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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy **Date:** March 2023

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602131M / <i>Marine Corps Lndg Force Tech</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	62.130	79.467	59.208	-	59.208	64.575	66.618	67.950	69.309	Continuing	Continuing
2958: <i>Cyberspace Activities</i>	0.000	4.898	5.100	5.100	-	5.100	5.202	5.306	5.412	5.520	Continuing	Continuing
3001: <i>Marine Corps Landing Force Tech</i>	0.000	44.683	48.367	54.108	-	54.108	59.373	61.312	62.538	63.789	Continuing	Continuing
9999: <i>Congressional Adds</i>	0.000	12.549	26.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.549

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 Marine Corps Operating Concept, which calls for Expeditionary Forces to conduct maneuver warfare in challenging, contested maritime environments characterized by complex terrain, technology proliferation, information and electronic warfare. 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, Post limitations, and information availability within Distributed, Intermittent and Limited 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 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).

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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	64.112	53.467	59.208	-	59.208
Current President's Budget	62.130	79.467	59.208	-	59.208
Total Adjustments	-1.982	26.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	26.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.982	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *Marine Corps Asset Life-Cycle Management*
- Congressional Add: *Unmanned Logistical Solutions*
- Congressional Add: *5G biometric installation access control demonstration*
- Congressional Add: *Microtube heat exchangers*
- Congressional Add: *Modular multi-mode autonomous seeker*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	1.448	0.000
	7.240	7.500
	3.861	4.000
	0.000	4.500
	0.000	10.000
Congressional Add Subtotals for Project: 9999	12.549	26.000
Congressional Add Totals for all Projects	12.549	26.000

Change Summary Explanation

Funding: No significant change.

Technical: No significant change.

Schedule: No significant change.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy										Date: March 2023		
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602131M / <i>Marine Corps Lndg Force Tech</i>			Project (Number/Name) 2958 / <i>Cyberspace Activities</i>				
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
2958: <i>Cyberspace Activities</i>	0.000	4.898	5.100	5.100	-	5.100	5.202	5.306	5.412	5.520	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 warfighters operating with size, weight and power constrained equipment in Disrupted, Intermittent, Limited 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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Expeditionary Cyber	4.898	5.100	5.100	0.000	5.100
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 Disrupted, Intermittent, Limited 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.					
FY 2023 Plans:					
- Continue algorithm and tool development for Cyber-EW (Electronic Warfare) capabilities for tactical engagement.					
- Continue 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.					
- Continue cyber threat identification (cyber health assessments) including vulnerability research of ubiquitous embedded systems focusing on devices commonly carried by Marines.					
- Continue development of new portable tools to capture software configuration management to include malware on forward deployed systems.					

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602131M / <i>Marine Corps Lndg Force Tech</i>	Project (Number/Name) 2958 / <i>Cyberspace Activities</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- 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.</p> <p>FY 2024 Base Plans:</p> <ul style="list-style-type: none"> - 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. - 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. <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: There is no significant funding change from FY 2023 to FY 2024.</p>					
Accomplishments/Planned Programs Subtotals	4.898	5.100	5.100	0.000	5.100

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks

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D. Acquisition Strategy
N/A

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Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602131M / <i>Marine Corps Lndg Force Tech</i>	Project (Number/Name) 3001 / <i>Marine Corps Landing Force Tech</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3001: <i>Marine Corps Landing Force Tech</i>	0.000	44.683	48.367	54.108	-	54.108	59.373	61.312	62.538	63.789	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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Command, Control, Communications, and Computers (C4)	5.955	7.200	8.100	0.000	8.100
<p>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 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.</p> <p>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.</p> <p>FY 2023 Plans:</p> <ul style="list-style-type: none"> - Continue developing portable technologies using advanced algorithms and machine learning to manage, control and exploit the electromagnetic spectrum. - 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. 					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- 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.</p> <p>- Initiate efforts to explore combined Electromagnetic Warfare (EW)/Cyber resilient communications and effects.</p> <p>FY 2024 Base Plans:</p> <p>- Continue developing portable technologies, precision pointing/tracking algorithms, software/hardware subsystem to extend surface connectivity over the horizon using low-signature optical communications.</p> <p>- 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.</p> <p>- 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.</p> <p>- Continue efforts to explore combined Electromagnetic Warfare (EW)/Cyber resilient communications and effects.</p> <p>- Initiate laboratory and outdoor test planning, information assurance and laser safety approval process for capability and flight integration.</p> <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: The increase in funding from FY 2023 to FY 2024 reflects an alignment to Naval priorities and a targeted investment in signature management, multi-domain sensors and robust communications networks necessary to close high priority capability gaps. These efforts meet the demands of the National Defense Strategy and directly support Navy and Marine Corps operating concepts Distributed Maritime Operations (DMO), Expeditionary Advanced Base Operations (EABO), Littoral Operations in a Contested Environment (LOCE) and Force Design 2030.</p>					
<p>Title: Firepower</p> <p>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 capacity, while maintaining mobility and tempo to operate inside actively contested maritime domains, to</p>	3.073	3.400	4.400	0.000	4.400

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>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. 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.</p> <p>FY 2023 Plans:</p> <ul style="list-style-type: none"> -Continue end-to-end navigation technology developments 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 decision-aid algorithms. <p>FY 2024 Base Plans:</p> <ul style="list-style-type: none"> - 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. <p>FY 2024 OCO Plans:</p>					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A					
<p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to 1) extend ranges and velocities of high-speed tactical missiles and projectiles to increase survivability, 2) provide high performance missile fuel to increase range and lethality of all DoD air-breathing powered systems currently using JP-10 fuel and 3) provide a modular combination warhead enhancement of cases/liners of low density reactive material (LDRM) for enhanced blast and high density reactive material (HDRM).</p>					
<p><i>Title:</i> Force Protection</p> <p><i>Description:</i> 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 Electronic Warfare, and counter Intelligence, Surveillance and Reconnaissance. 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 Size, Weight, Power, Cost constraints inherent to Marine Corps operation and the harsh nature of the amphibious environment.</p> <p>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.</p> <p><i>FY 2023 Plans:</i></p> <ul style="list-style-type: none"> - Continue computer vision/machine learning (CV/ML) approaches for detection and classification of obscured and camouflaged threats. - 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. 	6.462	6.750	7.750	0.000	7.750

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Continue effort to create multi-agent hardware and software components capable of autonomous operation in complex, contested, and congested environments. The objective is to create autonomous systems that can operate without relying on of radio communications and Global Navigation Satellite System (GNSS).</p> <p>- Initiate a follow-on and 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.</p> <p>FY 2024 Base Plans:</p> <p>- Continue computer vision/machine learning (CV/ML) approaches for detection and classification of obscured and camouflaged threats.</p> <p>- 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).</p> <p>-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.</p> <p>- Continue effort to create multi-agent hardware and software components capable of autonomous operation in complex, contested, and congested environments. The objective is to create autonomous systems that can operate without relying on of radio communications and Global Navigation Satellite System (GNSS).</p> <p>- 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.</p> <p>-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.</p> <p>- Initiate experimentation on full scale dynamic assembly followed by open air source integration testing and lab based prototype antenna feed network & dynamic mount testing.</p> <p>-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.</p> <p>Initiate research associated with enhanced waveform implementation.</p> <p>FY 2024 OCO Plans:</p>					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
N/A					
<p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to 1) 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 sUAS swarms and other unmanned systems in littoral regions and 2) 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.</p>					
<p><i>Title:</i> Human Performance, Training and Education</p> <p><i>Description:</i> 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 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.</p> <p><i>FY 2023 Plans:</i></p> <ul style="list-style-type: none"> - 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 into implementation of state-of-the-art and science-of-learning based training techniques to improve the development of small unit decision-making expertise. - Expand and extend small unit leader training and education continuum to increase learning outcomes for the warfighter. - Complete applied research into the ability of the warfighter to process information and speed good decision-making by implementing novel data collection and visualization techniques into Marine Corps specific applications. <p><i>FY 2024 Base Plans:</i></p>	3.265	3.400	4.400	0.000	4.400

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<ul style="list-style-type: none"> - 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. <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: The increase in funding from FY 2023 to FY 2024 is due to increased investments in decision-making and expertise development to improve the advancement in retention of skills in decision-making, situation awareness, including individual and team adaptability and coordination on decentralized, dynamic and dispersed battlefields.</p>					
<p>Title: Intelligence, Surveillance, And Reconnaissance (ISR)</p> <p>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.</p> <p>FY 2023 Plans:</p> <ul style="list-style-type: none"> - Continue effort to create new 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. 	5.379	5.700	6.360	0.000	6.360

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<ul style="list-style-type: none"> - Continue research to generate a new family of neural network algorithms to identify and counter adversarial deception. - Continue effort to create learning-enabled artificial intelligence (AI) algorithms to provide reactive and adaptive tactical and strategic planning for supporting logistic and 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 effort for use of Artificial Intelligence (AI) and machine learning to automate mission planning and mission re-planning. - Continue to develop end-to-end deep reinforced learning and demonstrate warfare at machine speed that can be applied to a very large force of manned and unmanned platforms. - Continue applied research on 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). - Initiate 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. <p><i>FY 2024 Base Plans:</i></p> <ul style="list-style-type: none"> - 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. 					

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Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602131M / <i>Marine Corps Lndg Force Tech</i>	Project (Number/Name) 3001 / <i>Marine Corps Landing Force Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<ul style="list-style-type: none"> - 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. - 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. <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: The increase in funding from FY 2023 to FY 2024 is due to increased investments in enhanced situational awareness, persistent surveillance, and tactical decision making through automated analysis of data and rapid integration of information and acquired knowledge.</p>					
<p>Title: USMC FNC Technology Candidates</p> <p>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</p>	4.696	4.987	6.086	0.000	6.086

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>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.</p> <p>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 developing and maturing the technology options that can be developed further in PE 0603640M Marine Corps Advanced Technology Development (ATD).</p> <p>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.</p> <p>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.</p> <p>FY 2023 Plans: This activity will continue to focus on developing promising technologies emerging from the FNC Applied Research program that have been matured to a Technology Readiness Level of 4 to 5. Development efforts include, but are not limited to, technologies that:</p> <ul style="list-style-type: none"> - Enable greater signature management of the Marine Air-Ground Task Force (MAGTF). - Support a multi-domain sensing of the electronic spectrum, Command and Control integration and automated collaboration of warfighting functions. - Enhance mobility, propulsion, autonomy, weapons, materials, logistics, vehicle architectures, and Electronic Warfare (to include cyber) protection for a light armored vehicle fleet. - Support improved warfighter training, performance, feedback and enhanced learning in live, virtual and constructive environments, and enhance warfighter health and endurance. - Optimize the balance between hard and flexible software development for future dynamic engagements in contested environments with adversaries. 					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Produce new repair techniques to include the use of solid-state technologies such as cold-spray and additive friction stir welding for structural repairs.</p> <p>FY 2024 Base Plans:</p> <ul style="list-style-type: none"> - 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). <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: The increase in funding from FY 2023 to FY 2024 is due to increased investments in Signature management and research in the area of on-site energy generation, storage and power management in support of Expeditionary Advanced Base Operations (EABO).</p>					
<p>Title: Logistics</p> <p>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.</p> <p>FY 2023 Plans:</p>	6.146	6.400	6.400	0.000	6.400

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Continue 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.</p> <p>- advance enhancement of combat capability by increasing energy production, storage, and distribution including curbing energy consumption of the individual Marine and other tactical assets.</p> <p>- Continue 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.</p> <p>FY 2024 Base Plans:</p> <p>- 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.</p> <p>- 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.</p> <p>- 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.</p> <p>- 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.</p> <p>- 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 dismantled warfighters.</p> <p>- Initiate development of two deep learning (DL)-based prognostic models based on event data and condition monitoring signals incorporating domain knowledge into prognostic models.</p> <p>- Initiate research regarding inhibitors to minimally trained operators performing first level repairs and identify solutions.</p> <p>- 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.</p> <p>- 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.</p> <p>- Initiate research leading to development of requirements for prognostic supply chain digital twin (SCDT) and model.</p>					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Initiate design of lighter and more effective body armor through modeling and assemblage of layered materials that will protect against ballistic threats.</p> <p>- Initiate atmospheric exposure testing of novel poly(styrene-catechol) based adhesive pretreatment and ground vehicle demonstration for corrosion prevention.</p> <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: There is no significant change from FY 2023 to FY 2024.</p>					
<p>Title: Maneuver</p> <p>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.</p> <p>The technologies included in this work address areas of mobility, materials, propulsion, signature reduction, modularity, and unmanned systems.</p> <p>FY 2023 Plans:</p> <ul style="list-style-type: none"> - Continue research that will focus on intelligent mobility technologies to enable greater capability in harsh off road and littoral environments, with efforts including predictive and adaptive mobility testing and demonstration. - Continue progress research 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, 	8.330	8.246	8.621	0.000	8.621

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B. Accomplishments/Planned Programs (\$ in Millions)					
and provide direct/indirect fires for future deployment in contested landing environment through integration of payloads developed under other activities.					
FY 2024 Base Plans:					
<ul style="list-style-type: none"> - 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 2024 OCO Plans:					
N/A					
FY 2023 to FY 2024 Increase/Decrease Statement:					
The increase in funding from FY 2023 to FY 2024 is due to the initiation of efforts to (1) provide persistent unmanned hydrographic sensing for wide-area maritime situational awareness in support of Expeditionary Advanced Base Operations and (2) 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).					
Title: Future Concepts, Technology Assessment, And Roadmapping					
	1.377	2.284	1.991	0.000	1.991

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>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.</p> <p>FY 2023 Plans: Continue: - 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. - 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. - Continue warfighter workshops and wargaming to understand highest potential for these technologies in order to shape investment priorities. - Continue and extend development of technology roadmaps, concepts, and holistic systems of systems approaches that fulfill the needs identified in in these concepts.</p> <p>FY 2024 Base 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. - 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.</p>					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Complete and extend development of technology roadmaps, concepts, and holistic systems of systems approaches that fulfill the needs identified in in these concepts. FY 2024 OCO Plans: N/A FY 2023 to FY 2024 Increase/Decrease Statement: The decrease in funding from FY 2023 to FY 2024 is due to the completion of efforts to extend development of technology roadmaps, concepts, and holistic system of systems approaches that fulfill the needs identified in in these concepts and the completion of efforts to understand highest potential for warfighter workshops and wargaming.					
Accomplishments/Planned Programs Subtotals	44.683	48.367	54.108	0.000	54.108

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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	0.000	12.549	26.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.549

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023
Congressional Add: Marine Corps Asset Life-Cycle Management FY 2022 Accomplishments: Conduct applied research supporting Marine Corps Asset Life-Cycle Management FY 2023 Plans: N/A	1.448	0.000
Congressional Add: Unmanned Logistical Solutions FY 2022 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 2023 Plans: 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.	7.240	7.500
Congressional Add: 5G biometric installation access control demonstration FY 2022 Accomplishments: Conduct applied research supporting 5G biometric installation access control demonstration FY 2023 Plans: Conduct applied research supporting 5G biometric installation access control demonstration	3.861	4.000
Congressional Add: Microtube heat exchangers FY 2022 Accomplishments: N/A FY 2023 Plans: Conduct applied research in support of microtube heat exchangers.	0.000	4.500
Congressional Add: Modular multi-mode autonomous seeker FY 2022 Accomplishments: N/A FY 2023 Plans: Conduct applied research in support of modular multi-mode autonomous seeker.	0.000	10.000
Congressional Adds Subtotals	12.549	26.000

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C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A