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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2023 Navy **Date:** April 2022

<b>Appropriation/Budget Activity</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy / BA 3: Advanced Technology Development (ATD)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603782N / <i>Mine and Expeditionary Warfare Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	0.000	1.905	1.981	2.007	-	2.007	2.048	2.088	2.130	2.173	Continuing	Continuing
2917: <i>Shallow Water MCM Demos</i>	0.000	1.905	1.981	2.007	-	2.007	2.048	2.088	2.130	2.173	Continuing	Continuing

**A. Mission Description and Budget Item Justification**

Explosive ordnance disposal is a critical naval mission vital to the safety of service members and civilians. Highly trained Sailors and Marines utilize their knowhow and courage combined with state-of-the-art technology to remove unexploded ordnance, land/sea mines and even chemical, biological and nuclear weapons. The Department of Defense (DoD) Directive 5160.62 "Single Manager Responsibility for Military Explosive Ordnance Disposal Technology and Training (EODT&T)" approved by the DoD Explosive Ordnance Disposal (EOD) Program Board (Sep 2012) guides research in this Program Element (PE). Unique needs and capabilities identified by the Joint Requirements Oversight Council (JROC) and the DoD EOD Program Board are also addressed by this PE, and provide the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval and Joint EOD forces in the 21st century. The strategy focuses and aligns Naval S&T with Naval missions, DoD EOD S&T with Joint EOD missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE primarily develops and demonstrates prototype Mine Countermeasures (MCM), Expeditionary Warfare and Joint EOD system components that support capabilities enabling Naval and Joint EOD Forces to influence operations ashore. Adversarial nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics, throughout the littorals. They also have the capability to develop or modify explosive devices such as mines and unexploded ordnance to construct Improvised Explosive Devices (IEDs) for the purpose of targeting Joint Forces. Real world operations have demonstrated the requirement to quickly counter the mine threat. Current operations have also demonstrated the requirement to quickly counter the threat from explosive hazards and IEDs during DoD operations. Advanced technologies must rapidly detect and neutralize all mine types, from deep water to the inland objective. Advanced technologies must enable Joint EOD forces to detect/locate, gain access, diagnose, render safe, neutralize, recover, exploit and dispose of a broad spectrum of explosive hazards including unexploded ordnance and IEDs. This program supports the advanced development and integration of sensors, processing, warheads, and delivery vehicles to demonstrate improved Naval Warfare capabilities. It supports the advanced development and integration of sensors and tools for standoff capabilities such as detection and location of IEDs (particularly in dismounted operations), dismounted diagnosis of buried munitions and other explosive hazards, precision render safe and neutralization of surface munitions and other explosive hazards, and enhanced access to IEDs. It supports the MCM-related FNC Enabling Capabilities (ECs).

Today's Sailors and Marines are enabled by naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

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<b>Appropriation/Budget Activity</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy / BA 3: Advanced Technology Development (ATD)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603782N / <i>Mine and Expeditionary Warfare Advanced Technology</i>
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This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels (TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

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

<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023 Base</b>	<b>FY 2023 OCO</b>	<b>FY 2023 Total</b>
Previous President's Budget	1.940	1.981	0.000	-	0.000
Current President's Budget	1.905	1.981	2.007	-	2.007
Total Adjustments	-0.035	0.000	2.007	-	2.007
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.035	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000
• Adjustments to Budget Year	-	-	2.007	-	2.007

**Change Summary Explanation**

Funding: No significant change.

Technical: No significant change.

Schedule: No significant change

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FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2023 Navy										<b>Date:</b> April 2022		
<b>Appropriation/Budget Activity</b> 1319 / 3					<b>R-1 Program Element (Number/Name)</b> PE 0603782N / Mine and Expeditionary Warfare Advanced Technology				<b>Project (Number/Name)</b> 2917 / Shallow Water MCM Demos			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023 Base</b>	<b>FY 2023 OCO</b>	<b>FY 2023 Total</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
2917: Shallow Water MCM Demos	0.000	1.905	1.981	2.007	-	2.007	2.048	2.088	2.130	2.173	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

This Project develops and demonstrates prototype technology for Mine Countermeasures (MCM), US Naval sea mining, and Expeditionary Warfare and Joint EOD system components that support capabilities enabling Naval and Joint EOD Forces to influence operations ashore. Adversarial nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, throughout the littorals including new generation mines having sophisticated performance characteristics. They also have the capability to develop or modify explosive devices such as mines and unexploded ordnance to construct Improvised Explosive Devices (IEDs) for the purpose of targeting Joint Forces. Real world operations have demonstrated the requirement to quickly counter the mine threat. Current operations have also demonstrated the requirement to quickly counter the threat from explosive hazards and IEDs during DoD operations. Advanced technologies must rapidly detect and neutralize all mine types, from deep water to the inland objective. Advanced technologies must enable Joint EOD forces to detect/locate, gain access, diagnose, render safe, neutralize, recover, exploit and dispose of a broad spectrum of explosive hazards including unexploded ordnance and IEDs. This program supports the advanced development and integration of sensors, processing, warheads, and delivery vehicles to demonstrate improved Naval Warfare capabilities.

This Project supports the advanced development and integration of sensors and tools for standoff capabilities such as detection and location of IEDs (particularly in dismantled operations), dismantled diagnosis of buried munitions and other explosive hazards, precision render safe and neutralization of surface munitions and other explosive hazards, and enhanced access to IEDs. It supports advanced development for battlespace shaping weapons including advanced undersea weapons. It supports the MCM related FNC Enabling Capabilities (ECs).

**B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)**

	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023 Base</b>	<b>FY 2023 OCO</b>	<b>FY 2023 Total</b>
<b>Title:</b> Joint EOD Demos	1.905	1.981	2.007	0.000	2.007
<b>Articles:</b>	-	-	-	-	-
<b>Description:</b> This activity focuses on developing and demonstrating technologies to support a standoff or remote capability for detection and location, diagnosis, render safe, neutralization and enhanced access. Efforts include: electromagnetic, electro-optical, radiographic and advanced sensors and systems for detection of explosive threat components including explosives, device housings/containers, and triggering mechanisms, standoff identification and confirmation of trace explosives, fusion of multi-sensor input for high confidence detection and diagnosis of buried and surface threats, highly dexterous manipulators and imitative controllers for lightweight, efficient (strength/weight ratio) dual manipulator systems integrated onto EOD robots for enhanced access, enhanced robotic autonomy to support EOD missions, data compression and visualization techniques					

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**B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)**

	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023 Base</b>	<b>FY 2023 OCO</b>	<b>FY 2023 Total</b>
<p>to support precise render safe and neutralization, and neutralization devices containing reactive materials to neutralize devices with low collateral damage. This S&amp;T investment supports the Joint Requirements Oversight Council (JROC) and DoD EOD Program Board validated requirements for Joint EOD missions. This S&amp;T investment provides critical S&amp;T transitions to acquisition programs. This investment in Joint EOD S&amp;T is reported annually to the DoD EOD Program Board. This S&amp;T investment is documented in the DoD EOD Applied Research Program Plan which is reviewed and approved annually by the DoD EOD Program Board.</p> <p><b>FY 2022 Plans:</b></p> <ul style="list-style-type: none"> <li>-Joint Explosive Ordnance Disposal (JEOD), Advanced Technology: Continue advanced technology development and demonstration for JEOD functional areas including detect, access, diagnose, and render safe/neutralize.</li> <li>-Joint Explosive Ordnance Disposal (JEOD), Detection: Continue efforts in the detection functional area. Specific efforts will include development and demonstration of advanced electro-optical and spectroscopic sensors for detection of explosives. The objective is to remotely detect bulk and trace explosives.</li> <li>-Joint Explosive Ordnance Disposal (JEOD), Remote Access: Continue efforts the access functional area. Specific efforts will include robotic manipulators, end effectors and haptics. The objective is to enable remote access to explosive threats and unexploded ordnance.</li> <li>-Joint Explosive Ordnance Disposal (JEOD), Acoustic Sensor: Continue detection of buried explosive threats with seismic- acoustic sensor. Specific effort includes demonstration of a robot mounted seismic acoustic sensor. The objective is to enable standoff detection of buried explosive threats with improved detection and classification statistics.</li> <li>-Joint Explosive Ordnance Disposal (JEOD), Man-Portable Prototypes: Continue efforts in diagnose and render safe/ neutralize functional areas. Specific efforts will include the development and demonstration of man-portable prototypes. The objective is to assess the status of explosive threats and ordnance and render safe/neutralize at standoff.</li> <li>-Joint Explosive Ordnance Disposal (JEOD), Rapid Large Area Clearance advanced technology development for rapid large area clearance of explosive threats. Specific effort includes collective demonstration of multiple prototypes for experimentation. The objective is to enable rapid large area clearance operations including</li> </ul>					

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**B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)**

	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023 Base</b>	<b>FY 2023 OCO</b>	<b>FY 2023 Total</b>
<p>detection of explosive threats, classification statistics and clearance of munitions from the operational area and render safe/neutralize at standoff.</p> <p><b>FY 2023 Base Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue Joint Explosive Ordnance Disposal (JEOD), Advanced Technology: continue development and demonstration for JEOOD functional areas including detect, access, diagnose, and render safe/neutralize.</li> <li>- Continue Joint Explosive Ordnance Disposal (JEOD), Detection: continue efforts in the detection functional area. Specific efforts will include development and demonstration of advanced electro-optical and spectroscopic sensors for detection of explosives. The objective is to remotely detect bulk and trace explosives.</li> <li>- Continue Joint Explosive Ordnance Disposal (JEOD), Remote Access: continue efforts the access functional area. Specific efforts will include robotic manipulators, end effectors and haptics. The objective is to enable remote access to explosive threats and unexploded ordnance.</li> <li>- Continue Joint Explosive Ordnance Disposal (JEOD), Acoustic Sensor: continue detection of buried explosive threats with seismic- acoustic sensor. Specific effort includes demonstration of a robot mounted seismic acoustic sensor. The objective is to enable standoff detection of buried explosive threats with improved detection and classification statistics.</li> <li>- Continue Joint Explosive Ordnance Disposal (JEOD), Man-Portable Prototypes: continue efforts in diagnose and render safe/ neutralize functional areas. Specific efforts will include the development and demonstration of man-portable prototypes. The objective is to assess the status of explosive threats and ordnance and render safe/neutralize at standoff.</li> <li>- Continue Joint Explosive Ordnance Disposal (JEOD), Rapid Large Area Clearance advanced technology development for rapid large area clearance of explosive threats. Specific effort includes collective demonstration of multiple prototypes for experimentation. The objective is to enable rapid large area clearance operations including detection of explosive threats, classification statistics and clearance of munitions from the operational area and render safe/neutralize at standoff.</li> </ul> <p><b>FY 2023 OCO Plans:</b></p>					

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<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023 Base</b>	<b>FY 2023 OCO</b>	<b>FY 2023 Total</b>
N/A					
<b><i>FY 2022 to FY 2023 Increase/Decrease Statement:</i></b> There is no significant funding change from FY 2022 to FY 2023.					
<b>Accomplishments/Planned Programs Subtotals</b>	1.905	1.981	2.007	0.000	2.007

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

**Remarks**

**D. Acquisition Strategy**  
N/A