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Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 3: Advanced Technology Development (ATD)</i>					R-1 Program Element (Number/Name) PE 0603758N / <i>Navy Warfighting Exp & Demo</i>							
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	0.000	65.608	40.591	47.167	-	47.167	-	-	-	-	-	-
2918: <i>Navy Warfighting Experiments and Demo</i>	0.000	65.608	40.591	47.167	-	47.167	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) guides ongoing research in the pursuit of innovative, decisive capabilities for our Sailors and Marines. ONR manages a broad, but priority-driven investment portfolio of near to long-term basic and applied research. This Program Element (PE) addresses the development of recent Science and Technology (S&T) breakthroughs to meet current operational needs from a subscale proof-of-principle into a full-scale prototype for warfighter experimentation during laboratory and operational demonstrations including Fleet Battle Problems (FBP), Limited Objective Experiments (LOEs) and Fleet/Force exercises. The key aspects of this PE are divided into five areas supporting the continuum of S&T from discovery to delivery: (1) Naval Warfare Experimentation develops rapid prototypes and provides them to the warfighter for experimentation during operational demonstrations and exercises; (2) Operations Analysis provides the Navy and Marine Corps the means to identify capability needs that can be addressed with science and technology solutions and inform future investment; (3) SwampWorks develops and demonstrates newly invented or recently discovered technologies that address emergent and enduring operational problems in an accelerated timeframe; (4) TechSolutions develops rapid response science and technology prototypes addressing Fleet/Force needs identified by Sailors and Marines at the deckplate level; and (5) support for the Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets.

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.

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.

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B. Program Change Summary (\$ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	67.739	40.709	41.302	-	41.302
Current President's Budget	65.608	40.591	47.167	-	47.167
Total Adjustments	-2.131	-0.118	5.865	-	5.865
• Congressional General Reductions	-	-0.118			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.599	0.000			
• SBIR/STTR Transfer	-1.532	0.000			
• Program Adjustments	0.000	0.000	6.000	-	6.000
• Rate/Misc Adjustments	0.000	0.000	-0.135	-	-0.135

Change Summary Explanation

Funding: FY22 increase supports investment in TANG and NavalX aligned technology development opportunities and initiatives.

Technical: Not applicable.

Schedule: Not applicable.

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Appropriation/Budget Activity 1319 / 3					R-1 Program Element (Number/Name) PE 0603758N / Navy Warfighting Exp & Demo				Project (Number/Name) 2918 / Navy Warfighting Experiments and Demo			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
2918: Navy Warfighting Experiments and Demo	0.000	65.608	40.591	47.167	-	47.167	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project focuses on the application of recent technology breakthroughs to meet current operational needs from a subscale proof-of-principle into a full-scale prototypes for warfighter experimentation during laboratory and operational demonstrations, Fleet Battle Problems (FBPs), Limited Objective Experiments (LOEs) and Fleet/Force exercises.

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Naval Warfare Experimentation	19.158	7.518	8.242	0.000	8.242
Articles:	-	-	-	-	-
<p>Description: The objective of this activity is to capitalize on recent technology breakthroughs to develop and integrate components including subsystems into prototypes quickly. These technologies are provided to the warfighter for experimentation, field experiments, and/or tests in simulated or actual environments. The use of Navy Warfare Development Command (NWDC) Fleet Experimentation (FLEX) events is encouraged. The net results are knowledge that only an experiment can provide and that will inform future Science and Technology (S&T) development and transition of capabilities.</p> <p>An example of Naval Warfare Experimentation efforts is funding of a SuperSwarm project which pushed the boundaries of manufacturing capabilities to build 5000 unmanned aerial vehicles and conducted experimentation, dropping over 1000 at a time from aircraft to determine naval utility.</p> <p>FY 2021 Plans: Maintain and leverage a Naval Research Enterprise (NRE) Experimentation and Analysis Opportunities catalogue to guide prioritized concept investigations in support of fleet/force needs and strategic S&T initiatives. Invest in operational experimentation such as tests, demonstrations, and large and small scale experimentation that will address emerging operational needs. Manage a NRE experimentation plan which will guide multi-year S&T experimentation efforts in response to emerging concepts and doctrine. Conduct early Technology Readiness Level concept investigations with Fleet and Force input to establish concept potential, and inform</p>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<p>NRE investment decisions. Leverage experimentation as an excursion to traditional programs to address additional warfighter needs and/or mitigate capability delivery risk.</p> <p>FY 2022 Base Plans: Continue to maintain and leverage a Naval Research Enterprise (NRE) Experimentation and Analysis Opportunities catalogue to guide prioritized concept investigations in support of fleet/force needs and strategic S&T initiatives. Investing in operational experimentation such as tests, demonstrations, and large and small scale experimentation that will address emerging operational needs. Managing a NRE experimentation plan which will guide multi-year S&T experimentation efforts in response to emerging concepts and doctrine. Conduct early Technology Readiness Level concept investigations with Fleet and Force input to establish concept potential, and inform NRE investment decisions. Leverage experimentation as an excursion to traditional programs to address additional warfighter needs and/or mitigate capability delivery risk.</p> <p>FY 2022 OCO Plans: N/A</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: There is no significant funding change from FY 2021 to FY 2022.</p>					
<p>Title: Operations Analysis</p> <p align="right">Articles:</p> <p>Description: The objective of this project is to provide operational analysis through studies, analyses, gaming, modeling and simulation (M&S), and experimentation to identify Navy and Marine Corps capability needs that can be addressed with S&T solutions. The effort includes core analysis of Science and Technology (S&T) programs, military utility/capability gaps analyses, war gaming, structured experimentation events, the articulation of the results of that analysis and war gaming, and the development of innovation strategies and messages resulting from these analyses.</p> <p>An example of an Operations Analysis effort would be conducting the Fast Agile Naval Technology Munitions (FANTOM) Technology Innovation Game (TIG) with the Naval Warfare Development Command and representatives from the fleet, force, and NRE to determine where application of super-cavitating torpedo technology can have the most significant, near term impact on warfighting capability which allows the NRE to more accurately focus its S&T investments.</p>	2.153 -	0.804 -	3.871 -	0.000 -	3.871 -

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<p>The Tactical Advancement for Next Generation (TANG) group assists in TECHDEV selection within Swampworks. TANG solves mission focused, human-centered challenges using innovation and design thinking methods. TANG initiatives tailor the research and solution generation methods to the respective topic and scope.</p> <p>FY 2021 Plans: Conduct warfighter workshops to discover and/or refine new concepts and issues and identify new focus areas for Science and Technology (S&T) development guided by the warfighter. Commission studies to investigate emerging areas for S&T investment and determine the naval specific challenges requiring NRE investment. Conduct Concept of Employment investigations to explore incorporating existing or new S&T into training or exercises to improve effectiveness. Conduct Concept of Operations investigations to explore how operational objectives or capabilities can be met with existing or new S&T. Work with the Navy Warfare Development Command in order to conduct Technology Innovation Games that help inform Science and Technology program capabilities.</p> <p>FY 2022 Base Plans: Continue to conduct new workshops, commission studies, and conduct Concept of Employment and Concept of Operations investigations.</p> <p>Initiate TANG projects that solve mission focused, human-centered challenges using innovation and systems engineering methods for the Navy and United States Marine Corps (USMC).</p> <p>TANG will support discovery of trends, sharing lessons learned, and empowering the workforce to solve problems and build their agility skills by providing high-quality, low-friction training and support to equip commands with warfighter-centered fundamentals.</p> <p>FY 2022 OCO Plans: N/A</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: The increase from FY 2021 to FY 2022 is due to increased investment in TANG aligned technology development opportunities and initiatives.</p>					
<p>Title: Swampworks</p> <p align="right">Articles:</p>	22.316	14.885	17.316	0.000	17.316
	-	-	-	-	-

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<p>Description: Description: The SwampWorks portfolio responds to opportunities for rapid and disruptive technologies to meet urgent warfighter needs, and addresses technology and sailor performance issues identified during experiments, exercises, and demonstrations.</p> <p>SwampWorks explores high-risk, disruptive, and innovative technologies and concepts that advance naval warfighter's capabilities. The program has substantial programmatic flexibility and is not limited to any set of technology areas. Ultimately, the goal is to provide a dramatic improvement for the warfighter at a rapid pace. Some of these technologies may become part of a follow-on technology development, may end up in the hands of the warfighter for Fleet/ Force experimentation, or may culminate in a significant Fleet/Force exercise that demonstrates capability that transitions into the Acquisition Program of Record (POR).</p> <p>The Naval Agility Cell (NavalX) group assist in TECHDEV selection within Swampworks. NavalX builds an agile, collaborative, and connected Naval network via regional Technology Bridges (Tech Bridges) to pursue high-risk, disruptive, and innovative technologies and concepts that advance naval warfighter's capabilities.</p> <p>FY 2021 Plans: Complete Digital Twin for USS JOHN F. KENNEDY (CVN 79) Advanced Weapons Elevator. Continue development of Quantum Gravimeter Navigation System. The remaining Science and Technology (S&T) projects that start in FY21 will be identified during FY21 as emerging warfighters needs are realized. Swampworks projects will continue to be aligned with National Defense Strategy, OSD Modernization Priorities and CNO / CMC Guidance.</p> <p>FY 2022 Base Plans: Complete development of the Quantum Gravimeter Navigation System. The remaining Science and Technology (S&T) projects that start in FY22 will be identified during FY22 as emerging warfighters needs are realized. Swampworks projects will continue to be aligned with National Defense Strategy, OSD Modernization Priorities and CNO / CMC Guidance. Apply the NavalX Innovation pipeline concept to source, curate, scan, incubate, prototype, validate, field and sustain new technologies to accelerate the discovery, development of new technologies and capabilities for naval warfighters.</p>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<p>NavalX and support discovery of trends, sharing lessons learned, and empowering the workforce to solve problems and build their agility skills by providing high-quality, low-friction training and support to equip commands with warfighter-centered fundamentals.</p> <p>FY 2022 OCO Plans: N/A</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: The increase from FY 2021 to FY 2022 is due to increased investment in NavalX aligned technology development opportunities and initiatives.</p>					
<p>Title: Tech Solutions</p> <p align="right">Articles:</p> <p>Description: TechSolutions develops rapid response Science and Technology (S&T) solutions to immediate Fleet/Force needs identified by individual Sailors at the deckplate level and Marines in the field. TechSolutions links warfighters to the government science and technology community to develop needed technologies as quickly as possible. Sailors, Marines and Science Advisors submit their issues throughout the year via the TechSolutions web portal. Projects are initiated directly from such requests and a prototype solution is developed collaboratively with the warfighter. Within 12 months the prototype is delivered into the hands of the warfighter and demonstrated in an operationally relevant context.</p> <p>Historical examples of technology requests have included an enhancement to weapons training for security forces that was satisfied by development of an Augmented Reality headset and instrumented weapons. A example is a request for automated video recording of interactions at sea that was satisfied by the development of 360 degree visible and infrared cameras and DVR for quickly generating reports with video documentation to transmit up the chain of command.</p> <p>FY 2021 Plans: This program will conduct new Science and Technology (S&T) developments based on Fleet/Force interactions and expressed warfighter needs. The program will be readily available to support the mission of the fleet by responding to Sailors/Marines need for technology. Developments will be undertaken to deliver rapid response solutions so warfighters can achieve mission success and perform their duties safer, more effectively and more efficiently by leveraging technology that has recently been developed or is emergent. Demonstrations will</p>	9.894	5.064	5.151	0.000	5.151
	-	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<p>be conducted with warfighters at the conclusion of developments to assess the utility of the technology and understand what steps remain to achieve transition.</p> <p>FY 2022 Base Plans: TechSolutions will continue to conduct new Science and Technology (S&T) developments based on Fleet/Force interactions and expressed warfighter needs. The program will be readily available to support the mission of the fleet by responding to Sailors/Marines need for technology. Developments will be undertaken to deliver rapid response solutions so warfighters can achieve mission success and perform their duties safer, more effectively and more efficiently by leveraging technology that has recently been developed or is emergent. Demonstrations will be conducted with warfighters at the conclusion of developments to assess the utility of the technology and understand what steps remain to achieve transition.</p> <p>FY 2022 OCO Plans: N/A</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: There is no significant funding change from FY 2021 to FY 2022.</p>					
<p>Title: Precision Strike Technology</p> <p align="right">Articles:</p> <p>Description: Efforts in this area support Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets. Ongoing efforts include conducting kill-chain studies to identify and recommend engineering trades to enable weapon system interoperability and data fusion alternatives. These studies assess engineering feasibility of various kill-chain options and assess the capability provided. Classified addendum includes further program details.</p> <p>FY 2021 Plans: Efforts in this area support Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets. Ongoing efforts include conducting kill-chain studies to identify and recommend engineering trades to enable weapon system interoperability and data fusion alternatives. These studies assess engineering feasibility of various kill-chain options and assess the capability provided.</p> <p>FY 2022 Base Plans: Continue efforts in the area supporting Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets. Ongoing efforts include conducting kill-chain studies to identify</p>	12.087 -	12.320 -	12.587 -	0.000 -	12.587 -

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
and recommend engineering trades to enable weapon system interoperability and data fusion alternatives. These studies assess engineering feasibility of various kill-chain options and assess the capability provided. Conduct efforts to refine technologies and techniques that fluidly combine surveillance electronic warfare with communications and electronics in support of current and predicted capability requirements to clearly understand and shape the EW battlespace. FY 2022 OCO Plans: N/A FY 2021 to FY 2022 Increase/Decrease Statement: There is no significant funding change from FY 2021 to FY 2022.					
Accomplishments/Planned Programs Subtotals	65.608	40.591	47.167	0.000	47.167

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

N/A

Remarks

D. Acquisition Strategy

Not applicable.