Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Navy	Date: March 2024
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602131M *I Marine Corps Lndg Force Tech*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	0.000	76.962	59.208	53.758	-	53.758	58.512	61.835	63.071	64.397	Continuing	Continuing
2958: *Cyberspace Activities*	0.000	4.947	5.100	5.202	-	5.202	5.306	5.412	5.520	5.636	Continuing	Continuing
3001: *Marine Corps Landing Force Tech*	0.000	46.916	54.108	48.556	-	48.556	53.206	56.423	57.551	58.761	Continuing	Continuing
9999: *Congressional Adds*	0.000	25.099	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	25.099

A. Mission Description and Budget Item Justification

The U.S. Navy/Marine Corps team is the most potent naval fighting force in the world. Fundamental to their success are the technologies necessary for effective distributed maritime operations. The Office of Naval Research (ONR) combines knowledge of the naval mission with researchers to select and explore solutions critical to expeditionary warfighting needs.

This Program Element (PE) addresses requirements outlined in the Expeditionary Advanced Base Operations (EABO), which is a form of expeditionary warfare that involves the employment of mobile, reduced signature, operationally relevant, and relatively easy to maintain and sustain naval expeditionary forces from a series of austere, temporary locations ashore or inshore within a contested or potentially contested maritime area in order to conduct sea denial, support sea control, or enable fleet sustainment. Additionally, USMC forces must be ready for worldwide contingency operations, which frequently includes contested urban environments with complex physical and operational challenges. This can include 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. These operating environments require 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 limitations, and command and control systems that work within degraded, disconnected, intermittent and limited environments with reduced threat detectability.

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 Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Navy	Date: March 2024
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602131M *I Marine Corps Lndg Force Tech*

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

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	79.467	59.208	64.575	-	64.575
Current President's Budget	76.962	59.208	53.758	-	53.758
Total Adjustments	-2.505	0.000	-10.817	-	-10.817
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.505	0.000			
• Program Adjustments	0.000	0.000	-10.817	-	-10.817
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: 9999: *Congressional Adds*		
Congressional Add: *Unmanned Logistical Solutions*	7.239	0.000
Congressional Add: *5G biometric installation access control demonstration*	3.862	0.000
Congressional Add: *Microtube heat exchangers*	4.344	0.000
Congressional Add: *Modular multi-mode autonomous seeker*	9.654	0.000
Congressional Add Subtotals for Project: 9999	25.099	0.000
Congressional Add Totals for all Projects	25.099	0.000

Change Summary Explanation

Funding: The decrease in FY 2025 is due to higher Department priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy			Date: March 2024
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602131M / *Marine Corps Lndg Force Tech*	Project (Number/Name) 2958 / *Cyberspace Activities*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
2958: *Cyberspace Activities*	0.000	4.947	5.100	5.202	-	5.202	5.306	5.412	5.520	5.636	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Project 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 radio frequency electronics, digital signal processing, computer engineering, software engineering, machine learning and data science to support Naval Expeditionary Forces operating with size, weight, and power constrained equipment in denied, degraded, intermittent, or limited (DDIL) communications environments. 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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Title: Expeditionary Cyber	4.947	5.100	5.202	0.000	5.202
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 Radio Frequency 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 denied, degraded, intermittent, or limited (DDIL) communications. 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 2024 Plans: - Complete development of sense-making algorithms through machine learning for the cyber physical layer and algorithms to assist in supply chain validation that are designed for small form-factor tools. - Complete development of new portable tools to capture software configuration management to include malware on forward deployed systems. - Continue algorithm and tool development for Cyber-EW (Electronic Warfare) capabilities for tactical engagement. - Continue cyber threat identification (cyber health assessments) including vulnerability research of ubiquitous embedded systems focusing on devices commonly carried by Marines.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue research into the development of low space, weight and power (SWAP) cyber secure technologies that when integrated into a single platform will enable dismounted Marines to conduct EW/Cyber missions in a highly responsive, dynamically reprogrammable and modular standards based configuration. - Initiate development on distributed mission planning with multi-security enclaves on tactical Cyber-EW systems. - Initiate development of a generic microprocessor fuzzer for firmware on embedded devices that can be extended to legacy Naval systems. - Initiate the development of automated binary analysis tool that can attribute features from malware campaigns. - Initiate the development of fuzzing techniques designed for components located within the RF chain. ***FY 2025 Base Plans:*** - Continue to develop tools and algorithms for Cyber-EW (Electronic Warfare) capabilities for tactical engagement. - Continue research to identify cyber threats (cyber health assessments) including vulnerability research of ubiquitous embedded systems focusing on devices commonly carried by Marines. - Continue advanced development research of low size, weight and power (SWAP) cyber secure technologies that when integrated into a single platform will enable dismounted Marines to conduct Cyber-EW missions in a highly responsive, dynamically reprogrammable and modular standards based configuration. - Continue research development on distributed mission planning with multi-security enclaves on tactical Cyber-EW systems. - Continue to develop a generic microprocessor fuzzer for firmware on embedded devices that can be extended to legacy Naval systems. - Continue development of automated binary analysis tool that can attribute features from malware campaigns. - Continue the development of fuzzing techniques designed for components located within the RF chain. - Initiate research into novel techniques for the exploitation of information technology devices for warfighting utilization by distributed forces. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
Accomplishments/Planned Programs Subtotals	4.947	5.100	5.202	0.000	5.202

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy											Date: March 2024	
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602131M / *Marine Corps Lndg Force Tech*				Project (Number/Name) 3001 / *Marine Corps Landing Force Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
3001: *Marine Corps Landing Force Tech*	0.000	46.916	54.108	48.556	-	48.556	53.206	56.423	57.551	58.761	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds applied research; technology assessment, road mapping, and concept development; and less technologically mature projects within the Future Naval Capability (FNC) process as means to inform, enhance, enable, and invent future concepts and capabilities with new Science and Technology (S&T). This project is organized into ten activities, the core of which is represented by the eight Expeditionary Warfighting Capability Areas.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Title: Command, Control, Communications, and Computers (C4)	6.984	8.100	6.651	0.000	6.651
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 denied, degraded, intermittent, or limited (DDIL) communications 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 cyber attacks. 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 size, weight, power, cost constraints, and interoperability within the joint environment. ***FY 2024 Plans:*** - Continue developing portable technologies, precision pointing/tracking algorithms, software/hardware subsystem to extend surface connectivity over the horizon using low-signature optical communications. - Continue investigations to increase bandwidth and dynamic range of portable systems to increase real-time situational awareness and enable assured spectrum operations in a congested and contested Electromagnetic environment.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue development of electromagnetic signature management, countermeasures, and interoperability technologies utilizing machine learning in order to manage the control and exploitation of the electromagnetic spectrum. - Continue efforts to explore combined Electromagnetic Warfare (EW)/Cyber resilient communications and effects. - Initiate laboratory and outdoor test planning, information assurance and laser safety approval process for capability and flight integration. ***FY 2025 Base Plans:*** - Complete the development of portable technologies, precision pointing/tracking algorithms, software/hardware subsystem to extend surface connectivity over the horizon using low-signature optical communications. - Complete the investigations to increase bandwidth and dynamic range of systems that are portable to increase real-time situational awareness and enable assured spectrum operations in a congested and contested Electromagnetic environment. - Complete the development of electromagnetic signature management, countermeasures, and interoperability technologies that utilize machine learning in order to manage the exploitation of the electromagnetic spectrum. - Complete efforts set to explore combined Cyber-EW resilient communications and effects. - Complete laboratory and outdoor test planning, information assurance and laser safety approval process need to access the capability and flight integration for the technology. - Initiate development of survivable kinetic weapon initiation and guidance technologies able to operate in contested electromagnetic environments. - Initiate focused research effort into distributed electronic warfare technologies against advanced threats by relocatable ground systems. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding decrease from FY 2024 to FY 2025 reflects a reduction in Command, Control, Communications, and Computers (C4) investments to support higher Departmental requirements.					
Title: Firepower ***Description:*** The activity investigates a large variety of weapons technologies to enhance fires capabilities of Fleet Marine Forces as part of joint maritime campaigns to counter emerging threats and create new opportunities for the joint force to secure operational advantage. Research efforts increase range, lethality, and	3.298	4.400	5.557	0.000	5.557

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
capacity, while maintaining mobility and tempo to operate inside actively contested maritime domains, to achieve overmatch fires capabilities when operating within the landward portions of the littorals, and to provide weapons system capabilities able to persist when operating within the adversary's intelligence, surveillance, collection, and weapons ranges. The focus on low size, weight, power, and cost of weapons components and weapon systems, having low manpower and cognitive burdens to operate, with low logistics burdens, stresses technical solutions. Weapons system technologies being developed include fire control, launch and propulsion, precision guidance, navigation, and control, seekers, fuzing, and lethality. ***FY 2024 Plans:*** - Continue end-to-end navigation technology developments for Global Positioning System (GPS) absent conditions, suitable for shaping trajectories of extended range, precision guided munitions in satellite and network-denied environments. - Continue research into real-time, multi-spectral target detection and identification technologies for expanded applications to weapons optics, aviation targeting and navigation sensors, unmanned aircraft systems, missile seekers, and naval platforms, to improve anomaly and object detection during degraded visibility and long-range day and night situations, and to improve fire-and-forget logic algorithms. - Initiate experimental test series investigating the minimum explosive quantity needed to provide a prompt reaction in a cylindrical equivalent of small munition form factor, including formulation mix/cast/cure and hardware build. - Initiate research and development to shock hydrocode modeling for specific formulation enhanced blast reaction regime. - Initiate research and development to validated simulations for effect of casing on formulation reaction regime and performance. - Initiate experimental test series for case effects on performance including formulation mix/cast/cure and hardware build. ***FY 2025 Base Plans:*** - Continue research effort to analyze end-to-end navigation technology developments for Global Positioning System (GPS) absent conditions, suitable for shaping trajectories of extended range, precision guided munitions in satellite and network-denied environments. - Continue research into real-time, multi-spectral target detection and identification technologies for expanded applications to weapons optics, aviation targeting and navigation sensors, unmanned aircraft systems, missile					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
seekers, and naval platforms, to improve anomaly and object detection during degraded visibility and long-range day and night situations, and to improve fire-and-forget logic algorithms. - Continue research and experimentation test series investigating the minimum explosive quantity needed to provide a prompt reaction in a cylindrical equivalent of small munition form factor, including formulation mix/cast/cure and hardware build. - Continue developmental research to validated simulations for effect of casing on formulation reaction regime and performance. - Continue experimental test series for case effects on performance including formulation mix/cast/cure and hardware build. - Complete applied research and development to shock hydrocode modeling for specific formulation enhanced blast reaction regime. - Initiate development of extended range, economical, high lethality munitions capable of providing wide area of effect battlefield with reduced salvo sizes. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding increase from FY 2024 to FY 2025 is due to (1) the initiation of effort for development of extended range, economical, high lethality munitions capable of providing wide area of effect battlefield with reduced salvo sizes and (2) increase investments in Firepower to further align research to address longer-range and more lethal future firepower priorities.					
Title: Force Protection ***Description:*** This activity investigates new ways and means to protect forces and materiel across all domain threats in all operational settings, from contested maritime, air, and land domains, to include complex urban environments. The portfolio protects against adversaries' challenges such as guided-rockets and missiles, mobile coastal artillery, threat electronic warfare, and counter intelligence, surveillance and reconnaissance, and waterborne threats from ports, harbors, and in the littorals. Mines and obstacles, both in the water and ashore, also complicate amphibious operations. The activity invests in vehicle survivability aspects that are exacerbated due to size, weight, power, and cost constraints inherent to Marine Corps operations and the harsh nature of maritime environments.	6.548	7.750	6.230	0.000	6.230

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Technologies addressed can include lightweight armor for ballistic and underbody blast protection, advanced sensors for counter tactical surveillance, active protection, signature management, and exploration of expeditionary undersea warfare capabilities. 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 2024 Plans:*** - Continue computer vision/machine learning (CV/ML) approaches for detection and classification of obscured and camouflaged threats. - Continue to create multi-agent hardware and software components capable of autonomous operation in complex, contested, and congested environments, leading to autonomous systems that can operate without reliance on radio communications or Global Navigation Satellite System (GNSS). -Continue research in enabling technologies for countering unmanned aerial vehicles. This addresses both an increase in number and sophistication of threat systems to include kinetic and/or controlled interceptors with a specific focus on countering UAV swarms and scalable/low-cost approaches. - Continue focused research effort into high-power directed energy weapon systems for increased efficiency and scalable power, when used by ground platforms/assets against adversarial ground and air threats. -Initiate research to provide a solid-state High-Power Microwave prototype in a form factor that upon transition will enable the USMC to conduct advanced expeditionary base operations (EABO) while being capable of defeating Unmanned Aircraft System sUAS swarms and other unmanned systems in littoral regions. - Initiate experimentation on full scale dynamic assembly followed by open air source integration testing and lab based prototype antenna feed network & dynamic mount testing. -Initiate effort to provide an energy efficient, high rep-rate burst duration prototype driver that is the most compact modulator solution high power NLTLsv (Non Linear Transmission Lines) and relativistic beam sources with short pulse durations. Initiate research associated with enhanced waveform implementation. ***FY 2025 Base Plans:*** - Continue research to enable technologies for countering unmanned aerial vehicles. The effort will address both an increase in number and sophistication of threat systems to include kinetic and/or controlled interceptors with a specific focus on countering Unmanned Aerial Vehicles (UAV) swarms and scalable/low-cost approaches.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Complete computer vision/machine learning (CV/ML) approaches for detection and classification of threats that are obscured and camouflaged. - Complete research effort to create multi-agent hardware and software components capable of autonomous operation in complex, contested, and congested environments, leading to autonomous systems that can operate without reliance on radio communications or Global Navigation Satellite System (GNSS). - Complete research to provide a solid-state High-Power Microwave technology in a form factor that will enable the Marine Corps to conduct Expeditionary Advanced Base Operations (EABO) while being capable of defeating Unmanned Aircraft Systems (UAS) swarms and other unmanned systems in littoral regions. - Complete full scale dynamic assembly experimentation followed by open air source integration testing and lab based prototype antenna feed network & dynamic mount testing. - Complete effort to provide an energy efficient, high rep-rate burst duration technologies that is the most compact modulator solution high power Nonlinear Transmissions Line (NLTL) and relativistic beam sources with short pulse durations. - Complete research effort associated with enhanced waveform implementation. - Complete research effort focused on high-power directed energy weapon systems for increased efficiency and scalable power, when used by ground platforms/assets against adversarial ground and air threats. - Initiate research to counter emerging threats to expeditionary forces from directed energy weapons, including High-Powered Microwave (HPM) source or High-Energy Laser (HEL) - Initiate design and prototyping of a compact and affordable interceptor and seeker package for kinetic force protection, both afloat and ashore. - Initiate research of relevant technologies that support maritime terrain shaping and area denial concepts ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding decrease from FY 2024 to FY 2025 reflects a reduction in Force Protection investments to support higher Departmental requirements.					
Title: Human Performance, Training and 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	3.298	4.400	4.715	0.000	4.715

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
and improves the advancement in retention of skills in decision making, situation awareness, including individual and team adaptability and coordination on decentralized, dynamic and dispersed battlefields. ***FY 2024 Plans:*** - Continue research on algorithm development using advanced analytics techniques to generate predictions and recommend actions to improve physical readiness and performance. - Continue research on generalized approaches for adaptive training and assessment that minimizes the need for content and curriculum development, and improves learning outcomes and engagement. - Continue research in training and decision tools to provide information to the warfighter at the point of friction to enhance individual performance, mitigate negative aspects of combat, and reduce negative consequences of stressors (e.g., sleep) to improve readiness and resilience. - Continue research to expand and extend small unit leader training and education continuum to increase learning outcomes for the warfighter. - Complete research into implementation of state-of-the-art and science-of-learning based training techniques to improve the development of small unit decision-making expertise. ***FY 2025 Base Plans:*** - Continue algorithm development research using advanced analytics techniques to generate predictions and recommend actions to improve physical readiness and performance. - Continue research effort that focuses on generalized approaches for adaptive training and assessment that minimizes the need for content and curriculum development and improves learning outcomes and engagement. - Continue research in training and decision tools to provide information to the warfighter to enhance individual performance at the friction point, mitigate negative aspects of combat, and reduce negative consequences of sleep stressors to improve readiness and resilience. - Continue research focused on expanding and extending small unit leader training and education continuum to increase learning outcomes for the warfighter. - Initiate development of realistic adversary and friendly agents to reduce the need for human control in constructive simulation training while maximizing training objectives. -Initiate research effort to develop extended reality, synthetic agent, and training feedback technologies that provide realistic synthetic enemies, and assessment support to ensure Marines are trained effectively and learning the right skills on pace to meet Marine Corps requirements.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
-Initiate research effort to improve warfighter resilience, operational readiness, and reduce early end of active service attrition. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
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, operational Course Of Action (COA) development, and autonomous surveillance in support of distributed operations. ***FY 2024 Plans:*** - Continue design of artificial intelligence (AI) algorithms to inform and support command decision making by inferring adversarial intent, plans, and tactics from sensor data. - Continue effort to create new artificial intelligence (AI) algorithms to automate the parsing of naval communications to create a common operating picture for naval tactical operators. - Continue design of neural network algorithms to identify and counter adversarial deception. - Continue design of learning-enabled artificial intelligence (AI) algorithms to provide reactive and adaptive tactical and strategic planning for supporting small unit mission level operations. - Continue development of new artificial intelligence (AI) algorithms capable of developing tactical plans, utilizing existing games and military simulations to derive winning strategies. - Continue applied research for dynamic metadata that enable question and answering techniques. - Continue development of algorithms to understand and recognize patterns in common intelligence and tactical pictures, useful for decision support tools. - Continue initial prototyping of Artificial Intelligence (AI) and machine learning systems to automate mission planning and mission re-planning. - Continue development of end-to-end deep reinforced learning-based systems that can control a very large force of manned and unmanned platforms.	5.529	6.360	6.314	0.000	6.314

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue design and development of strong artificial intelligence decision support systems that avoid bad decisions even when presented with very noisy data. - Continue research in analytic algorithms and visualizations (e.g., smart graphs, network shaping metrics, actionable visualizations, and network fractures). - Continue research to help warfighters best employ deception systems, detect when adversaries engage their own systems, and design systems architecture to enable experimentation within virtual or live environments. - Initiate design and development of autonomous robotic solutions for conducting pervasive loitering surveillance in support of distributed operations.					
FY 2025 Base Plans: - Complete research effort to design artificial intelligence (AI) algorithms to inform and support command decision making by inferring adversarial intent, plans, and tactics from sensor data. - Complete research to create new artificial intelligence (AI) algorithms to automate the parsing of naval communications creating a common operating picture for naval tactical operators. - Complete research to design neural network algorithms to identify and counter adversarial deception. - Complete research to design learning-enabled artificial intelligence (AI) algorithms that will provide reactive and adaptive tactical and strategic planning for supporting small unit level operations. - Complete research development of new Artificial Intelligence (AI) algorithms capable of developing tactical plans, utilizing existing games and military simulations to derive winning strategies. - Complete research for dynamic metadata that enable question and answering techniques. - Complete development of algorithms useful for decision support tools to understand and recognize patterns in common intelligence and tactical pictures. - Complete development of Artificial Intelligence (AI) and machine learning systems to automate mission planning and mission re-planning. - Complete research of end-to-end deep reinforced learning-based systems that can control a very large force of manned and unmanned platforms. - Complete design and development research of strong Artificial Intelligence (AI) decision support systems that avoid bad decisions even when presented with very noisy data. - Complete research effort to analyze algorithms and visualizations such as smart graphs, network shaping metrics, actionable visualizations, and network fractures. - Complete research effort to assist warfighters best employ deception systems, detect when adversaries engage their own systems, and design systems architecture to enable experimentation within virtual or live environments.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602131M / *Marine Corps Lndg Force Tech*	**Project (Number/Name)** 3001 / *Marine Corps Landing Force Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Complete design and development research of autonomous robotic solutions to conduct pervasive loitering surveillance in support of distributed operations. -Initiate research efforts into advanced frameworks for conducting Artificial Intelligence (AI) and Machine Learning (ML) analysis during tactical mission planning and execution in support of high tempo operations. -Initiate research effort to provide augmented realty overlays, multi-modal interfaces, and communication aides to significantly improve Marines' situational awareness and speed the kill chain. - Initiate the development of frameworks for intelligent signal processing resource allocation management on individual expeditionary platforms in real time. - Initiate the development of dynamic range compression filters that enable wideband, high sensitivity reception to continue in the presence of uncooperative loud signals. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
Title: USMC FNC Technology Candidates	4.837	6.086	6.460	0.000	6.460
Description: This R-2 Activity addresses the applied research 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 Program Element (PE) is to develop and mature technologies needed by the Marine Corps to initiate FNCs in PE 0603640M Marine Corps Advanced Technology Development (ATD) that can be commenced at higher Technology Readiness Levels (TRLs). Investments in this activity are coordinated with similar and non-duplicative efforts in PE 0602750N Future Naval Capabilities Applied Research, where the Navy's participation in the FNC Program is funded. The FNC Program is structured to accelerate the transition of new technologies to the Fleet and Force. Each effort is assessed for its technology maturity and transition commitment. Funding for FNCs, which have Technology Readiness Levels (TRLs) of 4/5 to 6 and also have transition funding commitments from acquisition Programs of Record, are resourced in PE 0603640M Marine Corps Advanced Technology Development. Funding for technology candidates at lower TRLs (3 to 4) are resourced in this PE 0602131M, Marine Corps Landing Force Technology. ONR works closely with the Resource Sponsors and acquisition stakeholders to develop high priority technological capabilities needed by the operational forces. FNC Budget Activity (BA) 2 investments develop candidate FNC technologies in an agile fashion by exploiting technology advances that respond rapidly to naval needs. This approach facilitates an optimum response when					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
developing and maturing the technology options that can be developed further in PE 0603640M Marine Corps Advanced Technology Development (ATD). The FNC Program favors a high level of collaboration. PE R-2 activities are mostly organized by the Office of Naval Research (ONR) Departments, which are tasked to collaborate with the acquisition stakeholders and their resource sponsors. A complete accounting of the technology candidates being developed and a full disposition of each technology development effort funded in this PE is provided annually to the Congressional oversight committees. ***FY 2024 Plans:*** - Continue research in the area of Signature Management. - Continue research supporting multi-domain sensing of the electronic spectrum. - Continue the Command and Control Thrust with applied research in the area of integration and automated collaboration as a function of command and control. - Continue research to provide a secure tactical computing infrastructure allowing applications to be dynamically deployed to support mission tasking requirements. - Continue feasibility studies and prototype development to test new Logistics techniques and capabilities that support expeditionary ground operations. - Continue research in the area of on-site energy generation, storage and power management in support of Expeditionary Advanced Base Operations (EABO). ***FY 2025 Base Plans:*** FY25 Plans: - Complete focused research in the area of Signature Management. - Complete research effort to support multi-domain sensing of the electronic spectrum. - Complete applied research in the area of integration and automated collaboration as a function of command and control. This research aligns to the Command and Control Thrust. - Complete research development to provide a secure tactical computing infrastructure allowing applications to be dynamically deployed to support mission-tasking requirements. - Complete feasibility studies and prototype development research to test capabilities and new Logistics techniques that support expeditionary ground operations.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Complete research effort in the area of on-site energy generation, storage and power management in support of Expeditionary Advanced Base Operations (EABO). - Initiate design of artificial intelligence (AI) algorithms to inform and support command decision making by inferring adversarial intent, plans, and tactics from sensor data. - Initiate development of extended range, area effects munitions that combine state of the art seeker and warhead technology while reducing required munition salvo sizes. - Initiate development of an improved infrared search and track prototype for expeditionary platforms using higher efficiency imaging techniques for passive situational awareness and identification of maritime targets. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
Title: Logistics	6.208	6.400	6.314	0.000	6.314
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 2024 Plans:*** - Complete research to predict vehicle health and prognostics of remaining useful life for military ground vehicles and equipment in support of logistics planning, execution and combat support. - Complete research to advance enhancement of combat capability by increasing energy production, storage, and distribution including curbing energy consumption of the individual Marine and other tactical assets. - Complete activities to involve applied research into new, rugged, low cost, and high specific power solar cell technologies, including investigation into the stability of the solar cells. Investigate developing more energy efficient componentry as part of the Marine warfighter loadout.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Initiate research towards de-risking future resilient energy ecosystems that will rely on hybridized hydrogen-based architectures that include hydrogen production, storage, and integration with renewable energy and batteries. - Initiate to design and develop a light-weight, portable, highly efficient energy conversion system to harvest energy from the ocean to provide reliable, easy, and cheap renewable energy to dismounted warfighters. - Initiate development of two deep learning (DL)-based prognostic models based on event data and condition monitoring signals incorporating domain knowledge into prognostic models. - Initiate research regarding inhibitors to minimally trained operators performing first level repairs and identify solutions. - Initiate research into augmented reality (AR) human interface devices (HID) in support of effective heads up/ hands free use in battlefield environment when executing technical instructions for repair. - Initiate research to better understand the direction of ongoing digital supply chain/logistic information technology (Log IT) development to ensure leveraging to the maximum extent possible existing body of knowledge. - Initiate research leading to development of requirements for prognostic supply chain digital twin (SCDT) and model. - Initiate design of lighter and more effective body army through modeling and assemblage of layered materials that will protect against ballistic threats. - Initiate atmospheric exposure testing of novel poly(styrene-catechol) based adhesive pretreatment and ground vehicle demonstration for corrosion prevention.					
FY 2025 Base Plans: - Continue research towards de-risking future resilient energy ecosystems that will rely on hybridized hydrogen-based architectures that include hydrogen production, storage, and integration with renewable energy and batteries. - Complete the design and scaled prototyping of light-weight, portable, highly efficient energy conversion system to harvest energy from the ocean, vehicle shock absorbers, photovoltaics, and other sources, to provide reliable, easy, and cheap renewable energy to dismounted warfighters. - Complete research development of two deep learning-based prognostic models based on event data and condition monitoring signals incorporating domain knowledge into prognostic models. - Complete applied research regarding inhibitors to minimally trained operators performing first level repairs and identify solutions.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Complete research into augmented reality human interface devices in support of effective heads up/hands free use in battlefield environment when executing technical instructions for repair. - Complete research to better understand the direction of ongoing digital supply chain/logistic information technology development to ensure leveraging to the maximum extent possible existing body of knowledge. - Complete research leading to development of requirements for prognostic supply chain digital twin and model. - Complete research effort to design lighter and more effective personal armor systems through modeling and assemblage of layered materials that will protect against weapon effects. - Complete atmospheric exposure testing of novel poly(styrene-catechol) based adhesive pretreatment and ground vehicle demonstration for corrosion prevention. - Initiate applied research on scaling and prototyping next-generation energy storage and energy generation technologies. - Initiate the development of analytic tools to integrate operational level logistics planning for Naval, Joint, and coalition forces across all classes of supply linked directly to operational requirements. - Initiate the development of an analytic methodology that automatically links equipment and mission-driven sustainment requirements to task-organized units at foundational-level such as platoons. - Initiate the development of predictive analytics that provides dynamic demand forecasting while accounting for supply chain constraints. - Initiate feasibility and scaling analysis of a bio-inspired subsurface resupply vessel. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
Title: Maneuver ***Description:*** This activity investigates new ways and means to land forces and material through contested sea-land surface interfaces to 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 of manned-unmanned teaming and autonomous vehicle collaboration.	7.999	8.621	5.052	0.000	5.052

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
The technologies included in this work address areas of mobility, materials, propulsion, signature reduction, modularity, and unmanned systems. ***FY 2024 Plans:*** - Continue research that will focus on intelligent mobility technologies to enable greater capability in harsh off road and littoral environments, with efforts including iterative predictive and adaptive mobility testing and demonstration. - Continue to research and study various technologies to improve off-road and littoral mobility and trafficability and to gain a better understanding of the vehicle-ground interface through terrain characterization and researching enhanced platform effectors that allow the system to adapt to varying terrain in near-real time, increasing operational tempo. - Continue research for amphibious vehicle autonomy through development of components for low-cost robotic autonomy kits (e.g. Sensing & Perception, Planning & Control, Localization, World Modeling and Integration) - Continue effort to develop sensors and autonomous behaviors to enable combat ground and amphibious vehicles to perform landing zone reconnaissance, create feint and decoys, deploy mine countermeasures, and provide direct/indirect fires for future deployment in contested landing environment through integration of payloads developed under other activities. - Initiate effort to provide persistent unmanned hydrographic sensing for wide-area maritime situational awareness in support of Expeditionary Advanced Base Operations. - Initiate research to design and develop autonomy capability for specific platforms in the USMC Mobile All-Domain Observation and Sensing System (MA-DOSS) and the Unmanned Swarming Amphibious Assault Craft (USAAC). ***FY 2025 Base Plans:*** - Continue research that will focus on intelligent mobility technologies to enable greater capability in harsh off road and littoral environments, with efforts including iterative predictive and adaptive mobility testing and demonstration. - Continue to research and study various technologies to improve off-road and littoral mobility and trafficability and to gain a better understanding of the vehicle-ground interface through terrain characterization and researching enhanced platform effectors that allow the system to adapt to varying terrain. - Continue research for amphibious vehicle autonomy through development of components for low-cost robotic autonomy kits (e.g. Sensing & Perception, Planning & Control, Localization, World Modeling and Integration)					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue effort to develop sensors and autonomous behaviors to enable combat ground and amphibious vehicles to perform various missions through integration of payloads developed under other activities. - Continue effort to provide persistent unmanned hydrographic sensing for wide-area maritime situational awareness in support of Expeditionary Advanced Base Operations. - Continue research to design and develop autonomy capability for specific platforms advancing the USMC Mobile All-Domain Observation and Sensing System (MA-DOSS) and the Unmanned Swarming Amphibious Assault Craft (USAAC). - Initiate effort to research technologies that enable more stable vehicle behaviors when operating amphibious platforms within the surf zone during high surf conditions. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding decrease from FY 2024 to FY 2025 reflects a reduction in Maneuver investments to support higher Departmental requirements.					
Title: Future Concepts, Technology Assessment, And Roadmapping ***Description:*** This activity supports the planning and integration of technology development efforts across the entire Program Element (PE). In conjunction with the Concepts Based Capabilities System and the Marine Corps Warfighting Laboratory, unique and novel concepts for advanced warfighting are developed and validated. Effectiveness analyses are conducted to identify the synergistic effects that can be achieved through the integration of emerging technology with innovative tactics, doctrine, and techniques. Technology assessments are conducted to determine the supporting technologies that have the highest impact across the warfare areas, and warrant further investment within this PE. Technology Roadmapping is conducted to help identify opportunities to leverage technology development within the Department of the Navy and the Department of Defense, as well as with the commercial sector and university communities. The resultant technology investment strategy is developed and used to guide out-year technology development efforts. ***FY 2024 Plans:*** - Continue to assess technologies and technology concepts that have potential alignment to the Marine Corps Operating Concept (MOC) as well as ability to support both Expeditionary Advanced Basing and Distributed Maritime Operation concepts.	2.215	1.991	1.263	0.000	1.263

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue effort to create methods and tools for studying the effectiveness of autonomous systems operating in adversarial environments. The effort will allow naval personnel to explore and develop novel human-machine teaming concepts under simulated combat conditions. - Complete warfighter workshops and wargaming to understand highest potential for these technologies in order to shape investment priorities. - Complete and extend development of technology roadmaps, concepts, and holistic systems of systems approaches that fulfill the needs identified in in these concepts. ***FY 2025 Base Plans:*** - Complete assessment of technologies and technology concepts with near-term transition and direct alignment with Marine Corps Operating Concept (MOC) and advanced expeditionary base operations (EABO) principles, as well as Distributed Maritime Operation concepts where contested logistics and communications may prove difficult. - Complete research effort to create methods and tools for studying the effectiveness of autonomous systems operating in adversarial environments. The effort will allow naval personnel to explore and develop novel human-machine teaming concepts under simulated combat conditions. -Initiate the assessment of technologies and technology concepts in support of future amphibious operations and the future naval warfare. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding decrease from FY 2024 to FY 2025 reflects a reduction in Future Concepts, Technology Assessment, And Road mapping investments to support higher Departmental requirements.					
Accomplishments/Planned Programs Subtotals	46.916	54.108	48.556	0.000	48.556

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	25.099	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	25.099

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
Congressional Add: Unmanned Logistical Solutions ***FY 2023 Accomplishments:*** The project will develop a littoral sensor perception system to provide our littoral USVs with reliable perception of their littoral environment including other vessels and targets along with bathymetry, wave, surf and current conditions. ***FY 2024 Plans:*** N/A	7.239	0.000
Congressional Add: 5G biometric installation access control demonstration ***FY 2023 Accomplishments:*** Conduct applied research supporting 5G biometric installation access control demonstration ***FY 2024 Plans:*** N/A	3.862	0.000
Congressional Add: Microtube heat exchangers ***FY 2023 Accomplishments:*** Conduct applied research in support of microtube heat exchangers. ***FY 2024 Plans:*** N/A	4.344	0.000
Congressional Add: Modular multi-mode autonomous seeker ***FY 2023 Accomplishments:*** Conduct applied research in support of modular multi-mode autonomous seeker. ***FY 2024 Plans:*** N/A	9.654	0.000
Congressional Adds Subtotals	25.099	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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D. Acquisition Strategy

N/A