and Reconnaissance (ISR) , Expeditionary Cyber and Firepower. These are ongoing efforts to develop and demonstrate advanced technologies and system concepts in an operational environment. Multiple transitions into the Sub-system/ Component Advanced Development Phase are planned, as well as fieldable prototyped to reduce risk in System Concept Development and Demonstration. A tactically effective Mine Countermeasures (MCM) capability is vital to Force Protection and necessary if Maneuver on land is to become a functional component of Naval Expeditionary Maneuver Warfare. Maneuver, supported by MCM provides synchronization and speed of detection, breaching, clearance, proofing, and marking operations. This project supports: 1) engaging regional forces in decisive combat on a global basis; 2) responding to all other contingencies and missions in the full spectrum of combat operations (high, middle, and low intensity), in Military Operations in Urban Terrain (MOUT), and in Operations other than War (OOTW); and 3) warfighting experimentation. By providing the technologies to enable these capabilities, this project supports the goals and objectives of the Strike, Littoral Warfare and Surveillance Joint Mission Areas. These are ongoing efforts to develop and demonstrate advanced technologies and system concepts in an operational environment.

In addition, this project supports the goals and objectives of the Naval Future Naval Capabilities Program. The USMC Future Naval Capabilities Activity, formerly named Littoral Combat/Power Projection (LC/PP), addresses the advanced technology development associated with the Marine Corps' participation in the Department of the Navy's (DoN) Future Naval Capabilities (FNC) Program. The eight Expeditionary Warfighting Areas support the the Technology Maturation portfolio investment. The USMC FNCs support the Technology Maturation/Acquisition Enabler investment.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS (C4)	6.167	6.950	7.500	0.000	7.500
Description: This activity integrates and demonstrates enhanced communications and situational awareness in warfighting environments and communication and situational awareness technologies for near term USMC operations. The focus is on development and leveraging advanced C4 technologies to enable enhanced Distributed Operations, Irregular Warfare, and Marine Corps Expeditionary Warfare. Specifically, the C4 Thrust intends to demonstrate markedly improved capabilities in over-the-horizon (OTH), beyond line-of-sight, and restricted environment communications; mobile networking; tactical decision making; tactical situational awareness; and small unit position location and navigation. Advanced technology resources will be applied to complement commercial, other service, and defense agency investments to produce a technology base to address identified Marine Corps technology gaps.					
FY 2016 Accomplishments:					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued urban navigation with limited Global Positioning System availability demonstrations. - Continued demonstrations of improved urban communications capabilities. - Continued developing tailored tactical Human to Machine Interfaces aligned to primary operational functions and non-intrusive within the battlespace. - Continued creating services for the tactical network that are fully operable with Distributed Common Ground System (DCGS) and the DCGS Integration Backbone. - Continued Application-Network Architectures, Conformal Antenna Integration and Demonstration Spiral 2 and C3 for the Individual Marine Spiral Two. - Continued Application Network Architecture and Automated Small Unit Decision Tools. - Continued Advanced Communications Systems and Small Unit C3. - Continued smart radio efforts. - Continued Tactical Cyber Warfare. - Continued Networking On-The-Move Technology insertion. - Completed mobile security. - Initiated MAGTF C2 Technology insertion.					
FY 2017 Plans: - Continue all efforts of FY 2016, less those noted as completed above. - Complete demonstrations of improved urban communications capabilities. - Complete Application-Network Architectures, Conformal Antenna Integration and Demonstration Spiral 2 and C3 for the Individual Marine Spiral Two. - Complete Application Network Architecture and Automated Small Unit Decision Tools. - Complete urban navigation with limited Global Positioning System availability demonstrations - Complete Advanced Communications Systems and Small Unit C3. - Initiate an Advanced HF Antenna effort.					
FY 2018 Base Plans: - Continue all efforts of FY 2017, less those noted as completed above. - Initiate Advanced Cryptography Technology. - Initiate Adaptive Distributed Messaging. - Transfer all Tactical Cyber Warfare efforts to the Expeditionary Cyber Activity.					
FY 2018 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2223 / *Marine Corps ATD*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
N/A					
Title: FIREPOWER	9.061	8.521	8.558	0.000	8.558
Description: 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. ***FY 2016 Accomplishments:*** - Continued development of targeting and engagement technologies for distributed operations collaborative fires integration and demonstrations. - Continued design, development, prototyping and testing of lightweight technologies that provide individual Marines enhanced capabilities to detect and identify man-size targets out to at least the maximum effective range of their personal weapons during all conditions (daylight, limited visibility, & darkness) by integrating multiple capabilities into a single system. - Continued Engineering and Development portion of Awareness for Lightweight Engagements and Remote Targeting (ALERT) to develop large aperture, lightweight lens with enhanced fields of view. - Continued the Engineering and Development portion of Semi-Autonomous Fires Technology (SAFT) to develop semi-autonomous fire control systems for use in next generation remote weapons systems, to enhance performance and minimize gunner/operator burden. - Continued investigation of the scalability of variable effects conventional munitions, gun, and propulsion technologies for improving firepower effectiveness while increasing affordability and decreasing logistics burden in support of expeditionary warfare. - Continued development of precision fires engagement technologies, to include trajectory shaped 81mm mortars, 83mm missiles, and smaller precision munitions. - Initiated High Reliability Dual Purpose Improved Conventional Munitions (DPICM) Replacement (HRDR) to include projectile integration, lethality enhancement, fuze setting integration and aerodynamic and aerospace technologies. ***FY 2017 Plans:*** - Continue all efforts of FY 2016, less those noted as completed above. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017, less those noted as completed above.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2223 / *Marine Corps ATD*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Initiate the advanced technology portion of Caseless, Lightweight, Low-volume Round (CLLVR) to develop lightweight, small caliber ammunition for individual, crew served, and remotely mounted weapons. ***FY 2018 OCO Plans:*** N/A					
Title: FORCE PROTECTION	9.519	10.720	10.043	0.000	10.043
Description: This activity supports the Force Protection Thrust's Advanced Technology Demonstration efforts in the areas of individual Marine platforms, equipment and autonomous systems. This includes technologies to enable detection, neutralization, breaching, and clearing of explosive hazards from the beach exit to inland objectives. Efforts supported under Force Protection also include the demonstration of technologies such as Air Defense/Counter Rocket, Artillery, and Mortar (CRAM) and counter tactical surveillance and targeting, including pre-shot sniper detection, technologies in support of maneuver warfare, small unit distributed operations, and technologies for improved Personnel Protective Equipment for individual protection against blast, ballistic, and blunt impact threats. ***FY 2016 Accomplishments:*** - Continued development of technologies to defeat side/top attack and advanced fuze mines through signature reduction and advanced signature duplication. - Continued development of technologies to locate and defeat IEDs. - Continued development of technologies to defeat advanced mine fuzes (seismic, acoustic, and infrared). - Continued Warfighter modeling and simulation efforts for the Warfighter-as-a-System analysis approach and methodology combining survivability, mobility, and warfighter performance parameters. - Continued demonstration of laser technology readiness for battlefield employment. - Continued physics-based characterization of signatures of proud/buried targets/explosive hazard indicators across the spectrum of applicable detection modalities using knowledge/investigation of target physics. - Continued a program to demonstrate the fusion of multiple modes of detection of explosive hazards into a single system. - Continued development of advance modular and scalable personal protective equipment utilizing advances in mobility/survivability modeling and simulation, materials, and bio-fidelic surrogates. - Continued development of materials and helmet systems that absorb/dissipate blast shock waves. - Continued an advanced technology demonstration for modular mission packages for the detection, neutralization, marking and reporting of explosive hazards using multiple, existing vehicles in movement to contact and amphibious raid scenarios.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2223 / *Marine Corps ATD*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued an advanced technology demonstration for autonomous vehicles in the detection, neutralization, marking and reporting of explosive hazards using multiple, existing vehicles in movement to contact and amphibious raid scenarios. - Continued an advanced technology demonstration that detect and classify tactical surveillance and targeting threats before engagement from a moving platform. - Continued an integrated technology demonstration to develop a system of systems that addresses route reconnaissance and clearance for a Marine Expeditionary Unit(MEU). - Continued a project to develop organic technology solutions for the detection and clearance of explosive hazards and obstacles encountered by Marine Corps forces during amphibious operations. - Continued a project to investigate the detection and neutralization of explosive hazards in multiple, diverse, environments. - Continued a program to fuse multiple technologies that will detect and classify tactical surveillance and targeting threats before engagement from a moving platform. - Continued projects to develop Personnel Protection Equipment (PPE) through novel Modular, Tailorable and scalable design concepts which increase survivability and operational suitability to the warfighter. - Continued broad based material (ceramics, fiber and Fiber Re-Enforced Plastics) to demonstrate the possibility of significant weight reductions (greater than 50%) can be achieved. - Completed Anti-Tank Guided Missile (ATGM) effort to defeat ATGMs in complex urban environment.					
FY 2017 Plans: - Continue all efforts of FY 2016, less those noted as completed above. - Complete a program to fuse multiple technologies that will detect and classify tactical surveillance and targeting threats before engagement from a moving platform. - Complete development of materials and helmet systems that absorb/dissipate blast shock waves. - Initiate an advanced technology demonstration that uses Warfighter modeling and simulation efforts and advanced materials to create, test, and evaluate modular and scalable personal protective equipment.					
FY 2018 Base Plans: - Continue all efforts of FY 2017, less those noted as completed above. - Complete Warfighter modeling and simulation efforts for the Warfighter-as-a-System analysis approach and methodology combining survivability, mobility, and warfighter performance parameters. - Complete an advanced technology demonstration that detect and classify tactical surveillance and targeting threats before engagement from a moving platform.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Complete an integrated technology demonstration to develop a system of systems that addresses route reconnaissance and clearance for a MEU. - Complete development of advance modular and scalable personal protective equipment utilizing advances in mobility/survivability modeling and simulation, materials, and bio-fidelic surrogates. - Complete projects to develop Personnel Protection Equipment (PPE) through novel Modular, Tailorable and scalable design concepts which increase survivability and operational suitability to the warfighter. - Complete broad based material (ceramics, fiber and Fiber Re-Enforced Plastics) to demonstrate the possibility of significant weight reductions (greater than 50%) can be achieved. ***FY 2018 OCO Plans:*** N/A					
Title: HUMAN PERFORMANCE, TRAINING & EDUCATION ***Description:*** This activity addresses the applied research effort of the Human Performance Training and Education thrust (HPT&E). The HPT&E thrust investment profile is directed at two technology investment areas, Warrior Resilience, and Decision Making and Expertise Development. Warrior Resilience efforts are focused on advanced training technologies and methodologies that enhance neural, cognitive, and physical readiness. Decision Making and Expertise Development efforts are focused on training and education technologies and methodologies that accelerate the development and improve the retention of skills in decision making, situation awareness, and individual and team adaptability and coordination on decentralized, dynamic and dispersed battlefields. The FY2017 to FY2018 decrease in HPT&E investment is due to completion of an agent-based surrogate instructor development environment (ASIDE), the acceleration and completion of a Marine augmented classroom environment (ACE) effort that will enhance instructors' teaching performance training to optimize the use of resilience skills (TOURS) and the completion of the USMC Basic School's project to test the efficacy of simulation based training in the school's curriculum. ***FY 2016 Accomplishments:*** - Continued the development of small-unit training for adaptability and resiliency in decision making (SUDM), to enhance the Marine Air Ground Task Force's capabilities by training and equipping small-unit leaders to handle the demanding complexities and possess the adaptive mindset necessary to operate across the spectrum of conflict; empowering our strategic corporals as well as all of our junior leaders to fight, operate, and win in this challenging security environment.	12.352	13.207	6.833	0.000	6.833

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Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2223 / *Marine Corps ATD*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued design and development of a Marine augmented classroom environment (ACE) that will enhance instructors' teaching performance and student learning outcomes. - Continued design and development of a test-bed and conduct The Basic School evaluation to test the efficacy of simulation based training in that curriculum. - Continued development and demonstrate an agent-based surrogate instructor development environment (ASIDE) to allow USMC to field small-team focused intelligent training solutions. - Continued development of an individualized fatigue countermeasure training tool for Marines that will provide increased fatigue resilience training effectiveness, improved fatigue management and reduced fatigue-related operational errors. - Continued development of a master instructor development system (MIND) which will provide measurement framework to support the development of master instructors by creating a developmental model of instructor mastery. - Completed the development of training to optimize the use of resilience skills (TOURS), specifically develop and iterate training modules for relapse prevention, deployable refresher training, supports for transfer climate and social support for small unit leaders. - Completed design and development of methods for establishing optimal training intervals for the Marine Corps Martial Arts Program (MCMAP) for improvement in physical performance and warrior mindset. - Initiated the development of measures of training effectiveness that connect training tasks with measures of performance under various stressors.					
FY 2017 Plans: - Continue all efforts of FY 2016, less those noted as completed above. - Complete design and development of a test-bed and conduct The Basic School evaluation to test the efficacy of simulation based training in that curriculum. - Complete development and demonstrate an agent-based surrogate instructor development environment (ASIDE) to allow USMC to field small-team focused intelligent training solutions. - Complete design and development of a Marine augmented classroom environment (ACE) that will enhance instructors' teaching performance and student learning outcomes. - Initiate a holistic model solution that leverages previous efforts in warrior resilience and fitness to enhance performance and mitigate injuries at the infantry small unit level.					
FY 2018 Base Plans: - Continue all efforts of FY 2017, less those noted as completed above.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Complete development of an individualized fatigue countermeasure training tool for Marines that will provide increased fatigue resilience training effectiveness, improved fatigue management and reduced fatigue-related operational errors. - Complete development of a master instructor development system (MIND) which will provide measurement framework to support the development of master instructors by creating a developmental model of instructor mastery. - Initiate adaptive training techniques to support training efficacy and efficiency. ***FY 2018 OCO Plans:*** N/A					
Title: INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR) ***Description:*** This activity supports the demonstration of technologies to enhance situational awareness and tactical decision making through automated analysis, fusion of data, rapid integration of information, and acquired knowledge resulting in actionable intelligence at the lower command levels. The activity includes the demonstration of ISR efforts involving enhanced reconnaissance and persistent surveillance, and sensors for unmanned ground and aerial vehicles. Advanced Technology demonstrations also include the collection of information [monitoring, sensing, and locating] in the 3D urban battlespace as well as exploiting information [identifying and classifying data] as part of the intelligence preparation of the battlespace in order to facilitate operational maneuver and distributed operations. The FY2017 to FY2018 increase in the ISR Activity funding is due the initiation of research on deriving node and network signatures that are predictive of future behavior by modeling node attributes, interactions and the content of published communication and the initiation of research on applying recommendation theory to assist the effectiveness of intelligence and operations staffs. ***FY 2016 Accomplishments:*** - Continued research on the development of automated data tagging algorithms that enable connected graphs of structured and unstructured data. - Continued technology development required to enable tactical UAS on-board processing of terabytes of data in real time. - Continued development of a user composable search and display capability enabled by map reduce technology.	4.576	5.170	7.829	0.000	7.829

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued project to improve the enterprise recognition of critical tactical information relevant to real-time mission execution. - Continued research on technologies needed to tailor information delivery to warfighters based on mission context and user preferences. - Continued project to demonstrate the feasibility of analytic populated big data architectures to populate and maintain a global knowledge environment relevant to rapid turn amphibious mission planning. - Continued project to develop a set of video analytic classifiers (entity, behavior, and scene) that can run in a power efficient manner in embedded hardware. - Continued project to improve expeditionary force capabilities to discover and process data across integrated cross domain systems. - Continued project to enable the synchronized planning and management and ISR assets given a set of disparate mission information requirements. - Continued project to enhance the extraction of target quality information from unregistered unstructured images and imagery. - Continued effort to automate the design and conduct of use cases relevant to tactical information requirements. - Continued research to develop a capacity to run tracklet fusion, track analysis and data to track or track to track correlation as a distributed service run as a map-reduce job, both forensically and in real time. - Continued research to develop a prototype system capable of maintaining the entity models needed for entity co referencing during real time natural language processing workflows. - Continued research on the development of a capability to automate the extraction of video events relevant to mission information needs in real time on power efficient hardware. - Continued research on implementing orchestrated advanced analytics running across cloud and non-cloud based architectures. - Completed new Actionable Intelligence for Expeditionary and Irregular Warfare efforts which include Human Network Decision Modeling and the fusion across modeling approaches to increase prediction accuracy. - Completed the development of a workflow manager capable of cloud service discovery and configuration. - Completed Tagging, Tracking, and Locating efforts to demonstrate a system that will automatically translate large amounts of wide area surveillance data into tracks, useful to expose entity to entity associations; build urban context, as well as detect events and anomalies; and associate objects, tasks, locations and events for creating actionable intelligence. - Completed research to develop concept based information retrieval from unstructured data sources based on structured grammars or intensity vectors.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Initiated project to optimize the collection planning process through automation by automatically generating sensor plans, automating the production of information products, and delivering the most relevant information to the warfighters to enable rapid response in an evolving intelligence environment. - Initiated project to develop a capability to automatically deliver mission relevant information to an agile tactical unit based on mission ontologies, user preferences and high level descriptions of information needs. - Initiated project to develop a capability that will track and enhance mission readiness enabled by a dynamic machine understanding of mission information needs, a matured sensor optimization ability and operations research applied to course of action analysis. - Initiated the development of level 1 and level 2 fusion capabilities applied to complex graphs. - Initiated the development of cost functions for predictions made from data embedding spaces. - Initiated the development of complex event detection that is informed by entity pedigree.					
FY 2017 Plans: - Continue all efforts of FY 2016, less those noted as completed above. - Complete research on the development of automated data tagging algorithms that enable connected graphs of structured and unstructured data. - Complete technology development required to enable tactical UAS on-board processing of terabytes of data in real time. - Complete research to develop a capacity to run tracklett fusion, track analysis and data to track or track to track correlation as a distributed service run as a map-reduce job, both forensically and in real time. - Complete research to develop a prototype system capable of maintaining the entity models needed for entity co referencing during real time natural language processing workflows. - Complete research on technologies needed to tailor information delivery to warfighters based on mission context and user preferences. - Complete project to enhance the extraction of target quality information from unregistered unstructured images and imagery. - Initiate the development of a knowledge informed workflow manager capable of generating workflows automatically in response to alert conditions. - Initiate the development of power efficient neuro inspired algorithms for machine understanding.					
FY 2018 Base Plans: - Continue all efforts of FY 2017, less those noted as completed above. - Complete project to improve expeditionary force capabilities to discover and process data across integrated cross domain systems.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Complete development of a user composable search and display capability enabled by map reduce technology. - Complete project to improve the enterprise recognition of critical tactical information relevant to real-time mission execution. - Complete research on the development of a capability to automate the extraction of video events relevant to mission information needs in real time on power efficient hardware. - Complete research on implementing orchestrated advanced analytics running across cloud and non-cloud based architectures. - Complete the development of complex event detection that is informed by entity pedigree. - Initiate research to derive node and network signatures from node attributes, interactions and published communications, and causality between topics and sentiments to enable prediction of future behavior and events. - Initiate research on applying recommendation theory to assist the effectiveness of intelligence and operations staffs. ***FY 2018 OCO Plans:*** N/A					
Title: USMC FUTURE NAVAL CAPABILITIES	18.255	20.150	26.803	0.000	26.803
Description: This R-2 Activity, formerly named Littoral Combat/Power Projection (LC/PP), addresses the advanced technology development associated with the Marine Corps' participation in the Department of the Navy's (DoN) Future Naval Capabilities (FNC) Program. Investments in this activity are coordinated with similar and non-duplicative efforts in PE 0603673N Future Naval Capabilities Advanced Technology Development, where the Navy's participation in the FNC Program is funded. The FNC Program represents the requirements-driven, delivery-oriented portion of the DoN Science and Technology (S&T) portfolio. FNC investments respond to Naval Technology Gaps generated by Integrated Process Teams (IPTs) that are co-managed by Navy and the Marine Corps flag/general officers with representation across the naval research enterprise. FNC funding is aligned to naval challenges that may be associated with any of the FNC focus areas (i.e., Pillars). FNCs contain both 6.2 Applied Research and 6.3 Advanced Technology Development Budget Activity (BA) components as technology is matured from a Technology Readiness Level (TRL) of 3 or 4 to a TRL of 6.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
The FY 2017 to FY 2018 increase in the USMC Future Naval Capabilities Activity is due to realigning funds within the PE for the initiation of the Fuel Efficient Technology Suite and Water Speed Enhancement efforts in FY 2018. ***FY 2016 Accomplishments:*** - Continued development of wide area surgical and persistent surveillance technologies (WASPS). - Continued Automated Processing for Spectral Exploitation and Dissemination (APSED) - Integrate and conduct laboratory tests of air-to-ground embedded processing capabilities. - Continued Compact Wide Area Reconnaissance and Spectral Sensor (CWARSS) - Finalize the design of the multi-access hardware architecture to accommodate Electro-Optic/Infra-Red (EO/IR) and hyperspectral sensors. - Continued development of spectral and reconnaissance imagery for tactical exploitation (SPRITE). - Continued Target Processing Center (TCP) Radar/Context Fusion by developing and testing algorithms to amplify or dampen threat surfaces based on Rules of Engagement (ROE). - Continued Target Processing Center (TCP) Radar Fusion and False Track Mitigation - Test and improve radar fusion and false track mitigation technologies within a relevant environment. - Continued development of the Ground Based Air Defense On-the-move high energy laser demonstrator (GBAD). - Continued Data Conditioning - Develop pattern recognition algorithms that can work against large Ground Moving Target Indicator (GMTI) data sets. - Continued Network Adaptive Communication Services - Develop gateway-mediated exchange mechanisms for existing or new gateways, and information sources using network awareness and multi-mode protocol adaptations. - Completed development of technologies to enable the exchange of actionable information at the tactical edge. - Completed development of the Azimuth and Inertial MEMS Navigation System (AIM). - Completed development and transition of Expeditionary Fighting Vehicle(EFV) obstacle detection capability to EFV Direct Reporting Program Manager (Expeditionary Fighting Vehicle Obstacle Avoidance System (EFVODS)). - Completed the development of algorithms capable of improving the accuracy of the threat picture in a targeting processing center. - Completed development of modular scalable effects prototype weapon. - Completed development of tactical urban breaching technologies. - Completed development of counter improvised explosive devices technologies.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Completed development of advanced survivability and mobility technologies for Marine Corps tactical and combat vehicles. - Completed 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. ***FY 2017 Plans:*** - Continue all efforts of FY 2016, less those noted as completed above. - Continue development of Densified Propellant Fire From Enclosure/Enclosed Space (DP FFE/CS)enabling capability; specifically the analysis to incorporate tungsten into the SMAW Block 2 rocket motor propellant to decrease the detrimental effects of launch back-blast and over-pressure in confined spaces. (Effort was previously funded by PE 0603673N Future Naval Capabilities Advanced Technology Development) - Complete EMW-FY12-03 Wide Area Surgical And Persistent Surveillance (WASPS). - Complete SHD-FY13-02 Ground Based Air Defense On-The-Move (GBAD). - Initiate development of Advanced Topcoat System - Ground Vehicle Enabling Capability (EPE-FY16-01); specifically the formulation development of a high performance, zero-isocyanate Chemical Agent Resistant Coating (CARC) system that provides enhanced corrosion resistance and improved operational functionality on ground vehicle platforms. - Initiate the development of a high reliability distributed fuzing system for the 155mm DPICM projectile. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017, less those noted as completed above. - Complete Densified Propellant Fire From Enclosure - Confined Space (FFE/CS) Propulsion Technologies - Test and demonstrate the final system configuration from the Shoulder-Launched Multipurpose Assault Weapon (SMAW) and prepare a Level 2 drawing package. - Initiate EMW-FY18-01 ACV 1.X Fuel Efficient Technology Suite - Conduct a drive-cycle and component-characterization analysis of alternatives to determine optimum gains for various technology pairings. - Initiate EMW-FY18-01 Marine Corps portion of ACV 1.X Water Speed Enhancement (this effort is co-funded in PE 0603673N Future Naval Capabilities Advanced Technology Development) - Estimate seaway loads to feed the hull design and conduct material studies and testing to identify the most promising materials. ***FY 2018 OCO Plans:*** N/A					
Title: LOGISTICS	13.160	14.061	9.500	0.000	9.500

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Description: 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 four pillars: efficient and responsive force sustainment, planning and directing logistics operations, logistics demand reduction, and fleet maintenance. These pillars are thoroughly integrated and perpetually related in execution. The FY 2017 to FY2018 decrease in the Logistics Thrust Activity is due to the completion of infrastructureless In-Transit Visibility (ITV) technologies to enable asset tagging, tracking, locating, and monitoring anywhere in the expeditionary supply chain, as well as the completion of multiple energy related projects to include storage and hybrid smart grid technologies. ***FY 2016 Accomplishments:*** - Continued analysis of material alternatives for automated vehicle health monitoring and reporting. - Continued demonstration of advanced concepts for mobile infrastructure. - Continued efforts to improve advanced electrical power generation from fuel cells and renewable sources as well as to improve the efficiency of conventional generation via hybridization and smart-grid technologies. - Continued integration and demonstration of advanced materials to reduce maintenance into selected vehicle and machinery components. - Continued the development of robotic systems to facilitate the packaging and handling of logistic supplies. - Continued a field demonstration of renewable energy devices and deployable equipment showing fewer liabilities when delivering expensive fuel, thereby lowering Marine Corps operational costs. - Continued operations research and analysis efforts to enhance seabased expeditionary supply chain concepts and technologies. - Continued development of alternative (non-electrochemical) energy storage technologies for hybrid power system load management. - Continued development of low energy desalination technologies to allow for efficient salt-water purification at the small/individual scale. - Continued the development of anti-fouling and non-fouling water purification components to enable enduring performance of small water purification systems.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued the development of real-time water quality monitoring systems for use with small scale water purification systems. - Continued the development of efficient water packaging and distribution technologies. - Completed exploring the development of portable fuel cell technologies capable of providing Power in the 100 Watt to 500 Watt power range. - Completed integration and demonstration of electrochemical ultracapacitors into hybrid electric power systems. - Initiated development of infrastructureless In-Transit Visibility (ITV) technologies to enable asset tagging, tracking, locating, and monitoring anywhere in the expeditionary supply chain. - Initiated the development of modular thermoacoustic systems capable of acting as power generation or heat-pump devices. - Initiated the development of alpha-particle semiconductors to harness energy from alpha-emitting materials and create ultra-high energy density nuclear batteries. - Initiated the development of ultra-high efficiency piezoelectric devices. - Initiated the development of intelligent microgrid systems for the expeditionary unit.					
FY 2017 Plans: - Continue all efforts of FY 2016, less those noted as completed above. - Complete integration and demonstration of advanced materials to reduce maintenance into selected vehicle and machinery components. - Complete analysis of material alternatives for automated vehicle health monitoring and reporting. - Complete demonstration of advanced concepts for mobile infrastructure. - Complete the development of robotic systems to facilitate the packaging and handling of logistic supplies. - Complete efforts to improve advanced electrical power generation from fuel cells and renewable sources as well as to improve the efficiency of conventional generation via hybridization and smart-grid technologies. - Complete operations research and analysis efforts to enhance seabased expeditionary supply chain concepts and technologies. - Complete development of alternative (non-electrochemical) energy storage technologies for hybrid power system load management. - Complete a field demonstration of renewable energy devices and deployable equipment showing fewer liabilities when delivering expensive fuel, thereby lowering Marine Corps operational costs. - Complete development of infrastructureless In-Transit Visibility (ITV) technologies to enable asset tagging, tracking, locating, and monitoring anywhere in the expeditionary supply chain.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Complete the development of modular thermoacoustic systems capable of acting as power generation or heat-pump devices. - Complete the development of alpha-particle semiconductors to harness energy from alpha-emitting materials and create ultra-high energy density nuclear batteries. - Complete the development of intelligent microgrid systems for the expeditionary unit. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017, less those noted as completed above. - Complete the development of ultra-high efficiency piezoelectric devices. ***FY 2018 OCO Plans:*** N/A					
Title: MANEUVER ***Description:*** The Maneuver Thrust Technology Area focuses on the development, demonstration, and transition of technologies that will increase the warfighting capabilities and effectiveness of current and future Marine Corps maneuver systems. This Thrust aims at capturing emerging technologies in the areas of mobility, materials, propulsion, survivability, durability, signature reduction, modularity, and unmanned systems. The emphasis is on enhancing capabilities for manned and unmanned ground platforms in support of Marine Corps expeditionary warfare objectives including: Expeditionary Force-21, Operational Maneuver from the Sea, Ship to Objective Maneuver, SeaBasing, and sustained operations ashore. ***FY 2016 Accomplishments:*** - Continued development of fuel efficiency and battlefield power systems for improved performance. - Continued survivability improvements and technologies to mitigate acceleration and traumatic brain injuries to occupants to enhance tactical mobility and survivability. - Continued advanced suspension systems development with ride height adjustment, ride quality adjustment, rollover prevention, and load equalizing systems for USMC tactical wheeled platforms to enhance tactical mobility in support of Distributed Operations. - Continued a survivability/active protection systems improvement effort to increase effectiveness of defeat (Pdefeat) of shoulder launched RPG type threats and ATGM threats on light platforms utilizing non-kinetic kill technologies.	13.435	14.576	13.598	0.000	13.598

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued efforts evaluating the current ground fleet platforms for their mobility and control capabilities as they relate to inclusion of an autonomous vehicle capability that will provide support to the dismounted Marine during Enhanced Company Operations (ECO). - Continued efforts to demonstrate integrated armor solutions that provide lighter weight armor materials with enhanced protection to vehicle occupants thereby enhancing tactical mobility and survivability. - Continued the development of autonomy technologies and system concepts that will enable unmanned ground vehicles (UGVs) to be used as autonomous logistic connector vehicles. - Continued the development of fuel saving vehicle technologies, including advanced transmission, power train, and electrical power system technologies. - Continued mobility technologies that enable improved vehicle/warfighter agility and stability. - Continued lightweight armor, material, and structural technologies that enable maneuver and survivability of small, light expeditionary platforms. - Continued survivability technologies that enable defeat of all unitary and tandem RPG and select ATGM threats, and the demonstration of survivable vehicles. - Continued the development of technologies that enable vehicle component modularity and reduce life cycle costs. - Continued development of a Combat S&T Vehicle demonstrator to enhance crew survivability and vehicle fuel efficiency. - Continued new mobility efforts for On-Board Vehicle Power to increase mobile exportable power for Diesel Electric Propulsion Concepts and a Fuels effort to investigate future fuel alternatives for internal combustion engines to include Fischer-Tropsch and coal gasification processes for use in military tactical wheeled vehicles. - Continued Maneuver Enabling Technologies such as Vehicle Stabilization to improve vehicle suspension and control technologies to stabilize the platforms themselves to improve ride quality, shoot on the move capability and human systems integration. - Continued development of a vehicle demonstrator that focuses on enhanced crew survivability. - Continued the development of autonomous perception technologies to enable operations under adverse atmospheric conditions. - Completed a Vehicle Demonstrator program to design and fabricate an Integrated Power Demonstrator platform capable of producing the power needs for mobility and survivability concept demonstrations. - Completed advanced electromagnetic armor technology development efforts.					
FY 2017 Plans: - Continue all efforts of FY 2016, less those noted as completed above.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continue programs to address and enhance maneuver capability gaps in mobility such as efforts, transitioned from 6.2, aimed at the development of an autonomous vehicle capability that will provide mobility and logistics support to the dismounted Marine during Enhanced Company Operations (ECO). - Complete studies to identify technology development plans to close identified force protection capability gaps. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017, less those noted as completed above. - Complete development of a vehicle demonstrator that focuses on enhanced crew survivability. ***FY 2018 OCO Plans:*** N/A					
Title: EXPEDITIONARY CYBER	0.000	0.000	4.000	0.000	4.000
Description: This activity supports the Cyber Advanced Technology Development program which is intended to provide freedom of maneuver and influence in the Cyber-Electronic Warfare domain while simultaneously denying the same to the adversary and protecting critical command systems. Technologies are being developed using a multi-disciplinary approach that combines RF electronics, digital signal processing, computer engineering, software engineering, machine learning and data science to support Naval Expeditionary warfighters operating with size, weight and power constrained equipment in disrupted, intermittent, low bandwidth environments (DIL). Areas of advanced technology development include urban RF mapping, RF-enabled cyber payloads, Cyber payload delivery architecture, Cyber battle damage and collateral damage assessment, anomaly detection, cognitive active authentication and full spectrum expeditionary cyber training. The increase from FY17 to FY18 is the result of realignment of resources for a more focused investment in Marine unique Expeditionary Cyber at the tactical edge to include protecting platforms, autonomous systems, sensors, and critical infrastructure. ***FY 2016 Accomplishments:*** N/A ***FY 2017 Plans:*** N/A ***FY 2018 Base Plans:*** - Initiate a USMC Expeditionary Cyber Advanced Technology Activity addressing Cyber at the Tactical edge.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Initiate RF-enabled cyber payloads. - Initiate low SWAP distributed precision time transfer. - Initiate cognitive authentication. ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	86.525	93.355	94.664	0.000	94.664

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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. 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)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
2297: *Futures Directorate*	0.000	41.861	47.061	59.743	-	59.743	47.443	48.392	48.392	49.360	Continuing	Continuing

A. Mission Description and Budget Item Justification

As a subordinate organization under the Deputy Commandant, Combat Development and Integration (DC, CD&I), the mission of the Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) is to identify future challenges and opportunities, develop warfighting concepts, and comprehensively explore options in order to inform the combat development process to meet the challenges of the future operating environment. DC, CD&I is designated as the United States Marine Corps (USMC) Advocate for Science and Technology (S&T). MCWL's Commanding General (CG) is the DC, CD&I designated Proponent of USMC S&T and serves as the USMC Executive Agent for Marine Corps S&T. The MCWL/FD also serves as the Marine Corps' liaison to the Joint Staff for Joint Concept Development and Experimentation; thereby facilitating service-specific experiments as well as participation in joint service experimentation.

The current MCWL/FD Campaign Plan addresses how the Naval Services must reshape their capabilities in order to meet the concepts and Concepts of Operations (CONOPS) called for in the Secretary of the Navy's "Cooperative Strategy 21" and the Marine Corps' capstone "Expeditionary Force 21 (EF21)" concept, according to the objectives of the Commandant of the Marine Corps' guidance to develop the future Marine Corps Force 2025. Execution of the MCWL/FD Campaign Plan results in recommendations to Marine Corps advocates and proponents so that they may more cohesively and logically structure the future Navy and Marine Corps team. In support of the Marine Corps' role to provide an ever-ready quick strike force to protect US interests, MCWL/FD pursues concepts and new capabilities focused on the Marine Air-Ground Task Force (MAGTF). The MAGTF is the Marine Corps' doctrinal, task organized, force deployment package. It consists of four elements: the Command Element that provides overarching command and control (C2) of the entire force; the Ground Combat Element normally built around a core infantry unit with supporting armor, artillery, and other ground units; the Aviation Combat Element which provides aircraft, air defense, and other aviation functions; and the Logistics Combat Element which consists of combat service support (CSS) elements including medical, supply, and transportation. Marine Corps Force 2025 also seeks to maximize the employment of electronic, information, and cyber warfare, as well as manned/unmanned teaming, within each element of the MAGTF. MCWL/FD also examines future enhancements in training, organization, and equipment. MCWL/FD accomplishes its mission through five subordinate Divisions:

Futures Assessment Division's (FAD's) mission is to: research, examine, and describe plausible future security environments 15 to 30 years into the future. Knowledge of these future security environments will provide an estimate of possible future threats, challenges, and opportunities, to include: the rise of possible partners and adversaries, emerging disruptive technologies, and likely sources of conflict. This work is largely accomplished through research, seminar participation, and coordination with various experts in academia, the intelligence community, and think tanks.

The mission of Concepts and Plans (CAP) Division is to: examine select future security environments, emerging warfighting opportunities and challenges, and Naval warfare and joint/coalition integration and capabilities, in order to develop Marine Corps Service concepts and CONOPS to promote development of the emergent Marine Corps force. CAP is responsible for the production of formally published concepts, CONOPS, and options for future force organization and posture that describe how the Marine Corps will operate and fight.

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Wargaming Division conducts formal wargames to frame emerging warfighting concepts, establish the Joint context for the Marine Corps Force Development System, and identify opportunities for development of experimental and non-experimental capabilities.

Experiment Division conducts live force concept-based experimentation to facilitate exploration of prototype and surrogate technologies, as well as Tactics, Techniques, and Procedures (TTPs), in order to better refine equipment requirements and to identify Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) initiatives needed to produce future capabilities.

Science and Technology (S&T) Division conducts investigations and assessments to identify, modify where appropriate, and evaluate technological capabilities that support advanced warfighting concepts, and to explore the military utility of promising new commercial or government technologies in support of urgent and compelling needs. MCWL/FD investigates the relevance to EF21 capabilities and gaps of advanced technologies according to the following EF21 derived Thrust Areas: Command, Control, Communications, and Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR); Autonomy and Robotics; MAGTF Fires; Maneuver; Expeditionary Logistics (to include Expeditionary Energy); Expeditionary Medicine; Cyber and Electronic Warfare (EW); and Force Protection.

MCWL/FD investments encompass inquiries into multiple warfighting areas, including: CSS and Force Protection; MAGTF C4; MAGTF ISR; Fires, Targeting, and Maneuver; and Warfighting Excellence.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: COMBAT SERVICE SUPPORT (CSS) AND FORCE PROTECTION	6.252	10.785	18.206	0.000	18.206
Description: This activity includes MCWL/FD CSS and force protection experimentation efforts including assessment of equipment, new Tactics, Techniques, and Procedures (TTP), training programs, and proposed organizational changes associated with enhanced capabilities. Although this category covers a few small (less than $500K per FY) efforts being pursued by MCWL/FD, most programs listed below are considered major (valued at $500K or more) or have near real-time operational impact. Investments in this activity may be conducted under the Thrust Areas of Expeditionary Logistics, Expeditionary Medicine, Force Protection, or Autonomy and Robotics. The FY 2016 to FY 2017 increase in category funding is attributable to a shift in radar technology use (due to lack of technological advances as well as availability), while investigating systems that can identify, neutralize, or destroy unmanned systems. This realization led to increased costs due to exploring additional/alternative radar capabilities. In addition, increased emphasis on logistics enablers, prototype autonomous air delivery technology purchases, and expanded efforts to enable standoff detection of Improvised Explosive Devices (IEDs) caused funding to increase.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
The funding increase from FY 2017 to FY 2018 is primarily attributable to initiation of the integration and experimentation with DARPA-initiated Vertical Take-Off and Landing (VTOL) developed technology for a full scale, modular multi-mission unmanned air system (UAS). ***FY 2016 Accomplishments:*** - Continued to develop and experiment with bio-sciences (medical) technologies. - Continued assessment of unmanned ground logistics delivery technologies that support infantry small unit operations. - Continued research and assessment of technologies that reduce the demand required to support the MAGTF. - Continued testing and assessment of logistics enablers in support of EF21 experimentation. - Continued assessment and experimentation with technologies that provide enhanced medical care over a distributed battlefield, to include "virtual" care and the use of autonomous systems in support of medical evacuation over ground, surface (water), or air. - Continued evaluation and assessment of emerging technologies that support energy demand reduction. - Continued investigation and assessment of logistics related emerging autonomous air delivery technologies and capabilities that further enhance current Programs of Record (PORs) and influence future planning and decision making. - Continued evaluation and experimentation with technologies that can identify, neutralize, or destroy unmanned systems (aerial, ground, or surface). - Completed a MCWL-Defense Advanced Research Projects Agency (DARPA) partnership for the development and demonstration of a MCWL centric legged robot in an effort to "Lighten the Load" of individual Marines. - Initiated research and assessment of advanced manufacturing techniques to determine military utility in expeditionary environments. - Initiated assessment and experimentation to understand the relevance of autonomy to ship to shore surface connectors. - Initiated assessments and experimentation with advanced technologies to enable standoff detection of IEDs. ***FY 2017 Plans:*** - Continue all efforts of FY 2016, less those noted as complete above. - Complete development and experimentation with bio-sciences (medical) technologies. - Complete research and assessment of technologies that reduce the demand required to support the MAGTF. - Initiate development and assessment of enhanced seabased medical capabilities in support of the MAGTF. ***FY 2018 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continue all efforts of FY 2017, less those noted as complete above. - Complete evaluation and assessment of emerging technologies that support energy demand reduction. - Complete research and assessment of advanced manufacturing techniques to determine military utility in expeditionary environments. - Initiate assessments and experimentation in order to provide logistics common operational picture for commanders and logistics planners across the area of operations. - Initiate assessments and experimentation on technologies which will either mask signatures generated by MAGTF elements across the signature spectrum (seismic, aural, electronic, visual) or will enable the MAGTF to deceive adversaries as to the true friendly locations. - Initiate integration and USMC experimentation of DARPA-developed technology for a full scale, modular, VTOL multi-mission UAS platform. ***FY 2018 OCO Plans:*** N/A					
Title: FIRES, TARGETING, AND MANEUVER	4.782	3.071	6.114	0.000	6.114
Description: This activity includes Marine Corps Warfighting Laboratory / Futures Directorate (MCWL/FD) experimentation efforts in the areas of fires, targeting, and maneuver including assessment of equipment, new Tactics, Techniques, and Procedures (TTP), training programs, and proposed organizational changes associated with enhanced capabilities. Although this category covers a few small (less than $500K per FY) efforts being pursued by MCWL/FD, most programs listed below are considered major (valued at $500K or more) or have near real-time operational impact. Investments in this activity will be conducted under the Thrust Areas of MAGTF Fires, Maneuver, and Autonomy and Robotics. The funding decrease from FY 2016 to FY 2017 reflects reduced levels of investment in autonomous swarming technologies and the completion of airborne and ground weaponized autonomous/semi-autonomous "man-in-the-loop" system evaluations and assessments. FY funding increase from 2017 to FY 2018 reflects expanding investigations in weaponized unmanned ground autonomous systems and initiating assessment and experimentation with munitions that enhance small tactical unit threat engagement abilities. ***FY 2016 Accomplishments:*** - Continued development and assessment of weaponized unmanned ground robotic systems.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued development of technologies that enhance the utility of autonomous systems. - Continued research, development, and experimentation with weapons and other ground combat systems that enhance the combat effectiveness of small units operating in the urban littorals. - Continued investigation of innovative technologies to enhance squad-level capabilities. - Continued evaluation and assessment of both airborne and ground weaponized autonomous/semi-autonomous "man-in-the-loop" systems. - Completed test and assessment of future ship to shore connectors that support EF21. - Initiated assessment and experimentation into the utility of robotic systems as platforms to support target acquisition and designation. - Initiated assessment of the expeditionary utility of autonomous swarming technologies for unmanned air and ground systems. ***FY 2017 Plans:*** - Continue all efforts of FY 2016, less those noted as complete above. - Complete evaluation and assessment of both airborne and ground weaponized autonomous/semi-autonomous "man-in-the-loop" systems. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017, less those noted as complete above. - Initiate assessment and experimentation with a suite of robust, responsive, and accurate munitions that will provide the small tactical unit with a capability to engage threat targets beyond engagement of current line-of-sight or indirect fire weapons in complex environments. ***FY 2018 OCO Plans:*** N/A					
Title: MARINE AIR-GROUND TASK FORCE (MAGTF) COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTERS (C4) ***Description:*** This activity encompasses all MCWL/FD C4 related experimentation efforts including assessment of equipment, new Tactics, Techniques, and Procedures (TTP), training programs, and proposed organizational changes associated with enhanced C4 capabilities. Although this category covers a few small (less than $500K per FY) efforts being pursued by MCWL/FD, most programs listed below are considered major (valued at $500K or more) or have near real-time operational impact. Investments in this activity will be conducted under the Thrust Areas of C4ISR and Cyber/EW.	10.020	9.770	10.525	0.000	10.525

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
The funding increase from FY 2017 to FY 2018 reflects increased efforts in Tactical Cyber/EW. ***FY 2016 Accomplishments:*** - Continued development and assessment of a MAGTF network management system. - Continued a follow-on effort to test and evaluate an integrated C2 application in support of EF21 experimentation. - Continued development and assessment of systems that permit Unmanned Aerial System (UAS) operations in a global positioning system (GPS) denied environment. - Continued development and assessment of a configurable C2 suite that enhances operations from aviation platforms in support of EF21 experimentation. - Continued investigations and assessment of technologies that support C2 enablers for shore deployed MAGTF elements that is platform agnostic and capable of deployment from the sea, air, or ground. - Continued evaluation and experimentation with emerging technologies that support future maritime C2 capabilities/EF21. - Completed development and assessment of a configurable C2 suite that enables operations from alternate seabased platforms in support of EF21 experimentation. - Completed development and assessment of a configurable C2 suite that enhances operations from L-Class shipping in support of EF21 experimentation. - Completed development and assessment of technologies that support a maritime Fly-In Command Element (FICE) capable of operating from the sea-base during the conduct of immediate crisis response operations. - Initiated assessment and experimentation with integration and interoperability of software applications to increase the situational awareness, lethality, and survivability of distributed tactical ground formations. ***FY 2017 Plans:*** - Continue all efforts of FY 2016, less those noted as complete above. - Complete development and assessment of a MAGTF network management system. - Initiate exploration, development, and experimentation of cyber/EW capabilities at the tactical level, to enable tactical operators to sense, visualize, and exploit the cyber/EW environment. - Initiate development and experimentation that enable seamless operations in a technology denied environment. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017, less those noted as complete above.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Complete development and assessment of a configurable C2 suite that enhances operations from aviation platforms in support of EF21 experimentation. - Initiate development and experimentation with new technologies for radio frequency (RF) signature reduction. - Initiate development and experimentation with enhanced/consolidated, MAGTF insert-able, and seamless over-the-horizon (OTH), on-the-move (OTM), and at-the-halt (ATH) communications capabilities which will support missions without pre-planned coverage areas. - Initiate development and experimentation with mission management capabilities (to be used by mounted and dismounted ground forces) that include sensor processing and exploitation, multi-sensor integration and control, multi-platform coordination, and situational awareness. ***FY 2018 OCO Plans:*** N/A					
Title: MARINE AIR-GROUND TASK FORCE (MAGTF) INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR) ***Description:*** This activity includes MCWL/FD ISR related experimentation efforts including assessment of equipment, new Tactics, Techniques, and Procedures (TTP), training programs, and proposed organizational changes associated with enhanced ISR capabilities. Although this category covers several small (less than $500K per FY) efforts being pursued by MCWL/FD, most programs listed below are considered major (valued at $500K or more) or have near real-time operational impact. Investments in this activity will be conducted under the Thrust Areas of C4ISR and Autonomy and Robotics. The decrease in funding from FY 2016 to FY 2017 reflects the completion of development and assessment of enhanced Unmanned Aerial System (UAS) sensor packages. The FY 2017 to FY 2018 increase is due to investigating, developing and/or assessing technologies that: reduce tactical surprise, automate UAS management, improve ground autonomy, and address employment concepts for information operations. ***FY 2016 Accomplishments:*** - Continued development and assessment of seabased and landing force ISR capabilities that enable EF21 experimentation. - Continued development, integration, and assessment of technologies to fuse multiple sensor payloads into a single user interface to enable utility for tactical operators.	5.619	4.048	6.414	0.000	6.414

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued development and assessment of enhanced UAS sensor packages. - Continued examination and assessment of technologies that support future employment of UAS operations from seabased platforms. ***FY 2017 Plans:*** - Continue all efforts of FY 2016. - Complete development and assessment of enhanced UAS sensor packages. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017, less those noted as complete above. - Initiate development and assessment of technologies that reduce tactical surprise by providing a self/air deployable UAS capable of dashing ahead of MV-22 aircraft to conduct final reconnaissance of objective area to update threat situation in route to objective area. - Initiate development and assessment of an expeditionary drone deployment system (in order to automate UAS ground handling, control, launch, and recovery) to enable mission-level tasking and untrained operations of a fleet of small UAS. - Initiate investigations on employment concepts for information operations at the tactical level, including an assessment of technological developmental requirements. ***FY 2018 OCO Plans:*** N/A					
Title: MARINE CORPS WARFIGHTING LABORATORY / FUTURES DIRECTORATE (MCWL/FD) OPERATIONS (SUPPORT) ***Description:*** MCWL/FD Operations (Support) efforts include overall MCWL/FD experimentation doctrine, planning, analysis, data collection, as well as technology transition tracking efforts. Programs listed below are considered major (valued at $500K or more) or have near real-time operational impact. The FY 2016 to FY 2017 as well as the FY 2017 to FY 2018 increases are attributable to increased levels of technical/engineering support needed to facilitate experimentation objectives. ***FY 2016 Accomplishments:*** - Continued to synthesize results and lessons learned into proposed DOTMLPF recommendations for the Marine Corps. - Continued to provide technical, strategic, and managerial support to Marine Corps experimentation.	10.782	11.682	12.418	0.000	12.418

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued to provide overall analysis and reporting of experimentation efforts, analytical assistance during experiment design, and maintenance of an ad-hoc analysis capability. - Continued deliberate broad-based commercial technology forecasting in support of experimentation long-range planning and combat development. - Continued technical, strategic, and managerial support for operations with advanced technology utilizing autonomy, robotics, and cyber capabilities. ***FY 2017 Plans:*** - Continue all efforts of FY 2016. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017. ***FY 2018 OCO Plans:*** N/A					
Title: WARFIGHTING EXCELLENCE ***Description:*** This activity includes Marine Corps Warfighting Laboraroty / Futures Directorate (MCWL/FD) efforts in the development and assessment of joint and service warfighting concepts, joint and service missions, analysis of emerging threats and opportunities, and joint capability experimentation. It also includes MCWL/ FD service experimentation in areas that impact multiple warfighting functions. Although this category covers several small (less than $500K per FY) efforts being pursued by MCWL/FD, most programs listed below are considered major (valued at $500K or more) or have near-real-time operational impact. The FY 2016 to FY 2017 increase in category funding is attributable to increased wargaming and involvement/ participation in joint arena technology demonstration programs with an ultimate aim to rapidly field needed capabilities by capitalizing on emergent technologies and innovational operational concepts. The FY 2017 to FY 2018 decrease in category funding is due to: reducing funds provided for joint programs in order to focus on assessing FY 2017 investment outcomes/progress as well as the completion of experimentation focused modeling and simulation development/assessments. ***FY 2016 Accomplishments:*** - Continued executive agent responsibilities for the Marine Corps Title Ten (X) Wargame, Expeditionary Warrior, as well as the Joint and other service Title X programs, such as the United States Army's Unified Quest, the Air	4.406	7.705	6.066	0.000	6.066

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Force's Unified Engagement and Futures wargame, and the Navy Global wargame. Title X war games address future capabilities in the context of Title X readiness responsibilities. - Continued management and oversight of non-Title X Wargaming, including the highly visible Office of the Secretary of Defense Net Assessment Transformation War Game series and the Special Operations Command wargaming series. - Continued to support the core Center for Emerging Threats and Opportunities (CETO) mission to: provide broad-based technical and analytical support for Marine Corps combat development and experimentation programs at the component, Service, and Joint levels. This support includes the full spectrum of combat development-related missions and tasks to include the assessment of plausible future security environments and the identification of future threats, adversaries, opportunities, technologies, strategic settings, and associated geographic, environmental, economic, and demographic conditions in order to inform the development of innovative warfighting concepts, CONOPS, and capabilities across the DOTMLPF spectrum. Serve as a catalyst to stimulate thought and debate on issues of importance to the Marine Corps. - Continued funding contributions to Joint Concept Technology Demonstrations (JCTDs) and Emerging Capability Technology Demonstrations (ECTDs) (formerly known as Advanced Concept Technology Demonstrations (ACTDs)). Both JCTDs and ECTDs are intended to rapidly field needed capabilities by using emergent mature technologies matched with innovative operational concepts. - Continued development and assessment of modeling and simulation hardware, software, and training capabilities that support planning/experimentation processes. ***FY 2017 Plans:*** - Continue all efforts of FY 2016. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017. - Complete development and assessment of modeling and simulation hardware, software, and training capabilities that support planning/experimentation processes. ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	41.861	47.061	59.743	0.000	59.743

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603640M / *MC Advanced Technology Demo*	**Project (Number/Name)** 2297 / *Futures Directorate*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

The primary objective of this PE is the development, demonstration, and assessment of technologies that represent capabilities to meet unique Marine Corps needs in conducting Expeditionary Maneuver Warfare in the future. 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.