Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy											Date: February 2018	
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 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	137.190	154.407	150.245	-	150.245	142.377	141.111	143.901	146.829	Continuing	Continuing
2223: *Marine Corps ATD*	0.000	91.213	94.664	103.176	-	103.176	94.386	93.146	94.988	96.920	Continuing	Continuing
2297: *Futures Directorate*	0.000	45.977	59.743	47.069	-	47.069	47.991	47.965	48.913	49.909	Continuing	Continuing

A. Mission Description and Budget Item Justification

This PE addresses demand signals emphasized by the Commandant of the Marine Corps, the Chief of Naval Operations, and the Chief of Naval Research, as well as those pulled from dynamic engagement with stakeholders. Research efforts are carefully selected to ensure they have the potential to expand warfighting capabilities, inform operational concepts and requirements development, and advance state of the art technology and scientific knowledge. Current guidance also highlights the need to accelerate our pace of development and guide the approach to rapid experimentation, prototyping, and learning.

As reflected in the Marine Corps Operating Concept, the current strategic guidance from the Commandant, expeditionary forces will conduct maneuver warfare in environments characterized by complex terrain, technology proliferation, information used as a weapon, a battle of signatures, and an increasingly contested maritime domain. Additionally, an emergent operation stressor is the contested urban environment which exemplifies the characterizations listed above. The urban environment is one of the most complex terrains with physical compartmentalization and canalization, additional physical dimensions (subterranean and multi-story structures), crowded conditions and associated threat obscuration, communications challenges, informational and human aspects, and proliferation of observation and fires technologies. This environment requires capabilities addressing all the activities within this PE and while it provides many challenges, unique opportunities are also presented and can further shape technology approaches.

These future challenges and portents demand robust technologies for the Marine Corps, but the technology options are constrained. They must have a lightweight deployable character, and the ability to operate in austere conditions with little fixed infrastructure or support while retaining the agility and lethality of an integrated maneuver force. Technology must provide full spectrum capability against robust and complex peer and near-peer adversaries while meeting size, weight, power, cost (SWAP-C) limitations, and information availability within distributed, intermittent and limited (DIL) environments.

The approach within this PE encompasses ideas that support both revolutionary and evolutionary capabilities, and in this way considers and balances both "push" and "pull" aspects of technology projects. This PE matures technologies emerging from PE 0602131M to develop concept prototypes and initial experimentation to confirm feasibility in an environment relavent to operations. 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 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**
Previous President's Budget	140.416	154.407	142.368	-	142.368
Current President's Budget	137.190	154.407	150.245	-	150.245
Total Adjustments	-3.226	0.000	7.877	-	7.877
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.137	0.000			
• Program Adjustments	0.000	0.000	0.000	-	0.000
• Rate/Misc Adjustments	0.000	0.000	7.877	-	7.877
• Congressional General Reductions Adjustments	-0.089	-	-	-	-

Change Summary Explanation

The FY 2019 funding request was reduced by $0.701 million to reflect the Department of Navy's effort to support the Office of Management and Budget directed reforms for Efficiency and Effectiveness that include a lean, accountable, more efficient government.

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
2223: *Marine Corps ATD*	0.000	91.213	94.664	103.176	-	103.176	94.386	93.146	94.988	96.920	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds advanced research; technology demonstration, experimentation, and prototyping; and more technologically mature projects within the Future Naval Capability (FNC) process as means to inform, enhance, enable, and invent future concepts and capabilities with new S&T. This project is organized into ten activities, the core of which is represented by the eight Expeditionary Warfighting Capability Areas.

Emphasized within this project are increased efforts to actively demonstrate advanced technologies and system concepts. These demonstrations and experiments focus on the specific technologies, not necessarily their operational application, and vary based on the technical maturity of the project. This early technology exposure gives Marines a view into the future and enables them use their imagination and innovation to envision novel employment of the technology and inform the acquisition process.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS (C4)	6.790	7.500	6.480	0.000	6.480
Description: This activity investigates robust, resilient, and secure networked communications pathways and capability that support an expeditionary force's distributed and disaggregated operations. Research supports both networked and local computation for communications that exploits the expeditionary forces close physical proximity to threats while mitigating shortfalls commiserate within distributed, intermittent, and limited (DIL) environments. Expeditionary forces must operate in the cyber domain and in addition to defending communications networks, vehicles, and weapons systems, are reliant on electronic controllers for basic operations and as such are susceptible to cyberattacks. Technologies addressed within this activity include secure, robust, self-forming, mobile communications networks; distributed computing to support information dissemination to all echelons; improved capabilities in over-the-horizon, beyond line-of-sight, and restricted environment communications and sensors; and software and data processing to support formation of an appropriate common picture. Other efforts include power management, low detectability, conforming to SWAP-C constraints, and interoperability within the joint environment. Further, this activity integrates and demonstrates enhanced communications and situational awareness capabilities in experimental and warfighting environments reflecting USMC operations. Advanced technology resources will be developed and applied to complement commercial, other service, and defense agency					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
investments to produce a technology base addressing identified Marine Corps technology gaps. Focus will be on developing component level prototypes and experimentation in relevant environments. ***FY 2018 Plans:*** - Continue urban navigation with limited Global Positioning System availability demonstrations. - Continue demonstrations of improved urban communications capabilities. - Continue Advanced HF Antenna effort. - Initiate Advanced Cryptography Technology. - Initiate Adaptive Distributed Messaging. - Transfer all Tactical Cyber Warfare efforts to the Expeditionary Cyber Activity. ***FY 2019 Base Plans:*** The C4 research effort focuses heavily on the continued development and integration of multiple underlying technologies into subsystems and system with the purpose of demonstrating the tactical exploitation of information and the electromagnetic spectrum. To address resiliency requirements of C4 this effort is closely coordinated with the Expeditionary Cyber research portfolio also described herein so as to most efficiently exploit multifunction capabilities in portable reduced SWAP-C systems. This integrated rapid co-design, prototyping, and experimentation approach will reduce time needed to provide new capabilities to the US Marine Corps. Developed and demonstrated technologies will include signature management, interoperability, spectrum maneuver, damage assessment monitoring, and information dominance for tactical edge systems. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The decrease from FY2018 to FY2019 is due to reduced investment in C4ISR technologies and increased investment in ISR and Expeditionary Cyber technologies and associated Project Unit Activities in accordance with projected funding requirements and phasing across other Marine Corps ATD objectives and activities.					
Title: FIREPOWER ***Description:*** The activity investigates a large variety of weapons to provide the warfighter with a decisive, yet surgical, tactical advantage to collectively address 21st-century combined-arms warfare against peer and near-peer states. Research efforts increase the reach, lethality and capacity, while retaining mobility and tempo beneficial to expeditionary maneuver warfare. Maintaining focus on size, weight, power, cost (SWAP-C) and distributed, intermittent and limited (DIL) environments stresses the technical solutions available.	8.326	8.558	16.955	0.000	16.955

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
This activity furthers the maturity of researched technology solutions by also developing the integration required to effectively demonstrate and test emergent capabilities. Achieving a true combined arms state involves a full systems approach for both kinetic and non-kinetic capabilities all driven by a holistic targeting capability. 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, targeting, launch/ propulsion, lethality, and accuracy. ***FY 2018 Plans:*** - Continue development of targeting and engagement technologies for distributed operations collaborative fires integration and demonstrations. - Continue 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. - Continue Engineering and Development portion of Awareness for Lightweight Engagements and Remote Targeting (ALERT) to develop large aperture, lightweight lens with enhanced fields of view. - Continue 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. - Continue 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. - Continue development of precision fires engagement technologies, to include trajectory shaped 81mm mortars, 83mm missiles, and smaller precision munitions. - Initiate High Reliability Dual Purpose Improved Conventional Munitions (DPICM) Replacement (HRDR) to include projectile integration, lethality enhancement, fuze setting integration and aerodynamic and aerospace technologies. - 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 2019 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
This activity will finalize development of direct electrical ignition for caseless small caliber ammunition for integration and testing. Development of fuzing and sensor technologies for cannon-delivered area effects munitions will continue. Systems engineering of supervised-autonomous weapon system control will continue, implementing engagement logic, to develop and demonstrate the key enabling technologies and command and control methods for weaponized unmanned ground vehicles. Efforts will include prototype weapon systems for technical evaluation. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY 2018 to FY 219 supports development of the High Reliability Dual Purpose Improved Conventional Munitions (DPICM) Replacement (HRDR) program to increase the reliability of cluster munitions, which will lead to increased lethality while reducing collateral damage.					
Title: FORCE PROTECTION ***Description:*** This activity investigates new ways and means to protect forces and materiel across all operational settings, from contested sea-land surface interfaces to complex urban environments. The portfolio protects against adversaries' challenges such as guided-rockets and missiles, mobile coastal artillery, threat EW, and counter-ISR. Mines and obstacles both in the water and ashore also complicate amphibious landings. The activity invests in vehicle survivability aspects that are exacerbated due to SWAP-C constraints inherent to Marine Corps operation and the harsh nature of the amphibious environment. Technologies addressed include lightweight armor for ballistic and underbody blast protection, advanced sensors for counter tactical surveillance, active protection, and signature management. This activity also considers technology for payloads, packages and sensors that are needed by amphibious vehicles (both manned and unmanned) including mine counter measures; explosive hazard defeat systems; and obstacle and threat detection systems as well as technologies for improved protection for individuals against blast, ballistic and blunt impact threats. ***FY 2018 Plans:*** - Continued development of technologies to defeat side/top attack and advanced fuze mines through signature reduction and advanced signature duplication. - Continue development of technologies to locate and defeat IEDs.	10.474	10.043	10.794	0.000	10.794

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue development of technologies to defeat advanced mine fuzes (seismic, acoustic, and infrared). - Continue demonstration of laser technology readiness for battlefield employment. - Continue 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. - Continue a program to demonstrate the fusion of multiple modes of detection of explosive hazards into a single system. - Continue development of materials and helmet systems that absorb/dissipate blast shock waves. - Continue 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. - Continue 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. - Continue 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. - Continue a project to investigate the detection and neutralization of explosive hazards in multiple, diverse, environments. - Continue a program to fuse multiple technologies that will detect and classify tactical surveillance and targeting threats before engagement from a moving platform. - Continue 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. - 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. - 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.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- 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 2019 Base Plans:*** This activity is focusing efforts on integrating and fusing sensor modalities while experimenting with the effectiveness of automated target recognition algorithms in high clutter environments at high speed over off-road terrains. Work will emphasize signature management of vehicle systems and integrating the knowledge of our own susceptibility, intelligence estimates of threat capabilities, and in situ data to enhance situational awareness. Focus is also on lightweight protection systems in the area of active protection that provide hemispherical coverage while reducing the threat to dismounted forces. Last, research is being conducted on modular, scalable, integrated stand-off RF based explosive hazard (IED & Mines) detection system that can be operated as a remote or autonomous system. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: HUMAN PERFORMANCE, TRAINING & EDUCATION ***Description:*** This activity investigates two technology investment areas, warrior resilience, and decision-making and expertise development. Warrior resilience is focused on advanced training technologies and methodologies that enhance neural, cognitive, and physical readiness. Decision making and expertise development accelerates the development and improves the retention of skills in decision making, situation awareness, and individual and team adaptability and coordination on decentralized, dynamic and dispersed battlefields. Focus will be on developing component level prototypes for Marines to evaluate and experiment with. ***FY 2018 Plans:*** - Continue 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. - Continue design and development of a Marine augmented classroom environment (ACE) that will enhance instructors' teaching performance and student learning outcomes.	12.904	6.833	6.107	0.000	6.107

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue design and development of a test-bed and conduct The Basic School evaluation to test the efficacy of simulation based training in that curriculum. - Continue development and demonstrate an agent-based surrogate instructor development environment (ASIDE) to allow USMC to field small-team focused intelligent training solutions. - Continue the development of measures of training effectiveness that connect training tasks with measures of performance under various stressors. - Continue 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. - 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 2019 Base Plans:*** Rapid advances in wearable and human performance related technologies have provided the opportunity to demonstrate the utility of these technologies with Marine Corps populations to increase physical readiness and reduce injuries. The increased use of simulation-based training capabilities such as augmented reality offer the possibilities to demonstrate new capabilities, such as 3D visualization, that will accelerate and increase decision making. Efforts will support hardware, software, data collection and demonstrations to support increase decision making and expertise development and warrior resilience. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR) ***Description:*** This activity investigates enhanced 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 to decision-makers, especially those at the lower command levels. This includes biometric monitoring for expeditionary operations,	5.051	7.829	8.460	0.000	8.460

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
operational course of action (COA) development, and autonomous surveillance in support of distributed operations. Further, 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. ***FY 2018 Plans:*** - Continue research on the development of automated data tagging algorithms that enable connected graphs of structured and unstructured data. - Continue technology development required to enable tactical UAS on-board processing of terabytes of data in real time. - Continue research on technologies needed to tailor information delivery to warfighters based on mission context and user preferences. - Continue 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. - Continue project to develop a set of video analytic classifiers (entity, behavior, and scene) that can run in a power efficient manner in embedded hardware. - Continue 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. - Continue effort to automate the design and conduct of use cases relevant to tactical information requirements. - Continue 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. - Continue research to develop a prototype system capable of maintaining the entity models needed for entity co referencing during real time natural language processing workflows.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue 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. - Continue 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. - Continue 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. - Continue the development of level 1 and level 2 fusion capabilities applied to complex graphs. - Continue the development of cost functions for predictions made from data embedding spaces. -- Continue the development of a knowledge informed workflow manager capable of generating workflows automatically in response to alert conditions. - Continue the development of power efficient neuro inspired algorithms for machine understanding. - 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. - Complete project to improve expeditionary force capabilities to discover and process data across integrated cross domain systems. - 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. ***FY 2019 Base Plans:*** This activity will begin to divest investments in approximate computing for power efficiency. Research and develop prototype systems for machine question answering capabilities and in automating machine generation					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
of complex standard military information based products. Investments are also continuing in experimentation and demonstration in artificial intelligence relevant to decision support and sensor autonomy. Increased focus will be put on investments in technology to enable all sensors, weapons, platforms to be smarter and more capable of knowing why, when and how to collaborate. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: USMC FUTURE NAVAL CAPABILITIES	19.688	26.803	26.885	0.000	26.885
Description: This R-2 Activity 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 objective of the work in this PE is to develop promising technologies emerging from the FNC technology candidates funded in PE 0602131M that have been matured to higher Technology Readiness Levels (TRLs). Investments in this activity are coordinated with similar and non-duplicative efforts in PE 0603673N. The FNC Program was restructured for FY19 to accelerate transition to the Fleet and Force. This restructuring involved a zero based review of all ongoing FNC projects, where each effort was assessed for its technology maturity and transition commitment. Ongoing efforts were categorized as FNCs or Technology Candidates. Some efforts were terminated and others were accelerated to achieve the goals of the restructured program. Funding for FNCs, which have higher Technology Readiness Levels (TRLs of 4/5 to 6) and transition funding commitments, is being resourced in this PE. Funding for FNC technology candidates at lower TRLs (3 to 4) is being resourced in PE 0602131M. ONR is working closely with the Resource Sponsors and acquisition stakeholders to develop high priority technological capabilities needed by the operational forces. Prior to FY19, FNC Program investments were selected almost two years in advance of execution. It was determined by Navy and Marine Corps leadership that this approach limits DON's ability to exploit technology advances and respond quickly to naval needs. As a result, future BA 3 investments supporting the FNC Program are now made less than one year before commencing execution. Because FNCs are now starting at higher TRLs, the typical duration of an FNC has been shortened to 3-years. The FNC Program has been fully restructured in favor of a more direct and higher level of collaboration. Individual R-2 Activities have been discontinued and investments are organized to enhance collaboration with the acquisition stakeholders and their resource sponsors. A complete accounting of the technologies being developed and a full disposition of each					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
technology development effort referenced as continuing in the FY18 plans of this PE will be provided separately to the Congressional oversight committees. ***FY 2018 Plans:*** - Continue development of wide area surgical and persistent surveillance technologies (WASPS). - Continue Automated Processing for Spectral Exploitation and Dissemination (APSED) - Integrate and conduct laboratory tests of air-to-ground embedded processing capabilities. - Continue 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. - Continue development of spectral and reconnaissance imagery for tactical exploitation (SPRITE). - Continue Target Processing Center (TCP) Radar/Context Fusion by developing and testing algorithms to amplify or dampen threat surfaces based on Rules of Engagement (ROE). - Continue Target Processing Center (TCP) Radar Fusion and False Track Mitigation - Test and improve radar fusion and false track mitigation technologies within a relevant environment. - Continue development of the Ground Based Air Defense On-the-move high energy laser demonstrator (GBAD). - Continue Data Conditioning - Develop pattern recognition algorithms that can work against large Ground Moving Target Indicator (GMTI) data sets. - Continue 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. - Continue 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. - Continue the development of a high reliability distributed fuzing system for the 155mm DPICM projectile. - 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. ***FY 2019 Base Plans:*** The advanced technologies being developed under this R-2 Activity include, but are not limited to, those that focus on developing promising technologies emerging from the FNC Applied Research program that have been					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
matured to a Technology Readiness Level (TRL) of 4 to 5 in the areas of asymmetric and irregular warfare, distributed operations, information dominance, maneuverability, survivability, self-defense and expeditionary warfare. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: LOGISTICS ***Description:*** This activity investigates the practical discipline and real world application of the deployment, sustainment, reconstitution, and re-deployment of forces engaged in expeditionary operations. 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. This includes efficient and responsive force sustainment, planning and directing logistics operations, logistics demand reduction, fleet maintenance, and expeditionary energy. Expeditionary Energy enhances combat capability of expeditionary warfighters by increasing the efficiency and effectiveness of energy production, storage, distribution and use. Beyond traditional energy efforts, this portfolio also looks at other issues, including energy-efficient behaviors and hybridization of energy sources. These pillars are thoroughly integrated and perpetually related in execution. ***FY 2018 Plans:*** - Continue analysis of material alternatives for automated vehicle health monitoring and reporting. - Continue demonstration of advanced concepts for mobile infrastructure. - Continue 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. - Continue integration and demonstration of advanced materials to reduce maintenance into selected vehicle and machinery components. - Continue the development of robotic systems to facilitate the packaging and handling of logistic supplies. - Continue a field demonstration of renewable energy devices and deployable equipment showing fewer liabilities when delivering expensive fuel, thereby lowering Marine Corps operational costs. - Continue operations research and analysis efforts to enhance seabased expeditionary supply chain concepts and technologies.	13.739	9.500	9.553	0.000	9.553

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue development of alternative (non-electrochemical) energy storage technologies for hybrid power system load management. - Continue development of low energy desalination technologies to allow for efficient salt-water purification at the small/ individual scale. - Continue the development of anti-fouling and non-fouling water purification components to enable enduring performance of small water purification systems. - Continue the development of real-time water quality monitoring systems for use with small scale water purification systems. - Continue the development of efficient water packaging and distribution technologies. - Initiate development of infrastructureless In-Transit Visibility (ITV) technologies to enable asset tagging, tracking, locating, and monitoring anywhere in the expeditionary supply chain. - Initiate the development of modular thermoacoustic systems capable of acting as power generation or heat-pump devices. - Initiate 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 intelligent microgrid systems for the expeditionary unit. - Complete the development of ultra-high efficiency piezoelectric devices.					
FY 2019 Base Plans: This activity has development and demonstration of advanced technologies to anticipate and reduce maintenance demands while increasing reliability. This includes advanced technology demonstrations of advanced manufacturing methods including metal additive manufacturing (AM), friction stir welding and additive friction stir welding, and cold spray for structural repair of Marine Corps equipment, creation of near net shaped parts, and advanced part demonstrations. This also includes research into the digital thread of information and cyber security required, from cradle to grave, for digital manufacturing methods, from raw materials through design, production, and qualification of parts for Marine Corps applications. This research area also includes advanced technology demonstrations that predict vehicle health and prognostics of remaining useful life for military ground vehicles and equipment in support of Condition Based Maintenance goals, while seeking to automate CBM practices through automatic data retrieval and algorithm development. The activity also will demonstrate the military utility of enhancing combat capability by increasing energy production, storage, distribution, and curbing energy consumption of the individual Marine and other tactical assets. This includes advanced system research into the scaled use of high specific power solar cell for Marine					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Corps applications ranging from the individual warfighter to augmenting the power and combat endurance unmanned robotic vehicles. Additionally investigated, system level research and demonstration of enhanced power and energy technologies to support the Marine warfighter as a system, to include enhanced power and energy storage technology, more energy efficient equipment, and enhanced power networks that enhance mission duration, decrease combat load, and enhance combat performance. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: MANEUVER ***Description:*** This activity investigates new ways and means to land forces and material through contested sea-land surface interfaces and then conduct maneuver warfare. In order to enable future Amphibious Operations, research efforts will support autonomous operations across the sea-surf-ground environment, improved fuel efficiency and speed of amphibious vehicles, amphibious vehicle technologies, water performance, and amphibious payloads to change the dynamics of a surface amphibious assault. This includes the emergence manned-unmanned teaming and autonomous vehicle collaboration. The technologies included in this work address areas of mobility, materials, propulsion, signature reduction, modularity, and unmanned systems. ***FY 2018 Plans:*** - Continue development of fuel efficiency and battlefield power systems for improved performance. - Continue survivability improvements and technologies to mitigate acceleration and traumatic brain injuries to occupants to enhance tactical mobility and survivability. - Continue 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. - Continue 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.	14.241	13.598	13.467	0.000	13.467

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue 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). - Continue efforts to demonstrate integrated armor solutions that provide lighter weight armor materials with - Continue the development of autonomy technologies and system concepts that will enable unmanned ground vehicles (UGVs) to be used as autonomous logistic connector vehicles. - Continue the development of fuel saving vehicle technologies, including advanced transmission, power train, and electrical power system technologies. - Continue mobility technologies that enable improved vehicle/warfighter agility and stability. - Continue lightweight armor, material, and structural technologies that enable maneuver and survivability of small, light expeditionary platforms. - Continue survivability technologies that enable defeat of all unitary and tandem RPG and select ATGM threats, and the demonstration of survivable vehicles. - Continue the development of technologies that enable vehicle component modularity and reduce life cycle costs. - Continue development of a Combat S&T Vehicle demonstrator to enhance crew survivability and vehicle fuel efficiency. - Continue 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. - Continue 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. - Continue the development of autonomous perception technologies to enable operations under adverse atmospheric conditions. - 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 development of a vehicle demonstrator that focuses on enhanced crew survivability.					
FY 2019 Base Plans: This activity will develop and evaluate mobility technologies and future concepts for the ground and amphibious fleet to improve maneuverability across a range of challenging terrain environments. Work will emphasize					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
experimentation with autonomy approaches through both simulation and live events for amphibious vehicles from small low cost craft, traditional amphibious combat and assault vehicles, and landing craft. Additional focus will be on integrating real time precepts with learned information, a priori knowledge, and contextual understanding to facilitate informed autonomous decision making. There will be demonstration and experimentation with systems that enable intelligent planning, reasoning, learning, and control to affect tactically appropriate autonomous behaviors in littoral and urban environments. In addition efforts will be pursued in component technology and prototypes for future advanced manned expeditionary ground vehicles and amphibians. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: EXPEDITIONARY CYBER ***Description:*** This activity provides 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, limited environments (DIL). Areas of applied research include distributed precision time, predictive software defined radio architectures, coordinated Cyber and Spectrum maneuver to mitigate detection and exploitation, tactical Cyber visualization, discovering and mapping networks in dense urban environments, contextual awareness and blind channel characterization. ***FY 2018 Plans:*** - Initiate a USMC Expeditionary Cyber Advanced Technology Activity addressing Cyber at the Tactical edge. - Initiate RF-enabled cyber payloads. - Initiate low SWAP distributed precision time transfer. - Initiate cognitive authentication. ***FY 2019 Base Plans:*** The Expeditionary Cyber portfolio focuses heavily on the development and integration of multiple underlying technologies into subsystems and system demonstrations supporting experimentation. The Expeditionary Cyber	0.000	4.000	4.475	0.000	4.475

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
portfolio is also closely coordinated with the C4 research portfolio also described herein to efficiently exploit co-design opportunities and shorten development times needed to keep pace in an environment rapidly driven by Moore's Law. Battle damage assessment technologies are integrated into system sensor technologies to prove efficacy in an increased TRL application in cyber experimentation. Cyber experimentation will be performed on an autonomous system operating in a test range. Novel resilient cyber components and architectures integrated into a multi-function cyber-EW system will be demonstrated in a realistic electro-magnetic (EM) environment measuring performance. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY2018 to FY2019 is due to increase investment in autonomous cyber experimentation.					
Accomplishments/Planned Programs Subtotals	91.213	94.664	103.176	0.000	103.176

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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
2297: *Futures Directorate*	0.000	45.977	59.743	47.069	-	47.069	47.991	47.965	48.913	49.909	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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: COMBAT SERVICE SUPPORT (CSS) AND FORCE PROTECTION	8.658	18.206	8.142	0.000	8.142
Description: This activity includes MCWL/FD CSS and force protection experimentation efforts including assessment of equipment, new TTPs, training programs, and proposed organizational changes associated with enhanced capabilities. This area provides seabasing, expeditionary logistics, urban combat, and expeditionary medicine experimentation support. 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. ***FY 2018 Plans:*** - Continue assessment of unmanned ground logistics delivery technologies that support infantry small unit operations. - Continue testing and assessment of logistics enablers in support of EF21 experimentation. - Continue 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. - Continue evaluation and assessment of emerging technologies that support energy demand reduction.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue 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. - Continue evaluation and experimentation with technologies that can identify, neutralize, or destroy unmanned systems (aerial, ground, or surface). - Continue assessment and experimentation to understand the relevance of autonomy to ship to shore surface connectors. - Continue assessments and experimentation with advanced technologies to enable standoff detection of IEDs. - Continue development and assessment of enhanced seabased medical capabilities in support of the MAGTF. - 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 2019 Base Plans: Continue to develop prototypes and experiment with logistics enablers in support of dismounted operations and the EF-21 concept. This includes completing assessment and experimentation to understand the relevance of autonomy to ship to shore surface connectors to focus on development and experimentation with afloat and forward-deployed metal adaptive manufacturing. Continue to explore technologies and methodologies that reduce resource consumption and enhance sustainability of the distributed units. Pursue investigations and experimentation with independent, conditioned, reliable power sources to dismounted and/or distributed forces operating in austere conditions. Wrap-up assessments and experimentation in order to provide logistics common operational picture for commanders and logistics planners across the area of operations. Continue to develop and study technologies that enhance unit survivability; to include various aspects of critical care and medical related protocols and processes.					
FY 2019 OCO Plans:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding decrease from FY 2018 to FY 2019 is mainly attributable to an FY 2018 $10M investment to support integration and experimentation with a Defense Advanced Research Projects Agency (DARPA)-initiated Vertical Take-Off and Landing (VTOL) developed technology prototype for a full scale, modular multi-mission unmanned air system (UAS). Funding completes experimental prototype development, flight testing, and validation of operating characteristics.					
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 TTPs, training programs, and proposed organizational changes associated with enhanced C4 capabilities. The area provides cutting edge/enhanced over-the-horizon (OTH), beyond line of sight (BLOS), satellite and non-satellite based C4 capabilities to support experimentation. 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. ***FY 2018 Plans:*** - Continue development and assessment of systems that permit unmanned aerial system (UAS) operations in a global positioning system (GPS) denied environment. - Continue development and assessment of a configurable C2 suite that enhances operations from aviation platforms in support of EF21 experimentation. - Continue 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. - Continue evaluation and experimentation with emerging technologies that support future maritime C2 capabilities/EF21. - Continue assessment and experimentation with integration and interoperability of software applications to increase the situational awareness, lethality, and survivability of distributed tactical ground formations. - Complete development and assessment of a MAGTF network management system. - Continue 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.	8.931	10.525	8.614	0.000	8.614

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue development and experimentation that enable seamless operations in a technology denied environment. - Complete development and assessment of a configurable C2 suite that enhances operations from aviation platforms in support of Expeditionary Force 21 (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 2019 Base Plans:*** Continue to identify and assess a collaborative solution that provides tailorable OTH, OTM communications, situational awareness, and fires for the forward deployed MAGTF to include Digital Integration (DI). Experiment with a BLOS, OTH, OTM voice, data, and position location information network in an EF-21 environment. Conclude development and assessment of systems that permit UAS operations in a GPS denied environment. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding decrease from FY2018 to FY2019 is the result of the completion of selected efforts related to the development and assessment of a configurable C2 suite that enhances operations from aviation platforms in support of EF21 experimentation.					
Title: FIRES, TARGETING, AND MANEUVER	8.193	6.114	6.029	0.000	6.029
Description: This activity includes MCWL/FD experimentation efforts in the areas of fires, targeting, and maneuver including assessment of equipment, new TTPs, training programs, and proposed organizational changes associated with enhanced capabilities. This area increases FTM related troop environmental awareness, lethality, and mobility using fused sensors as well as unmanned weaponized and reconnaissance air and ground vehicle platforms to support experimentation. 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					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
$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. ***FY 2018 Plans:*** - Continue development and assessment of weaponized unmanned ground robotic systems. - Continue development of technologies that enhance the utility of autonomous systems. - Continue research, development, and experimentation with weapons and other ground combat systems that enhance the combat effectiveness of small units operating in the urban littorals. - Continue investigation of innovative technologies to enhance squad-level capabilities. - Continue assessment and experimentation into the utility of robotic systems as platforms to support target acquisition and designation. - Continue assessment of the expeditionary utility of autonomous swarming technologies for unmanned air and ground systems. - 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 2019 Base Plans:*** Continue to develop technologies, demonstrate, and experiment with robotic systems organic to an infantry company for intelligence collection, indirect fires, direct fires and breaching capabilities. Complete assessment of the expeditionary utility of autonomous swarming technologies for unmanned air and ground systems. Pursue company level precision guided munitions. Initiate efforts to provide a missile system with a real-time wireless data link to provide lethal beyond line of sight fires (sea-land and land-land) against static and moving targets in the urban littoral environment. Automate robotic control systems/software to reduce the burden of control and increase manned and unmanned teaming. Initiate and complete investigations into battery configuration and ruggedization as well as associated battery-driven gearbox of an amphibious electric all-terrain vehicle. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant difference between FY18 and FY19.					
Title: MARINE AIR-GROUND TASK FORCE (MAGTF) INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR)	2.887	6.414	4.376	0.000	4.376

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Description: This activity includes MCWL/FD ISR related experimentation efforts including assessment of equipment, new TTPs, training programs, and proposed organizational changes associated with enhanced ISR capabilities. Using a variety of fused sensors to mesh data, video, and images and incorporating a common tactical controller to operate multiple air and ground ISR platforms, this area enhances small unit situational awareness as well as exploitation and forward engagement ability via experimentation. 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. ***FY 2018 Plans:*** - Continue development and assessment of seabased and landing force ISR capabilities that enable EF21 experimentation. - Continue development, integration, and assessment of technologies to fuse multiple sensor payloads into a single user interface to enable utility for tactical operators. - Continue examination and assessment of technologies that support future employment of UAS operations from seabased platforms. - Continue assessment and experimentation with integration and interoperability of software applications to increase the situational awareness, lethality, and survivability of distributed tactical ground formations. - 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 2019 Base Plans:*** Continue to increase situational awareness of battlespace in order to defend against and repel enemy attacks in those domains at the company and lower echelons. Assess systems to combine sensor and telemetry data from multiple unmanned platforms (ground, surface (water), and air) in order to provide a more relevant and usable					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
tactical picture. Initiate efforts to provide a small, lightweight, semi-autonomous system that can self-navigate structure interiors while simultaneously visibly inspecting and creating real-time three-dimensional (3D) maps. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding decrease from FY2018 to FY2019 is due to a reduced investment in investigating, developing and/or assessing technologies that: automate UAS management efforts and narrowing focus on efforts that seek to enhance sensor payload management (focusing on commercial off-the-shelf small UASs).					
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. This area provides overarching experimentation doctrine, planning, management, technical/engineering support, analysis, data collection, and reporting. Programs listed below are considered major (valued at $500K or more) or have near real-time operational impact. ***FY 2018 Plans:*** - Continue to synthesize results and lessons learned into proposed DOTMLPF recommendations for the Marine Corps. - Continue to provide technical, strategic, and managerial support to Marine Corps experimentation. - Continue to provide overall analysis and reporting of experimentation efforts, analytical assistance during experiment design, and maintenance of an ad-hoc analysis capability. - Continue deliberate broad-based commercial technology forecasting in support of experimentation long-range planning and combat development. - Continue technical, strategic, and managerial support for operations with advanced technology utilizing autonomy, robotics, and cyber capabilities. ***FY 2019 Base Plans:*** Continue to provide encompassing experimentation doctrine, planning, analysis, and data collection in order to conduct relevant enactments and report on experimentation results. Look to the future and identify up	12.298	12.418	12.659	0.000	12.659

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
and coming (cutting edge) technology areas of interest. Provide generalized as well as specific program engineering, technical, and management support. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant difference between FY18 and FY19.					
Title: WARFIGHTING EXCELLENCE ***Description:*** This activity includes 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. ***FY 2018 Plans:*** - 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 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.	5.010	6.066	7.249	0.000	7.249

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- 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. - Complete development and assessment of modeling and simulation hardware, software, and training capabilities that support planning/experimentation processes.					
FY 2019 Base Plans: Continue to support the combat development process by helping to develop and refine emerging concepts, conceptualize force design, and identify future capabilities and deficiencies within future operating environments. This is accomplished by means of enhancing current functional capabilities by investigations into Next Generation Wargaming tools as well as conducting extensive wargaming as an augmentation to live force experimentation. Efforts include 11 planned wargames (4 large, 5 medium, and 2 small) with areas of interest covering EF21 related concepts. Focusing 15 to 30 years in the future, continue to offer top level identification and analysis of emerging asymmetric threats and opportunities. This is accomplished by capitalizing on a myriad of foresight assessments of future operating environments. Continue to develop, assess, and provide insight into joint efforts and warfighting concepts. Specific areas of investment include: 1) Demonstrating the military utility of a resilient, low-cost, effective, high-altitude balloon-borne communications platform that can be rapidly deployed to enhance warfighter communication capabilities and 2) Informing the development of distributed mobile amphibious (and ground) assault fuel logistics capabilities as well as demonstrating the feasibility of executing the concept in support of a "fight tonight" scenario using current fleet assets, by adapting current naval practices. Initiate investigations into candidate technologies that support urban operations, in an effort to identify/eliminate capability gaps and develop TTPs to include subterranean maneuver. This is an attempt to: 1) Develop a 5th generation force capable of ship to shore movement against a peer adversary, enabling distributed maneuver at varied distances and 2) Develop a 6th generation force capable of dominating the urban environment. The concepts: 1) Explore innovative delivery systems to augment current ability to maneuver troops, effects, and materiel from ship to shore in contested environments and 2) Involve integration by engineers and scientists with planners and operators to identify key capability concept areas for development.					
FY 2019 OCO Plans: N/A					
FY 2018 to FY 2019 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
The funding increase from FY2018 to FY2019 is due to investigations which focus on operating in urban environments.					
Accomplishments/Planned Programs Subtotals	45.977	59.743	47.069	0.000	47.069

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, 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.