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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 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>
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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	1,209.728	111.281	151.547	99.782	-	99.782	-	-	-	-	-	-
0223: <i>Sub Combat System Improvement (ADV)</i>	610.882	49.205	55.171	55.442	-	55.442	-	-	-	-	-	-
2033: <i>Adv Submarine Systems Development</i>	550.157	32.939	33.430	29.957	-	29.957	-	-	-	-	-	-
2096: <i>Payload Delivery Development</i>	19.507	10.378	13.885	2.527	-	2.527	-	-	-	-	-	-
3391: <i>SSN/SSGN Survivability Program</i>	16.319	9.112	11.460	11.856	-	11.856	-	-	-	-	-	-
9710: <i>Advanced Submarine Technology Development</i>	0.000	0.000	28.601	0.000	-	0.000	-	-	-	-	-	-
9999: <i>Congressional Adds</i>	12.863	9.647	9.000	0.000	-	0.000	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) supports innovative research and development in submarine Hull, Mechanical and Electrical (HM&E) and combat systems technologies and the subsequent evaluation, demonstration, and validation for submarine platforms. It will increase the submarine technology base and provide subsystem design options not currently feasible. The PE also supports programs transitioning from Science and Technology (S&T), Defense Advanced Research Projects Agency (DARPA), Independent Research & Development (IR&D), and Small Business Innovation Research (SBIR) projects.

SUMMARY OF MAJOR BUDGET REQUEST CHANGES IN THIS PE FROM FY 2021 TO FY 2022 (NET DECREASE OF \$-51.765M):

- PROJECT 0223 net increase from FY 2021 to FY 2022 (\$+0.271M) was driven by an increase to the Large Vertical Array (LVA) development program required to pace the threat of evolutionary quieting of adversary submarines. Funding supports the procurement of sensors, urethanes, and cables necessary to fabricate a Conformal Acoustic Velocity Sonar (CAVES) LVA test panel and to stand up a SSN 688i Class CAVES LVA working group that will identify requirements and initiate design concepts.
- PROJECT 2033 net decrease from FY 2021 to FY 2022 (\$-3.473M) is due to planned phasing within the Advanced Hull Treatments project. Material procurements and the majority of shipyard labor supporting the Hull Treatment patch installation on Virginia Class Submarine (VCS) Hull C occurs in FY 2021. The FY 2022 budget completes final phases of VCS Hull C demo patch installation, and supports data analysis on VCS Hull B treatment patch, as well as technology maturation on other Low Technology Readiness Level (TRL) Office of Naval Research (ONR) developed prototype treatments.
- PROJECT 2096 net decrease from FY 2021 to FY 2022 (\$-11.358M) reflects the adjustment of funds for the Payload Handling System (PHS).
- PROJECT 3391 net increase from FY 2021 to FY 2022 (\$+0.396M) supports increased effort for TEMPALT development.
- PROJECT 9710 net decrease from FY 2021 to FY 2022 (\$-28.601M) is the result of the vertical kill of Project 1.

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<p>- PROJECT 9999 net decrease from FY 2021 to FY 2022 (\$-9.000M) reflects only FY 2021 Congressional Adds.</p> <p>DESCRIPTION/JUSTIFICATION BY PROJECT:</p> <p>PROJECT 0223: The Submarine Combat System Improvement (Advanced) (Non-ACAT) Project researches, develops, and tests new sonar, combat system, imaging, and electronic warfare software and develops, tests, and prototypes new sonar arrays for Program Executive Office Submarine (PEO SUB) programs, delivering approximately thirty (30) new capabilities every other year. This Project supports Navy Submarine Acoustic Superiority and Technology Insertion Initiatives through the application of advanced development and testing of sensors and sensor processing systems supporting tactical control systems improvements. Improvements are supportive of 'A Cooperative Strategy for 21st Century Sea Power and the Chief of Naval Operations (CNO) Design for Maintaining Maritime Superiority'; addressing all components to include Strengthen Naval Power At and From Sea, Achieve High Velocity Learning, Strengthen Our Navy Team for the Future, and Expand and Strengthen Our Network of Partners. This Project addresses threats posed by China, Russia, Iran, and Korea, improved lethality of U.S. Submarine Forces and 3rd Offset Capabilities in the Unmanned and Automated Systems domains.</p> <p>Project 0223 is comprised of four (4) major efforts: Advanced Processing Builds (APB), Flank Array Demonstration (FAD), Advanced Sensors, and Large Vertical Array (LVA).</p> <p>APB develops, tests and transitions capabilities for:</p> <ul style="list-style-type: none">- APB Acoustics, transitioning to AN/BQQ-10- APB Tactical Control, transitioning to AN/BYG-1- APB Imaging, transitioning to AN/BVY-1- APB Electronic Warfare (EW), transitioning to AN/BLQ-10 <p>FAD conducts testing and analysis on the existing LVA and supports maintenance and correction of identified problems on the array. This project concludes in FY 2020, transitioning results to the LVA project.</p> <p>Advanced Sensors develops new technologies for Hull Mounted and Towed Arrays. Hull Mounted Array improvements support submarine applications only. Towed array improvements are shared to support surface and surveillance applications.</p> <p>LVA leverages demonstrated FAD developments to conduct critical testing and analysis needed to improve array performance and develop sensor employment tactics. It will introduce new electronic hardware and new software applications to enhance array and signal processing performance. These improvements will be incorporated in future LVA builds for VIRGINIA class SSNs and OHIO and COLUMBIA classes of SSBNs as well as backfits.</p> <p>PROJECT 2033: Advanced Submarine Systems Development (ASSD) is a non-acquisition program that develops, matures and tests advanced technologies for successful integration into current and future submarine classes, lowers the technical/cost risks of integrating new technologies prior to acquisition, and speeds the delivery of capability and lethality into the Fleet.</p>		

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ASSD transitions Hull, Mechanical, and Electrical (HM&E) technologies, and future naval concepts from the Science & Technology (S&T) and Research and Development (R&D) communities through the development, maturation, and integration of technology projects to operational submarine platforms for assessment, testing, and evaluation. Once projects have proven their maturity and promise through at-sea demonstration, they are formally transitioned into acquisition Programs Of Record (PORs). Additionally, ASSD operates and maintains R&D infrastructure assets that are critical to the long-term design, assessment and construction of modern, stealthy submarine platforms.

Project 2033 is comprised of three budget categories: Strategic Capability Infrastructure, Long Range R&D Investment, and Rapid Technology Development.

The major developmental efforts include:

Strategic Capability Infrastructure

- Large Scale Vehicle (LSV)
- Intermediate Scale Measurement System (ISMS)
- High Gain Measurement System (HGMS)
- South TOTO Acoustic Measurement Facility (STAFAC) Recapitalization

Long Range R&D Investment

- Advanced Material Propeller (AMP) Technology
- Advanced Signature Management
- Advanced SSN Technologies
- Next Generation Thrust (future propulsor/shafting technologies)
- Advanced Hull Treatments

Rapid Technology Development

- Innovation Technology Transfer

PROJECT 2096: Payload Delivery Development, consists of the Payload Handling System (PHS).

Payload Delivery Development is a program used for the integration of large deployable and retrievable payloads with submarines. RDT&EN funding will be used to develop a prototype payload launch and recovery system utilized with submarine large ocean interfaces to accommodate large diameter payloads and offboard systems. The project enables launch and recovery of these systems from submarines. This will provide the Submarine Force with the capability to launch and recover large payloads and offboard systems of various configurations in support of critical Undersea Warfare (USW) missions, providing battle space awareness and extending war-fighting reach in support of Subsea and Seabed Warfare (SSW) mission objectives. This capability has been identified as a key enabler for the following critical USW mission areas: Intelligence, Surveillance, and Reconnaissance (ISR), Anti-Submarine Warfare (ASW), Anti-Surface Warfare (ASUW), Naval Special Warfare (NSW), Mine Warfare, Subsea and Seabed Warfare (SSW), Counter- Autonomous Underwater Vehicle (AUV) Warfare, Electromagnetic Maneuver Warfare (EMMW), Deception, and Non-Lethal Sea Control. This capability is paramount to winning the great power competition emerging between world powers and maintaining dominance in the undersea domain.

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- FY 2022 funding profile decrease reflects the adjustment of funds for the PHS system.

PROJECT 3391: In 2013, OPNAV N97 established SSN/SSGN Survivability Program (S3P) as a separate project area within ASSD to assure SSN/SSGN survivability and the ability of submarines to complete their joint warfighting missions even if covert mobility is compromised. FY 2018 is the first year of S3P execution as Project 3391 under ASSD with level funding across the FYDP. PBR 19 proposes technology projects that would help pace world-wide technology advances and red investments so as to track and assess US undersea superiority technology insertion plans and their impact on SSN/SSGN survivability.

PROJECT 9710: Details of the project are classified SECRET and are submitted to Congress in the classified budget justification books.

B. Program Change Summary (\$ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	115.717	185.356	153.975	-	153.975
Current President's Budget	111.281	151.547	99.782	-	99.782
Total Adjustments	-4.436	-33.809	-54.193	-	-54.193
• Congressional General Reductions	-	-0.826			
• Congressional Directed Reductions	-	-41.983			
• Congressional Rescissions	-	-			
• Congressional Adds	-	9.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-4.436	0.000			
• Program Adjustments	0.000	0.000	-50.427	-	-50.427
• Rate/Misc Adjustments	0.000	0.000	-3.766	-	-3.766

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

Project: 9999: *Congressional Adds*

Congressional Add: *Small Business Technology Insertion*

Congressional Add: *Improved CAVES Technology*

Congressional Add: *Workforce Partnership Research*

	FY 2020	FY 2021
	9.647	0.000
	0.000	4.000
	0.000	5.000
Congressional Add Subtotals for Project: 9999	9.647	9.000
Congressional Add Totals for all Projects	9.647	9.000

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<p>Change Summary Explanation</p> <p>FUNDING CHANGES SINCE THE PREVIOUS PRESIDENT'S BUDGET AT THE OVERALL PE LEVEL:</p> <ul style="list-style-type: none">- FY 2020 net decrease of \$-4.436M reflects the Small Business Innovative Research (SBIR) transfer.- FY 2021 net decrease of \$-33.809M reflects program adjustments as follows: \$-31.440 for Restoring Acquisition Accountability (\$-27.430M for Project 9710 and \$-4.010M for Project 2096); \$-10.543M for Project 9710 Unjustified New Start; \$-0.826M for the application of a fair-share Congressional undistributed reduction; \$+5.000M for Workforce Partnership Research; and \$+4.000M for Improved CAVES Technology.- FY 2022 net decrease of \$-54.193M reflects adjustments as follows: \$-1.000M to Project 2033 to realign funding for executability; \$+4.075M to Project 2033 to fund the South TOTO Acoustic Measurement Facility (STAFAC) acoustic range that reaches end of design life in 2023; \$-45.519M to Project 9710 to vertically kill Project 1; and \$-9.708M to Project 2096 for higher priority department requirements, and \$-0.582M for Navy Working Capital Fund (NWCF) and \$-1.459M for miscellaneous rate adjustments. <p>INFORMATION AT THE PROJECT LEVEL:</p> <p>PROJECT 0223: FUNDING: The FY 2021 (\$55.171M) to FY 2022 (\$55.422M) budget increase (\$+0.271M) was driven by an increase to the LVA development program required to pace the threat of evolutionary quieting of adversary submarines. Funding supports the procurement of sensors, urethanes, and cables necessary to fabricate a CAVES LVA test panel and to stand up a SSN 688i Class CAVES LVA working group that will identify requirements and initiate design concepts.</p> <p>SCHEDULE CHANGES:</p> <ul style="list-style-type: none">- APB-19 Step-4 At-Sea Test shifted from 2Q20 to 3Q20 and Transition to PEO SUB Production Programs shifted from 3Q20 to 1Q21 due to platform maintenance issues and schedule changes. APB-19 EW Step-4 At-Sea Test was added in 4Q20.- APB-21 Step-4 At-Sea Test/Transition to Program Executive Office for Submarines (PEO SUB) Production Programs moved from 3Q21/4Q21 to 1Q23/2Q23, APB-23 Step-4 At-Sea Test/Transition to PEO SUB Production Programs moved from 2Q23/3Q23 to 1Q25/2Q25, and APB-25 Step-4 At-Sea Test/Transition to PEO SUB Production Programs moved from 2Q25/3Q25 to outside the Future Years Defense Program (FYDP). Beginning in FY 2022, the Navy is pursuing a transformation across Submarine Warfare Federated Tactical Systems (SWFTS) to maximize cyber-resiliency and the speed of capability delivery. The transformation will be accomplished through a transition to an agile development processes comprised of a continuous series of 12-week software program increments in a DevSecOps environment. This process will better align with industry practice and enable the SWFTS systems to leverage industry capability improvements in Artificial Intelligence (AI) and Machine Learning (ML) and other emerging technologies, while also being more responsive to cyber needs. The transformation is aligned to the requirements contained in program Capability Development Documents (CDDs) and to the requirements contained in the OPNAV requirement Letter 9010, Serial N97/19U141554 dated 22 May 2019. As APB delivers via SWFTS, changes are required in the 0223 Project's software development and integration methodologies to remain well synchronized with the production programs. Instead of delivering an improved APB to the PEO SUB SWFTS production programs at the end of development (which the production program offices then had to integrate, mature, test, and certify), development capabilities will now be integrated into the latest SWFTS production hardware baseline as they are ready, on a continuing basis. This adds flexibility to the program, allowing urgent changes to be fielded more rapidly than the previous every-two-years cycle, and provides an integrated software build requiring less effort at the end of development. Dates for final delivery and transition to PEO SUB SWFTS Production Programs of the latest of the 12-week APB software		

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<p>increments are 2Q23 for APB-21 and 2Q25 for APB-23, which is driven by the planned Developmental Test (DT) schedule for the respective APBs. This extended period of APB-21 and APB-23 activity will be used to further mature the product and to allow the introduction of more capability. This new approach has pushed APB-25 delivery and transition to outside of the FYDP.</p> <p>- Additional fidelity was included to better describe Advanced Sensors activity.</p> <p>PROJECT 2033: The FY 2022 funding request was reduced by \$1 million to account for the availability of prior year execution balances. The South TOTO Acoustic Measurement Facility (STAFAC) Recapitalization project has been added to the program of record in FY22.</p> <p>PROJECT 2096: - FY 2022 funding profile decrease reflects the adjustment of funds for the PHS system.</p> <p>PROJECT 3391: S3P top-line resourcing increases to conduct Advanced Signature Management/Countermeasures development.</p> <p>PROJECT 9710: Details of the project are classified SECRET and are submitted to Congress in the classified budget justification books.</p>		

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Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>				Project (Number/Name) 0223 / <i>Sub Combat System Improvement (ADV)</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
0223: <i>Sub Combat System Improvement (ADV)</i>	610.882	49.205	55.171	55.442	-	55.442	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

FY 2021 TO FY 2022 BUDGET REQUEST INCREASE: The FY 2021 (\$55.171M) to FY 2022 (\$55.442M) budget increase (\$+0.271M) was driven by an increase to the LVA development program required to pace the threat of evolutionary quieting of adversary submarines. Funding supports the procurement of sensors, urethanes, and cables necessary to fabricate a Conformal Acoustic Velocity Sonar (CAVES) LVA test panel and to stand up a SSN 688i Class CAVES LVA working group that will identify requirements and initiate design concepts.

The Submarine Combat System Improvement (Advanced) (Non-ACAT) Project addresses technology challenges to improve tactical control in littoral and open ocean environments for a variety of operational missions including peacetime engagement, surveillance, battle space preparation, deterrence, regional sea denial, precision strike, task group support, and ground warfare support. These technologies, developed by Navy technology bases, the private sector, Office of Naval Research (ONR), Future Naval Capabilities (FNC), and Defense Advanced Research Projects Agency (DARPA) are then transitioned. Prototype hardware/software systems are developed to demonstrate technologically promising system concepts in laboratory and at-sea submarine environments. The Advanced Sensor development program develops and tests new sensors and demonstrates large array configurations. Current efforts are directed at Towed Array sensor technologies, telemetry, and architecture, to improve reliability and performance while decreasing program life cycle costs. For large array configurations, Conformal Acoustic Velocity Sonar (CAVES), Wide Aperture Array (WAA), Large Vertical Aperture (LVA), a Bow Conformal Array (BCA), and Large Flank Array (LFA) technologies are also being pursued. The focus of sensor processing technology efforts through the Advanced Processing Build (APB) program will address improvements in imaging, tactical control, Electronic Warfare (EW) and acoustics, including detection, localization, classification, ranging, tracking, situational awareness, tactical decision aids, command decision support tools and displays and other functions essential to mission success. APB will also develop capabilities related to Unmanned Aerial and Undersea Vehicles and automated technologies specific to China, Russia, Iran, and Korea. Technologies and/or capabilities developed under this Project will be shared, as applicable to reduce costs and optimize reuse, with development programs for surface ship sonar, Advanced Capability Build (ACB) and surveillance platforms, Advanced Surveillance Build (ASB). ACB and APB are managed under a common development process titled AxB. While each platform retains its uniqueness and focus in functional domains essential to mission success, a premium is placed on development of common capabilities and modular architecture technologies to maximize commonality and cost effectiveness.

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Advanced Processing Build (APB)	39.830	45.531	44.192	0.000	44.192
Articles:	-	-	-	-	-
Description: Advanced Processing Builds (APBs) adhere to a four step process:					

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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>Step-1: Algorithm/technology assessment by peer review panels of Subject Matter Experts (SME) to down-select technologies and assist developers with technical guidance.</p> <p>Step-2: Algorithm/technology testing with open and closed data sets to further down-select and refine capabilities prior to integration and testing.</p> <p>Step-3: Land-based system-level testing stimulated by the Submarine Multi-Mission Team Trainer (SMMTT), in a realistic tactical environment.</p> <p>Step-4: At-sea testing on an operational submarine.</p> <p>APB requirements are generated by the Submarine Tactical Requirements Group (STRG), a group of senior post command officers chaired by the Flag Officer, Director of Undersea Warfare Development Center (UWDC). Requirements are vetted by COMSUBPAC and COMSUBFOR, then provided as direction by the Chief of Naval Operations (CNO), OPNAV N97. PEO SUB provides Milestone Decision Authority (MDA) oversight and approval. Steps 1 and 2 are conducted in a pipeline style, parallel to system integration and production. This makes Steps 1 and 2 independent of any particular Build (e.g APB-19, APB-21) and allows for development of longer lead technologies. The content of a specific APB build (every two years on the odd year) is then determined through a series of discussions with the Fleet/STRG aimed at selecting the most relevant and mature technologies available in the APB pipeline. Integration at the String and System level is performed followed by Steps 3 and 4, as applicable, and transitioned to production.</p> <p>Beginning in FY 2022, the Navy is pursuing a transformation across Submarine Warfare Federated Tactical Systems (SWFTS) to maximize cyber-resiliency and the speed of capability delivery. The transformation will be accomplished through a transition to an agile development process comprised of a continuous series of 12-week software program increments in a DevSecOps environment. This process will better align with industry practice and enable the SWFTS systems to leverage industry capability improvements in Artificial Intelligence (AI) and Machine Learning (ML) and other emerging technologies, while also being more responsive to cyber needs. As APB delivers via SWFTS, changes are required in the 0223 Project's software development and integration methodologies to remain well synchronized with the production programs. Instead of delivering an improved APB to the Program Executive Office for Submarines (PEO SUB) SWFTS production programs at the end of development (which the production program offices then had to integrate, mature, test, and certify), development capabilities will now be integrated into the latest SWFTS production hardware baseline as they are ready, on a continuing basis.</p> <p>FY 2021 Plans:</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
<ul style="list-style-type: none"> - Continue developing candidate capabilities for APB-21 and validate performance against requirements. - Initiate development of candidate capabilities for inclusion in APB-23. - Refine continuous Development, Security, and Operations (DevSecOps) process and software pipeline in coordination with production program offices. - Assist production program offices with combat system re-architecture to improve cybersecurity. - Continue development of Machine Learning and Artificial Intelligence (AI), with emphasis on Deep Learning and Big Data Analytics. Seek system performance improvements and 3rd Offset (automation) capabilities not currently achievable with legacy technology. - Continue Step-1 and Step-2 development and testing of concepts, algorithms, and technologies in response to Fleet requirements consistent with the multi-year capability development road map. - Implement Electronic Warfare (EW) detection improvements against complex signals, and integrate off-hull payloads into the Submarine Warfare Federated Tactical Systems (SWFTS) construct. - Begin integration of Interactive Multi-Sensor Analysis Training (IMAT) software capabilities with APB common Tactical Decision Aids (TDAs). Begin to adapt software architecture to a container-based approach to facilitate rapid updates and sharing with the Surface and Air communities. <p>FY 2022 Base Plans:</p> <ul style="list-style-type: none"> - Conduct Step-3 lab test of APB-21. Analyze results to inform improvements, tactics and training. - Continue to develop candidate capabilities for inclusion in APB-23. - Refine continuous development (DevSecOps) process and software pipeline in coordination with production program offices. - Assist production program offices with combat system re-architecture to improve cybersecurity - Continue development of Machine Learning and AI, with emphasis on Deep Learning and Big Data Analytics. Seek system performance improvements and 3rd Offset (automation) capabilities not currently achievable with legacy technology. - Continue Step-1 and Step-2 development and testing of concepts, algorithms, and technologies in response to Fleet requirements consistent with the multi-year capability development road map. - Implement EW detection improvements against complex signals, and integrate off-hull payloads into the SWFTS construct. <p>FY 2022 OCO Plans:</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
N/A					
<i>FY 2021 to FY 2022 Increase/Decrease Statement:</i> The FY 2021 (\$45.531M) to FY 2022 (\$44.192M) decrease (\$-1.339M) is due to the incorporation of NWCF and non-specific rate adjustments, and the application of service contracts savings.					
<i>Title:</i> Flank Array Demonstration (FAD)	0.375	0.000	0.000	0.000	0.000
<i>Articles:</i>	-	-	-	-	-
<i>Description:</i> FAD conducts testing and analysis on the existing LVA and supports maintenance and correction of identified problems on the array. This project concludes in FY 2020, transitioning results to the LVA project.					
<i>FY 2021 Plans:</i> N/A					
<i>FY 2022 Base Plans:</i> N/A					
<i>FY 2022 OCO Plans:</i> N/A					
<i>Title:</i> Advanced Sensors	7.000	7.140	7.250	0.000	7.250
<i>Articles:</i>	-	-	-	-	-
<i>FY 2021 Plans:</i> - Continue Open Architecture Telemetry (OAT) development of the Advanced Development Model (ADM) array. - Test the active and passive sensor design concept panel in support of SSN(x) and BCA and provide detailed design efforts. Additional testing is necessary to validate studies conducted in FY 2019 to FY 2020, and to collect data that will be used to improve the acoustic performance of the Bow Conformal Array (BCA). - Complete active and passive studies for BCA and SSN(x). Conduct acoustic test tank and environmental panel testing.					
<i>FY 2022 Base Plans:</i> - Continue OAT development and initiate fabrication of the ADM array. - Develop, build, and test active and passive sensors in support of BCA and SSN(x).					
<i>FY 2022 OCO Plans:</i>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)						
N/A						
FY 2021 to FY 2022 Increase/Decrease Statement: The FY 2021 (\$7.140M) to FY 2022 (\$7.250M) increase (\$+0.110M) is in line with inflation associated with the RDT&EN appropriation.						
Title: Large Vertical Array (LVA)						
Articles:						
Description: LVA development is a follow-on effort to the exploratory work conducted under the FAD project.						
FY 2021 Plans:						
- Continue conducting at-sea testing events for LVA2 and analyze at-sea test results.						
- Provide on-site support for the maintenance, troubleshooting, and repair of faulty or failed array inboard/outboard components. Document troubleshooting and repair findings for evaluation by engineering team and provide findings/recommendations to the forward fit and backfit LVA production programs for Virginia, Ohio, and Columbia Class Submarines.						
FY 2022 Base Plans:						
- Continue conducting at-sea testing events for LVA2 and analyze at-sea test results.						
- Provide on-site support for the maintenance, troubleshooting, and repair of faulty or failed array inboard/outboard components. Document troubleshooting and repair findings for evaluation by engineering team and provide findings/recommendations to the forward fit and backfit LVA production programs for Virginia, Ohio, and Columbia Class Submarines.						
- Stand up a SSN 688i Class Conformal Acoustic Velocity Sonar (CAVES) LVA working group with the purpose to develop plans to certify a second source for LVA technology and establish competition for future efforts.						
- Perform analysis/studies, identify requirements, and initiate design for a conceptual prototype for SSN 688i Class Submarines.						
FY 2022 OCO Plans:						
N/A						
FY 2021 to FY 2022 Increase/Decrease Statement: The FY 2021 (\$2.500M) to FY 2022 (\$4.000M) increase (\$+1.500M) to the LVA development program is required to pace the threat of evolutionary quieting of adversary submarines. Additional funding supports the						
		FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
		2.000	2.500	4.000	0.000	4.000
		-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 0223 / <i>Sub Combat System Improvement (ADV)</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
procurement of sensors, urethanes, and cables necessary to fabricate a CAVES LVA test panel and to stand up a SSN 688i Class CAVES LVA working group that will identify requirements and initiate design concepts.					
Accomplishments/Planned Programs Subtotals	49.205	55.171	55.442	0.000	55.442

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

<u>Line Item</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022 Base</u>	<u>FY 2022 OCO</u>	<u>FY 2022 Total</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• RDTEN/0205620N: <i>Surface ASW Cmbt Sys Integr</i>	28.439	29.217	28.804	-	28.804	-	-	-	-	-	-
• RDTEN/0603562N/0770: <i>Adv Sub Supp Equip Prog</i>	4.445	4.752	4.736	-	4.736	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

Use competitively awarded contracts from Broad Agency Announcement (BAA) solicitations, Other Transaction Authority (OTA), and Small Business Innovative Research (SBIR) initiatives. Integration to fielded systems performed under contracts awarded by the recipient production program within PEO SUB. Advanced Processing Builds (APBs) adhere to a four-step process and are tested in a laboratory and at-sea on an operational submarine. Performance metrics are established for each build and documented in a Measurement and Analysis Plan.

APB Four-Step Process:

- Step-1: Algorithm/technology assessment by peer review panels of Subject Matter Experts (SME) to down-select technologies and assist developers with technical guidance.
- Step-2: Algorithm/technology testing with open and closed data sets to further down-select and refine capabilities prior to integration and testing.
- Step-3: Land-based system-level testing stimulated by the Submarine Multi-Mission Team Trainer (SMMTT), in a realistic tactical environment.
- Step-4: At-sea testing on an operational submarine.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy												Date: May 2021			
Appropriation/Budget Activity 1319 / 4				R-1 Program Element (Number/Name) PE 0603561N / Advanced Submarine System Development				Project (Number/Name) 0223 / Sub Combat System Improvement (ADV)							
Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
APB, LVA, Advanced Sensor Development	C/CPFF	Adaptive Methods : VA	1.775	0.300	Dec 2019	0.324	Dec 2020	0.325	Dec 2021	-		0.325	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Alion Sciences : VA	3.267	0.000		0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Arete : CA	0.550	0.000		0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Chesapeake Science (L-3) : MD	7.551	0.000		0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Electric Boat : ME	1.980	0.000		0.000		2.125	Dec 2021	-		2.125	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	General Dynamics : VA	26.640	1.992	Dec 2019	2.151	Dec 2020	2.151	Dec 2021	-		2.151	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	GA Tech Research Institute : GA	3.156	0.385	Dec 2019	0.416	Dec 2020	0.415	Dec 2021	-		0.415	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	In Depth Engineering : VA	7.435	0.950	Jan 2020	1.026	Dec 2020	1.025	Dec 2021	-		1.025	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	JHU/APL : MD	117.444	7.885	Dec 2019	11.340	Feb 2021	11.350	Dec 2021	-		11.350	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Lockheed Martin : VA	90.559	9.494	Oct 2019	10.173	Oct 2020	11.175	Dec 2021	-		11.175	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Lockheed Martin : NY	10.064	0.600	Mar 2020	0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Metron : VA	10.238	0.750	Jan 2020	0.810	Dec 2020	0.815	Dec 2021	-		0.815	-	-	-
APB, LVA, Advanced Sensor Development	C/CPAF	NSMA : VA	13.744	0.500	Feb 2020	0.702	Apr 2021	0.700	Jan 2022	-		0.700	-	-	-
APB, LVA, Advanced Sensor Development	WR	NSWC/Carderock : MD	34.334	2.357	Oct 2019	2.792	Jan 2021	2.775	Nov 2021	-		2.775	-	-	-
APB, LVA, Advanced Sensor Development	WR	NUWC/Newport : RI	115.601	10.422	Oct 2019	10.020	Oct 2020	9.225	Nov 2021	-		9.225	-	-	-
APB, LVA, Advanced Sensor Development	WR	ONI : DC	2.295	0.000		0.000		0.000		-		0.000	-	-	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 0223 / <i>Sub Combat System Improvement (ADV)</i>
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Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
APB, LVA, Advanced Sensor Development	WR	ONR : VA	2.725	0.000		0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Progeny : VA	8.796	0.650	Jan 2020	0.702	Mar 2021	0.700	Dec 2021	-		0.700	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	PSU/ARL : PA	11.813	0.650	Jan 2020	0.702	Feb 2021	0.700	Dec 2021	-		0.700	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	SAIC : VA	3.555	0.000		0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	Sedna Digital : VA	17.284	2.000	Nov 2019	2.160	Nov 2020	2.175	Dec 2021	-		2.175	-	-	-
APB, LVA, Advanced Sensor Development	WR	SSC/San Diego : CA	1.963	0.000		0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	MIPR	U.S. Army Research Lab : MD	1.700	0.000		0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	MIPR	U.S. Army/MITRE : NJ	4.595	0.000		0.000		0.000		-		0.000	-	-	-
APB, LVA, Advanced Sensor Development	MIPR	U.S. Hanscom AFB/ MIT Lincoln Labs : MA	23.598	2.556	Dec 2019	2.760	Dec 2020	2.775	Dec 2021	-		2.775	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	UT/ARL : TX	33.877	1.985	Jan 2020	2.144	Dec 2020	2.145	Dec 2021	-		2.145	-	-	-
APB, LVA, Advanced Sensor Development	C/CPFF	VAR : VAR*	31.354	3.945	Dec 2019	5.129	Dec 2020	2.951	Dec 2021	-		2.951	-	-	-
Subtotal			587.893	47.421		53.351		53.527		-		53.527	-	-	N/A

Remarks
* Consists of multiple performing activities with funding for each not greater than \$1M per year.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy											Date: May 2021				
Appropriation/Budget Activity 1319 / 4						R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>					Project (Number/Name) 0223 / <i>Sub Combat System Improvement (ADV)</i>				

Management Services (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management Support - Acquisition, Business & Finance	C/CPFF	EG&G (URS) : VA	4.291	0.000		0.000		0.000		-		0.000	-	-	-
Program Management Support - Acquisition, Business & Finance	C/CPAF	BAE Systems : MD	12.665	0.000		0.000		0.000		-		0.000	-	-	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	CGI Federal* : VA	5.092	1.726	Jan 2020	0.000		0.000		-		0.000	-	-	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	KMS Solutions* : VA	0.000	0.000		1.761	Dec 2020	1.850	Dec 2021	-		1.850	-	-	-
Program Office Travel	Allot	NAVSEA PEO IWS5 : DC	0.941	0.058	Jan 2020	0.059	Nov 2020	0.065	Oct 2021	-		0.065	-	-	-
Subtotal			22.989	1.784		1.820		1.915		-		1.915	-	-	N/A

Remarks
 *In addition to program office support, CGI Federal/KMS Solutions provide technical planning, systems engineering, and test support. CGI Federal/KMS Solutions also provide Subject Matter Experts (SMEs) as members of the Advanced Processing Build (AB) technical Peer Review Working Groups and Integrated Product Teams (IPTs) in support of designing and refining candidate technologies for inclusion into APB deliveries.

	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	610.882	49.205	55.171	55.442	-	55.442	-	-	N/A

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 0223 / <i>Sub Combat System Improvement (ADV)</i>
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	FY 2020				FY 2021				FY 2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project 0223												
Advanced Processing Build (APB) Development Pipeline	APB Development Pipeline											
Advanced Processing Build (APB-19)			▲ ASW Step-4 At-Sea Test				▲ EW Step-4 At-Sea Test					
							■ Transition to PEO SUB Production Programs					
Flank Array Demonstration (FAD)	Maintenance											
Advanced Sensors	TL-29A OAT Development											
											TL-29A OAT ADM Fabrication	
	Hull Array Sensor Development											
	Bow Conformal Array Assessments/Concept Designs											
Large Vertical Array (LVA)	Maryland Maintenance/Test Planning/Testing/Analysis											
									688i LVA Feasibility Study			

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 0223				
Advanced Processing Build (APB): APB Development Pipeline	1	2020	4	2022
APB-19: At-Sea Test	3	2020	3	2020
APB-19: EW At-Sea Test	4	2020	4	2020
APB-19: Transition to PEO SUB Production Programs	1	2021	1	2021
Flank Array Demonstration (FAD): Maintenance	1	2020	4	2020
Advanced Sensors: Hull Array Sensor Development	1	2020	4	2022
Advanced Sensors: Bow Conformal Array Assessments/Concept Designs	1	2020	4	2021
Advanced Sensors: TL-29A OAT Development	1	2020	2	2022
Advanced Sensors: TL-29A OAT ADM Fabrication	3	2022	4	2022
Large Vertical Array (LVA): Maryland Maintenance/Test Planning/Testing/Analysis	1	2020	4	2022
Large Vertical Array (LVA): 688i LVA Feasibility Study	1	2022	4	2022

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy										Date: May 2021		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>				Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</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
2033: <i>Adv Submarine Systems Development</i>	550.157	32.939	33.430	29.957	-	29.957	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Advanced Submarine Systems Development (ASSD) is a non-acquisition program that develops, matures and tests advanced technologies for successful integration into current and future submarine classes, lowers the technical/cost risks of integrating new technologies prior to acquisition, and speeds the delivery of capability and lethality to the Fleet.

ASSD transitions Hull, Mechanical, and Electrical (HM&E) technologies, and future naval concepts from the Science & Technology (S&T) and Research and Development (R&D) communities through the development, maturation, and integration of technology projects to operational submarine platforms for assessment, testing, and evaluation. Once projects have proven their maturity and promise through at-sea demonstration, they are formally transitioned into acquisition Programs Of Record (PORs). Additionally, ASSD operates and maintains strategic R&D infrastructure and measurement assets that are critical to the long-term design, assessment and construction of modern, stealthy submarine platforms.

Project 2033 is comprised of three programmatic budget categories: Strategic Capability R&D Infrastructure, Long Range R&D Investment, and Rapid Technology Development. Strategic infrastructure investments maintain and operate critical, one-of-a-kind undersea warfare R&D assets that enable the design and manufacture of the stealthiest submarines in the world, without the requirement to develop and test at full scale, which is inordinately expensive and risky. Long-range R&D investment is the maturation and prototyping at full scale of long-range (5-10 years) technologies, to enable their readiness for incorporation into existing and future submarines. The objective is to achieve high technology readiness (TRL-7) of the targeted technology so that it can be incorporated into the baseline submarine design during the detailed design contract award. This is class agnostic technology development that supports the VIRGINIA program, the COLUMBIA program, and any future submarine new construction programs. Rapid Technology Development projects are efforts designed to rapidly mature higher TRL capabilities and field the particular technology project capability within an 18-30 month window, from program start to submarine at-sea demonstration. Also included in this category are innovative technology transition projects, seedling efforts (<\$800K/year) which assess new technology candidates and keep the submarine and Undersea Warfare (USW) technology pipeline primed. All SUB073/ASSD projects are determined by senior USW leadership and N97 sponsor direction.

The Program works with Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR), Office of Secretary of Defense (OSD), Office of Naval Research (ONR), and Defense Advanced Research Projects Agency (DARPA) organizations to identify and mature technology candidates for integration into current/future submarine classes to provide new/transformational capabilities, while achieving total-ownership cost reductions. Experimentation and demonstration are also conducted in a joint warfighting context with other services, (i.e. Marine Corps, Army, Air Force), to enable early assessment of a new technology's warfighting capabilities, and to inform the Fleet and acquisition community on smarter technology-selection decisions. This Program also supports cooperative R&D through Information/Data Exchange Agreements (IEA/ DEA) and joint Project Arrangements (PA) with international Allies, which target core technology maturation, future submarine component concept designs, etc. Major technology developmental efforts within this budget submission include:

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

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Strategic Capability R&D Infrastructure

- Large Scale Vehicle (LSV)
- Large Scale Vehicle Recapitalization
- Intermediate Scale Measurement System (ISMS)
- High Gain Measurement System (HGMS)
- South TOTO Acoustic Measurement Facility (STAFAC) Recapitalization

Long Range R&D

- Advanced Hull Treatments
- Next Generation Thrust (future propulsor/shafting technologies, composite materials, and integrated stern designs)
- Advanced Material Propeller
- Advanced SSN Technologies
- Advance Signature Management

Rapid Technology Development

- Innovative Technology Transfer

Overall, FY22 funding level reflects a minor decrease in overall budget from FY21. Funding within the Strategic Capability Infrastructure pillar decreased due to minor program adjustments. The decrease in the Long Range R&D pillar is due to planned phasing within the Advanced Hull Treatment installation on VCS Hull C, which transitions from material procurement/installation phases in FY21 into the subsequent underway demonstration, data collection and data analysis phases in FY22. Noteworthy programmatic budget changes include: 1) The transition of the Precision Submarine Maneuvering and Control (PSMC) project work from this project element to the VIRGINIA Class and Advanced Undersea Systems programs to centralize these R&D efforts and more efficiently align with platform capability development; 2) The inclusion of R&D funding in support of the STAFAC lifecycle Recapitalization project; 3) The transition of Hull Treatments demonstration projects into the data collection and analysis phases, and continued tech maturation and assessment of Low Technology Readiness Level (TRL) treatments.

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Strategic Capability R&D Infrastructure	22.179	21.843	20.737	0.000	20.737
Articles:	-	-	-	-	-
Description: Sustains Navy R&D capability for continued operations of the Large Scale Vehicle (LSV), Intermediate Scale Measurement System (ISMS), and High Gain Measurement System (HGMS) test facilities in support of VIRGINIA and COLUMBIA Class Programs, numerous other smaller programs, and future submarine technology development. These facilities are a critical enabler supporting the conduct of large-scale model					

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
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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>experiments and focus on evaluating the stealth, control, affordability, and operational effectiveness of new submarine technologies. The technology validation provided by the model experiments has provided significant cost and schedule savings by allowing prototyping at scale, vice with first-of-hull assets.</p> <p>This project also funds STAFAC Recapitalization, which modernizes the existing South Toto Acoustic Measurement Facility (STAFAC), which is currently at its 15 year design life. It provides a lifecycle replacement of deep-water mooring and cabling systems, eliminates obsolete sensors and data transfer technology, and inserts capabilities required to support the measurement and assessment of COLUMBIA and other future submarine platforms to ensure their stealth.</p> <p>FY 2021 Plans: LSV-2: Conduct LSV-2 core ship systems maintenance, maintain crew qualification, ensure compliance with all LSVSAFE and general regulations, maintain and operate acoustic data navigation and control systems and all required shore support systems. Support ship and system alterations to safely conduct COLUMBIA signature and propulsor trials, and preparations for upcoming trials by planning and approvals. Complete critical COLUMBIA propulsor R&D trials. Conduct triannual LSV Independent Assessment audit. Support ship and system alterations to safely conduct composite shaft trials. Execute LSV-2 drive recapitalization process: shipset of modernized electric drive module components (inverters and converters). Continue Electronic Drive Control Electronics (EDCE) testbed upgrade and continuity plan, planning for EDCE tech refresh, and conduct supporting procurement and manufacturing.</p> <p>ISMS: Continue ongoing system refurbishment and replacement on ISMS. Operate and maintain ISMS acoustic test range underwater and shore-based facilities. Continue support of structural acoustics, target strength and radiated noise measurements in support of COLUMBIA, ONR, and other fleet needs. Complete refurbishment of Experimental Support Platform (ESP) Barge restoring capability to ISMS range for full maintenance, repair, and test support.</p> <p>HGMS: Operate and maintain HGMS acoustic test range underwater and shore-based facilities in support of highly accurate acoustic data from LSV2 operations.</p> <p>FY 2022 Base Plans:</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>LSV2: Conduct LSV-2 core ship systems maintenance, maintain crew qualification, ensure compliance with all LSVSAFE and general regulations, maintain and operate acoustic data navigation and control systems and all required shore support systems. Support ship and system alterations to safely conduct Integrated Shafting and VIRGINIA propulsor trials, and preparations for upcoming trials by planning and approvals. Support restoration from Integrated Shafting trials.</p> <p>Continue LSV-2 drive recapitalization process: receive and test first articles of modernized electric drive module components (inverters and converters). Complete EDCE refresh system design. Continue manufacture of drive components and install as production schedule and operational schedule permits.</p> <p>ISMS: Continue ongoing system refurbishment and replacement on ISMS. Operate and maintain ISMS acoustic test range underwater and shore-based facilities. Continue support of structural acoustics, target strength and radiated noise measurements in support of COLUMBIA, SSN(X), ONR, and other fleet needs.</p> <p>HGMS: Operate and maintain HGMS acoustic test range underwater and shore-based facilities in support of highly accurate acoustic data from LSV2 operations. Complete planning for mid-life refresh to begin procurements in FY23.</p> <p>STAFAC Recapitalization: FY22 R&D efforts leverage Technology Studies, Analysis of Alternatives, Requirements Definition and component-level Preliminary Design efforts initiated in FY19-21 under Acoustic Trials program and Ship Acquisition Program Manager (SHAPM) sponsorship and complete transition from Design Phase into follow-on Production and Procurement Phases. Planned R&D activity includes component prototyping, finalization of Component Designs, systems engineering/design, a Critical Design Review and the development of supporting technical specifications for long lead-time procurement items.</p> <p>FY 2022 OCO Plans: N/A</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: The overall decrease from FY21 to FY22 is due to minor program adjustments.</p>					
<p>Title: Long Range R&D</p> <p align="right">Articles:</p> <p>Description: Develop advanced technologies and tools to increase current and future submarine capabilities, lower</p>	10.548	11.287	8.920	0.000	8.920
	-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<p>acquisition and life-cycle costs, and enhance survivability. Develop technologies and materials that facilitate new and enhance existing warfighting concepts. The program currently supports development of advanced submarine hull coatings for improved acoustic performance, maintainability and cost, with the objective of near-term implementation on VIRGINIA and COLUMBIA Class platforms, as well as future submarine classes. The budget line continues to develop technologies for alternative propulsion/propulsor designs to enhance submarine performance, maneuverability and stealth while reducing submarine acquisition costs. This long-range R&D effort continues to develop and demonstrate technologies for future submarines in areas of hull and platform technologies, propulsors, propellers, corrosion control, ship control, electric actuation, sensors, survivability, and other systems which increase near-term capability and provide cost reduction for in-service and future submarine classes.</p> <p>FY 2021 Plans: ADVANCED HULL TREATMENT. Conduct assessment of installation procedures, adhesion and durability following sea trial on VIRGINIA Class Submarine (VCS Hull B). Install two large ONR advanced hull treatment patches (one on each side) of a VA class submarine (VCS Hull C) undergoing an availability in Portsmouth Naval Shipyard.</p> <p>ADVANCED SIGNATURE MANAGEMENT (ASM): Prototyping Efforts: Develop initial ASM Concept of Operation (CONOP)/procedural guidance. Complete development and review of Technical Data Package Development for ASM TEMPALT in support of FY22 at-sea system demonstration. Project Arrangements: Continue data analysis on shore-based testing/modeling results. Continue collaborative planning for deferred Partner Underwater Electro-Magnetic (UEM) Measurement Trials in FY22.</p> <p>NEXT GENERATION THRUST (NGT). Conduct initial demonstration of Integrated Shafting and Propulsor (IS&P) assembly on LSV-2. Initiate follow-up "Generation 2" IS&P design of composite shaft concept. Begin concept design for a full-scale (SSN) demo of an IS&P assembly. Continue development of most promising NGT concepts and continue tool design improvement initiatives in support of New SSN propulsion technology development.</p> <p>ADVANCED MATERIAL PROPELLER (AMP). Complete instrumentation and installation of full-scale AMP propeller on partner submarine and conduct Sea Trial. Conduct follow-on destructive testing and analysis of full-scale propeller data per follow-on Project Arrangement.</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021		
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>			
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)					
ADVANCED SSN TECHNOLOGIES. Continue assessment of new technologies for future submarines in support of the Tactical Submarine Evolution Plan (TSEP) and continue studies to assess potential impacts on platform capability. Continue studies on enabling technologies and platform integration barriers. Continue development on critical, long-lead technologies/materials.					
FY 2022 Base Plans:					
ADVANCED HULL TREATMENT. Complete the installation of two large ONR advanced hull treatment patches (one on each side) of a VA class submarine (VCS Hull C) undergoing an availability in Portsmouth Naval Shipyard. Continue with assessment of adhesion, durability and performance following sea trial on VCS Hull B.					
NEXT GENERATION THRUST (NGT). Conduct manufacturing and demonstration of "Generation 2" Integrated Shafting and Propulsor (IS&P) assembly on LSV-2. Continue concept design for a full-scale SSN demo of an IS&P assembly and shaft fatigue test facility. Continue development of most promising NGT concepts (e.g., Integrated Stern, Multi-Material Propeller Prototype (M2P2), advanced materials manufacturing) and continue tool design improvement initiatives in support of New SSN propulsion technology development.					
ADVANCED MATERIAL PROPELLER (AMP). Continue post-sea trial destructive testing and analysis of full-scale propeller data per follow-on Project Arrangement					
ADVANCED SSN TECHNOLOGIES. Continue assessment of new technologies for future submarines in support of the Tactical Submarine Evolution Plan (TSEP). Continue studies and prototype testing to assess potential impacts on platform capability. Continue development and maturation of critical, long-lead technologies/materials.					
FY 2022 OCO Plans:					
N/A					
FY 2021 to FY 2022 Increase/Decrease Statement:					
The decrease from FY21 to FY22 is due to planned phasing within the Advanced Hull Treatments project. Material procurements and the majority of shipyard labor supporting the Hull Treatment patch installation on VCS Hull C occurs in FY21. The FY22 budget completes final phases of VCS Hull C demo patch installation, and supports data analysis on VCS Hull B treatment patch, as well as technology maturation on other Low TRL ONR developed prototype treatments.					
Title: Rapid Technology Development					
	0.212	0.300	0.300	0.000	0.300

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Articles:	-	-	-	-	-
<p>Description: Conduct Navy and joint demonstrations of advanced technologies and payloads to assess the operational value of the technologies/systems under consideration, and speed transition of operational capabilities. Coordinate with new construction and in-service program offices to synchronize ship technology demonstration and insertion with design/delivery timelines.</p> <p>FY 2021 Plans: Continue to leverage products and analysis from Naval Laboratories, Small Business (SBIR/STTR), industry Independent Research and Development (IRAD), and Foreign Comparative Testing efforts to identify/develop innovative submarine and USW technology transition project candidates. FY 21 planned projects include the deployment of a prototype Ship Control System Data Monitoring System (SCSDMS) aboard a VIRGINIA Class Submarine, and the assessment of various SBIR/STTR efforts in the area of HM&E enablers of Directed Energy.</p> <p>FY 2022 Base Plans: Continue to leverage products and analysis from Naval Laboratories, Small Business (SBIR/STTR), industry Independent Research and Development (IRAD), and Foreign Comparative Testing efforts to identify/develop innovative submarine and USW technology transition project candidates. FY 22 planned projects include prototype sensor and component development in support of measurement ranges.</p> <p>FY 2022 OCO Plans: N/A</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Slight decrease in funding from FY21 to FY22 due to minor program adjustments.</p>					
Accomplishments/Planned Programs Subtotals	32.939	33.430	29.957	0.000	29.957

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

<u>Line Item</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022 Base</u>	<u>FY 2022 OCO</u>	<u>FY 2022 Total</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• OPN/0941: <i>Submarine Support Equipment</i>	44.895	64.632	88.284	-	88.284	-	-	-	-	-	-

Remarks

A portion of the funding required for the STAFAC Recapitalization project is included within the OPN project above.

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>

D. Acquisition Strategy

Non-ACAT program with BA4 R&D investment. Projects transition via formal processes to acquisition programs of record for inclusion into existing ship baselines or insertion as capability upgrades. Concept Formulation (CONFORM) contracts with the only two submarine design/construction shipyards, General Dynamics Electric Boat (GDEB) and Huntington Ingalls Industries Newport News Shipbuilding (HII-NNS) facilitate this process. Engagement with industry via competitively awarded Small Business Innovation Research (SBIR) and topic-specific Broad Agency Announcement (BAA) contracts are used to build vendor base and support development of R&D products for enhanced submarine capability in the areas of advanced Hull Mechanical & Electrical (HM&E) technology, stealth improvements and payload system development. Program leverages technical analysis and prototyping support from University Affiliated Research Centers (UARC), such as Penn State University Applied Research Laboratory and Johns Hopkins Applied Physics Laboratory via NAVSEA UARC contract vehicles. Program utilizes Interagency Agreements with National Laboratories, such as Sandia National Laboratory and Oak Ridge National Laboratory to leverage their unique technical competencies in energy, sensing systems, materials and advanced/additive manufacturing.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>
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Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Product Development	C/FFP	DRS Technologies : Milwaukee, WI	1.000	5.530	Apr 2020	3.310	Feb 2021	0.000		-		0.000	-	-	-
Product Development	WR	NSWC Crane : Crane, IN	0.640	0.000		0.295	Dec 2020	0.301	Dec 2021	-		0.301	-	-	-
Product Development	C/CPFF	Rolls Royce Marine : Walpole, MA	0.100	0.100	Jun 2020	0.000		0.000		-		0.000	-	-	-
Product Development	WR	NSWC PHILLY : Philly, PA	0.440	0.275	Nov 2019	0.385	Nov 2020	0.375	Nov 2021	-		0.375	-	-	-
Product Development	WR	NRL : Washington, DC	3.007	0.000		0.102	Nov 2020	0.104	Nov 2021	-		0.104	-	-	-
Product Development	SS/CPFF	HII : Newport News, VA	20.064	3.150	Apr 2020	1.670	Jan 2021	1.671	Jan 2022	-		1.671	-	-	-
Product Development	SS/CPFF	EB : Groton, CT	80.073	4.605	Apr 2020	4.785	Jan 2021	3.521	Jan 2022	-		3.521	-	-	-
Product Development	WR	NSWC : Carderock, MD	102.473	3.185	Apr 2020	4.421	Nov 2020	5.907	Nov 2021	-		5.907	-	-	-
Product Development	SS/CPFF	ARL/PSU : State College, PA	10.553	0.597	Apr 2020	1.203	Apr 2021	1.227	Apr 2022	-		1.227	-	-	-
Product Development	SS/CPFF	JHU/APL : Laurel, MD	24.671	0.250	Apr 2020	0.255	Apr 2021	0.260	Apr 2022	-		0.260	-	-	-
Product Development	Various	Various : Various	36.796	0.202	Apr 2020	0.296	Jan 2021	0.302	Jan 2022	-		0.302	-	-	-
Product Development	WR	NUWC : Newport, RI	80.808	0.550	Mar 2020	1.020	Mar 2021	0.000	Nov 2021	-		0.000	-	-	-
Product Development	WR	ONR : Arlington, VA	10.224	1.700	May 2020	0.000		0.000		-		0.000	-	-	-
Product Development	SS/CPFF	Progeny : Manassas VA	0.695	0.000		0.000		0.000		-		0.000	-	-	-
Product Development	MIPR	Oak Ridge National Lab : Oakridge, TN	0.000	0.550	Apr 2020	0.110	Mar 2021	0.260	Mar 2022	-		0.260	-	-	-
Product Development	SS/CPFF	APL/University of Washington : Seattle, WA	0.000	0.000		0.000		0.910	Nov 2021	-		0.910	-	-	-
Subtotal			371.544	20.694		17.852		14.838		-		14.838	-	-	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>
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Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			

Remarks
 FY21 to FY22 decrease for DRS due to cessation of LSV Recap efforts with DRS
 FY21 to FY22 increase for NSWC Carderock due to ramp up in effort due to STAFAC Recapitalization
 Various/VAR is used to group multiple activities with small funding levels.

Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Contractor Engineering Support	SS/CPFF	Various : Various	17.646	1.000	Mar 2020	1.420	Mar 2021	1.140	Mar 2022	-		1.140	-	-	-
Government Engineering Support	WR	Various : Various	7.934	0.371	Oct 2019	0.379	Oct 2020	0.587	Oct 2021	-		0.587	-	-	-
Travel	WR	NAVSEA HQ : Not Specified	1.309	0.106	Oct 2019	0.108	Oct 2020	0.110	Oct 2021	-		0.110	-	-	-
Subtotal			26.889	1.477		1.907		1.837		-		1.837	-	-	N/A

Remarks
 Various/VAR is used to group multiple activities with small funding levels.

Test and Evaluation (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Developmental Test & Evaluation	C/CPFF	GDIT : Bayview, ID	3.200	1.000	Mar 2020	2.000	Nov 2020	1.800	Nov 2021	-		1.800	-	-	-
Developmental Test & Evaluation	SS/CPFF	EB : Groton, CT	31.128	4.066	May 2020	4.147	Jan 2021	3.979	Jan 2022	-		3.979	-	-	-
Developmental Test & Evaluation	WR	NSWC/PHILLY : PHILLY, PA	9.584	0.240	Dec 2019	0.493	Dec 2020	0.503	Nov 2021	-		0.503	-	-	-
Developmental Test & Evaluation	Various	Various : Various	9.407	0.689	Apr 2020	0.703	Apr 2021	0.717	Mar 2022	-		0.717	-	-	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>
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Test and Evaluation (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Developmental Test & Evaluation	WR	NUWC : Newport, RI	32.215	0.500	Apr 2020	0.510	Nov 2020	0.426	Nov 2021	-		0.426	-	-	-
Developmental Test & Evaluation	WR	NSWC : Carderock, MD	60.396	4.273	Apr 2020	4.462	Nov 2020	4.500	Nov 2021	-		4.500	-	-	-
Developmental Test & Evaluation	SS/CPFF	HII : Newport News, VA	5.794	0.000	Apr 2020	0.606	Jan 2021	0.618	Jan 2022	-		0.618	-	-	-
Developmental Test & Evaluation	SS/CPFF	JHU/APL : Laurel, MD	0.000	0.000		0.750	Apr 2021	0.739	Apr 2022	-		0.739	-	-	-
Subtotal			151.724	10.768		13.671		13.282		-		13.282	-	-	N/A

Remarks
 Various/VAR is used to group multiple activities with small funding levels.
 GDIT contract supports engineering services/technical support of LSV, ISMS, and associated infrastructure at Acoustic Research Detachment Bayview Idaho.

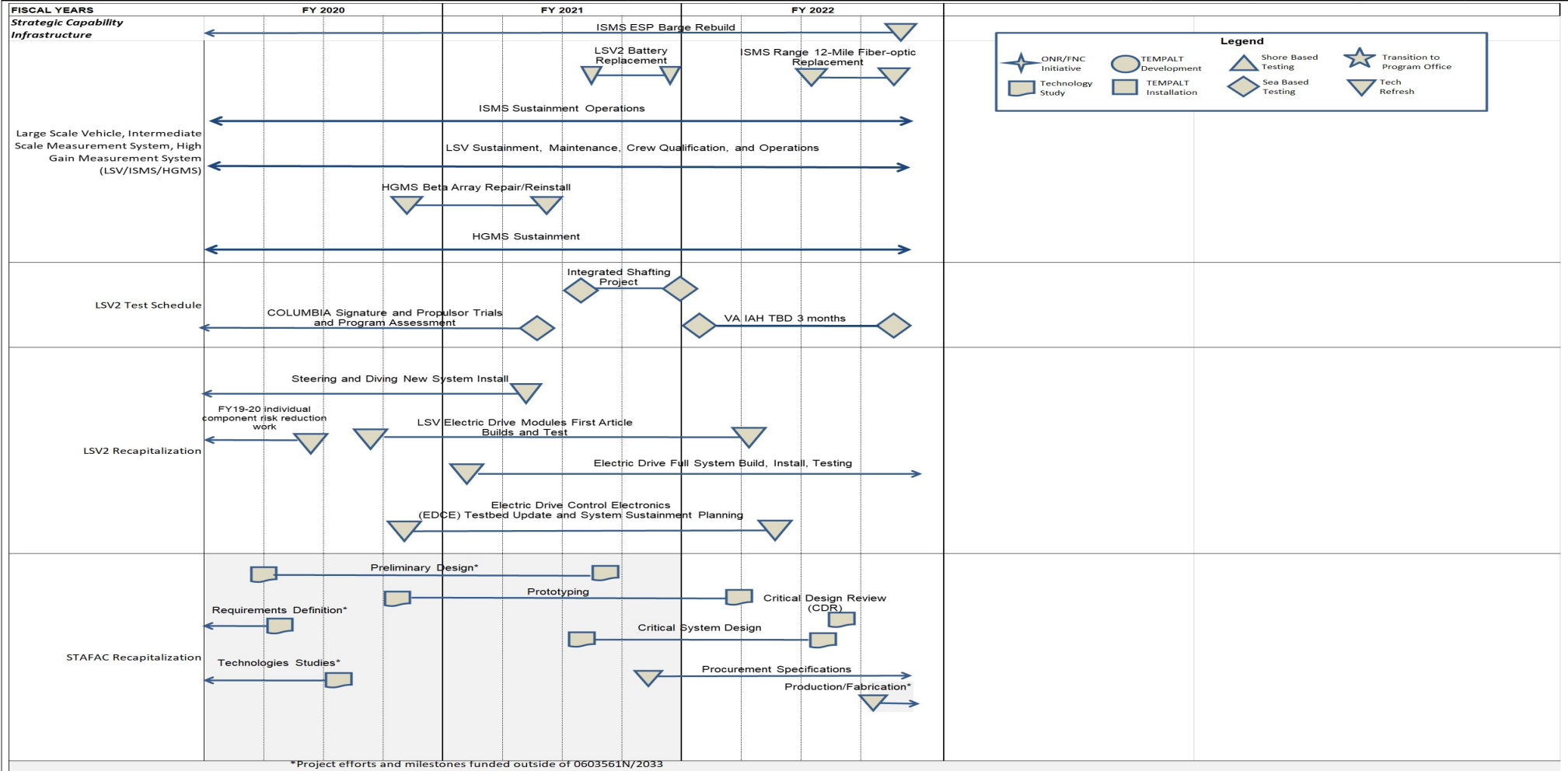
	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	550.157	32.939	33.430	29.957	-	29.957	-	-	N/A

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy **Date: May 2021**

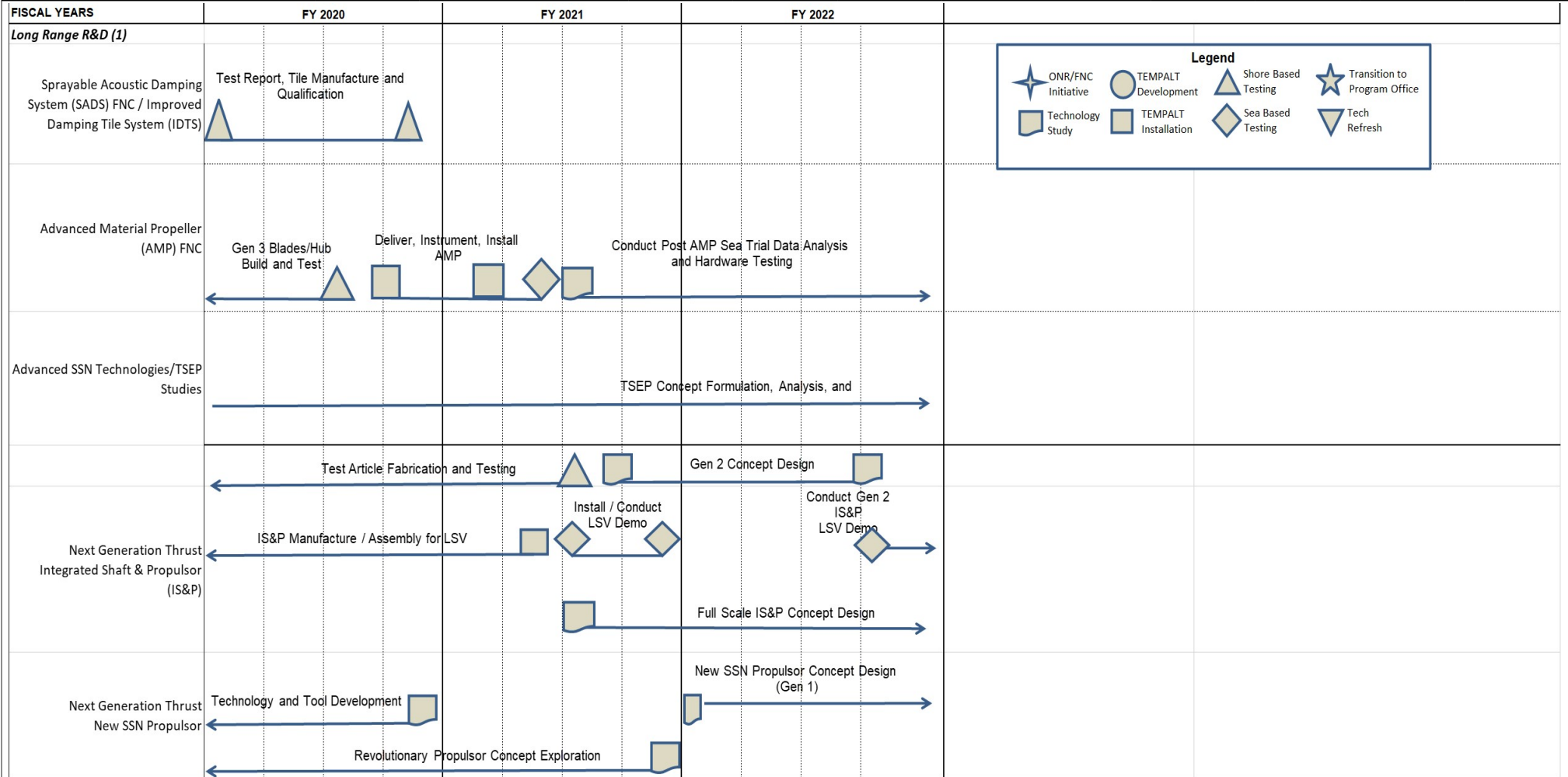
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>
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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy **Date: May 2021**

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>
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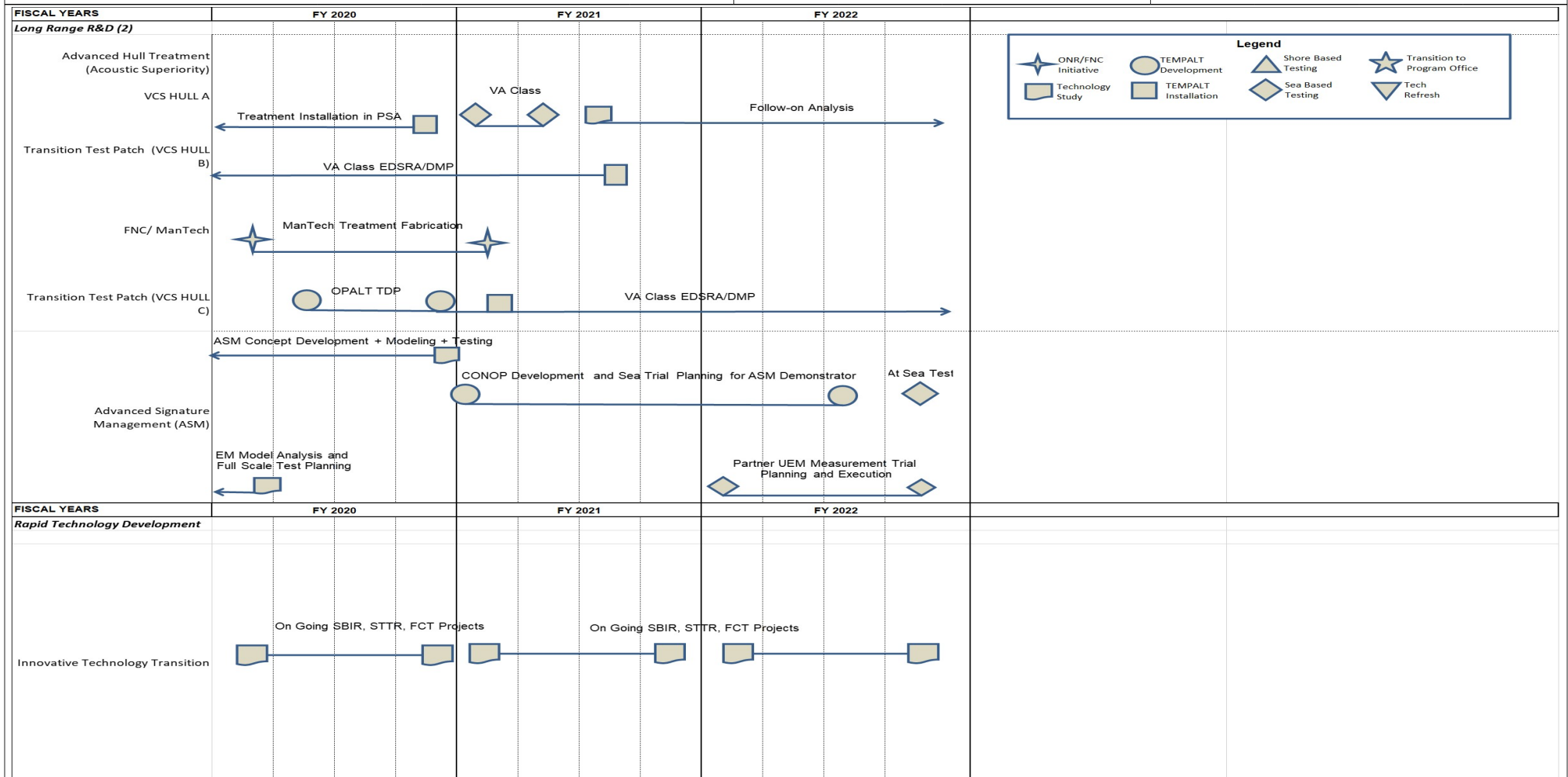
Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy

Date: May 2021

Appropriation/Budget Activity
1319 / 4

R-1 Program Element (Number/Name)
PE 0603561N / Advanced Submarine System Development

Project (Number/Name)
2033 / Adv Submarine Systems Development



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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 2033				
Strategic Capability Infrastructure: ISMS/LSV /HGMS- ISMS ESP Barge Rebuild	1	2020	4	2022
Strategic Capability Infrastructure: ISMS/LSV/HGMS - Range 12 mile fiber-optic replacement	3	2022	4	2022
Strategic Capability Infrastructure: ISMS /LSV/HGMS - LSV Sustainment, Maintenance, Crew Qualification and Operations	1	2020	4	2022
Strategic Capability Infrastructure: ISMS /LSV/HGMS - LSV Battery Replacement	3	2021	4	2021
Strategic Capability Infrastructure: ISMS/LSV/HGMS - ISMS Range Sustainment Operations	1	2020	4	2022
Strategic Capability Infrastructure: ISMS/LSV/HGMS - HGMS Sustainment	1	2020	4	2022
Strategic Capability Infrastructure: ISMS/LSV/HGMS - HGMS Beta Array Repair/ Reinstall	4	2020	2	2021
Strategic Capability Infrastructure: LSV2 Test Schedule - COLUMBIA Signature and Propulsor Trials and Program Assessment	1	2020	2	2021
Strategic Capability Infrastructure: LSV2 Test Schedule - Integrated Shafting	3	2021	4	2021
Strategic Capability Infrastructure: LSV2 Test Schedule - VA IAH TBD (3 months)	1	2022	4	2022
Strategic Capability Infrastructure: LSV2 Recapitalization - LSV2 Steering and Diving New System Install Replacement	1	2020	2	2021
Strategic Capability Infrastructure: LSV2 Recapitalization - FY19-FY20 Individual Component Risk Reduction work	1	2020	2	2020
Strategic Capability Infrastructure: LSV2 Recapitalization - Electric Drive Modules First Article Builds and Test	3	2020	2	2022
Strategic Capability Infrastructure: LSV2 Recapitalization - Electric Drive Full System Build, Install, Testing	1	2021	4	2022

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Strategic Capability Infrastructure: LSV2 Recapitalization - Electronic Drive Control Electronics (EDCE) Test bed Update and System Sustainment Planning	4	2020	2	2022
Strategic Capability Infrastructure: STAFAC Recapitalization - Prototyping	4	2020	2	2022
Strategic Capability Infrastructure: STAFAC Recapitalization - Critical System Design	3	2021	3	2022
Strategic Capability Infrastructure: STAFAC Recapitalization - Procurement Specifications	4	2021	4	2022
Strategic Capability Infrastructure: STAFAC Recapitalization - Critical Design Review	3	2022	3	2022
Long Range R&D: SADS/IDTS - Test Report, Tile Manufacture	1	2020	4	2020
Long Range R&D: Advanced Material Propeller (AMP) - Manufacture and test Gen 3 blades and hub	1	2020	3	2020
Long Range R&D: Advanced Material Propeller (AMP) - Deliver instrument and install AMP propeller	4	2020	2	2021
Long Range R&D: Advanced Material Propeller (AMP) - At-sea test on partner submarine	2	2021	2	2021
Long Range R&D: Advanced Material Propeller (AMP) - Post-sea trial data analysis and hardware testing	3	2021	4	2022
Long Range R&D: SSN(X) - Advanced SSN Technologies/TSEP Studies - TSEP concept formulation, analysis, and design	1	2020	4	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) -Test Article fabrication and testing	1	2020	3	2021
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - IS&P Manufacture/Assembly for LSV	1	2020	2	2021
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Install/Conduct LSV Demo	3	2021	4	2021
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Gen 2 Design/Manufacturing	3	2021	4	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Conduct Gen 2 IS&P LSV Demo	4	2022	4	2022

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2033 / <i>Adv Submarine Systems Development</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Full Scale IS&P Concept Design	3	2021	4	2022
Long Range R&D: Next Generation Thrust New SSN Propulsor - Technology and Tool Dev	1	2020	4	2020
Long Range R&D: Next Generation Thrust New SSN Propulsor - New SSN Propulsor Concept Design (Gen 1)	1	2022	4	2022
Long Range R&D: Next Generation Thrust New SSN Propulsor - Revolutionary Propulsor Concept Exploration	1	2020	4	2021
Long Range R&D: Advanced Hull Treatments - Treatment Installation and PSA	1	2020	4	2020
Long Range R&D: Advanced Hull Treatments VA Class Sea Based Testing	1	2021	2	2021
Long Range R&D: Advanced Hull Treatments - Follow-on Analysis	3	2021	4	2022
Long Range R&D: Transition Test Patch (VCS HULL B) - VA Class EDSRA/DMP	1	2020	3	2021
Long Range R&D: FNC/ManTech - ManTech Treatment Fabrication	1	2020	1	2021
Long Range R&D: Transition Test Patch (VCS HULL C) -OPALT TDP	2	2020	4	2020
Long Range R&D: Transition Test Patch (VCS HULL C) - VA Class EDSRA/DMP	2	2021	4	2022
Long Range R&D: Advanced Signature Management -Concept Development, Modeling and Test Analysis	1	2020	4	2020
Long Range R&D: Advanced Signature Management - CONOP Dev and Sea Trial Planning for Demo	1	2021	3	2022
Long Range R&D: Advanced Signature Management - At Sea Test	4	2022	4	2022
Long Range R&D: Advanced Signature Management - EM Model Testing/Analysis and Full Scale Test Planning	1	2020	1	2020
Long Range R&D: Advanced Signature Management - Partner UEM Measurement Trial, Planning/Execution	1	2022	4	2022
Rapid Technology Development: Innovative Technology Transition - Conduct assessment of technology initiatives, SBIR transition work, STTR, Foreign Comparative Tests	1	2020	4	2022

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy										Date: May 2021		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>				Project (Number/Name) 2096 / <i>Payload Delivery Development</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
2096: <i>Payload Delivery Development</i>	19.507	10.378	13.885	2.527	-	2.527	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

FY 2022 funding profile decreases based upon a change in requirements, completion of current system design efforts, completion of a Technical Data Package (TDP) and final disposition of material procured in FY20/21.

Payload Delivery Development is a program used for the integration of deployable and retrievable payloads with submarines. RDT&EN funding will be used to develop a prototype payload launch and recovery system utilized with submarine large ocean interfaces to accommodate payloads and offboard systems. The project enables launch and recovery of these systems from submarines. This will provide the Submarine Force with the capability to launch and recover payloads and offboard systems of various configurations in support of critical Undersea Warfare (USW) missions, providing battle space awareness and extending war-fighting reach in support of Subsea and Seabed Warfare (SSW) mission objectives. This capability has been identified as a key enabler for the following critical USW mission areas: Intelligence, Surveillance, and Reconnaissance (ISR), Anti-Submarine Warfare (ASW), Anti-Surface Warfare (ASUW), Naval Special Warfare (NSW), Mine Warfare, Subsea and Seabed Warfare (SSW), Counter- Autonomous Underwater Vehicle (AUV) Warfare, Electromagnetic Maneuver Warfare (EMMW), Deception, and Non-Lethal Sea Control. This capability is paramount to winning the great power competition emerging between world powers and maintaining dominance in the undersea domain. In addition to technology development, the program will support engineering and integration of new and existing technologies to enable rapid prototyping and fielding of future payload capabilities for VIRGINIA Class (VCS) Payload Modules (Block V and VI) and will be in coordination with the Tactical Submarine Evolution Plan (TSEP) objectives for VCS Block VII and/or SSN(x). The prototype system capability will also provide the Fleet [i.e., Commander, Naval Submarine Forces (COMSUBFOR), Unmanned Undersea Vehicle Squadron One (UUVRON ONE), etc.] with the ability to conduct Fleet funded experimentation with unmanned payloads, enabling an agile environment through at-sea demonstrations, which will provide Fleet and acquisition stakeholders with relevant payload employment data to inform Concepts of Operations (CONOPs) and fielding decisions for future systems.

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Payload Handling System (PHS)	10.378	13.885	2.527	0.000	2.527
Articles:	-	-	-	-	-
Description: Payload Delivery Development includes the development of "middle-ware" handling systems used to deploy and retrieve undersea vehicles, payloads, and offboard systems from submarines. Funding will be used to design and develop a build to print Technical Data Package (TDP) for a system to facilitate the raising, lowering and articulation of payloads into and out of submarine large ocean interfaces (e.g. missile tubes; torpedo tubes) to increase future war fighting capabilities. Additionally, these efforts include the transfer					

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2096 / <i>Payload Delivery Development</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<p>of technology and final design packages to industry for future multi-unit procurement and application on future VIRGINIA Class and other future submarines.</p> <p>Long lead-time material purchases began in FY20 and continued into FY21. This material will be dispositioned by the end of FY22.</p> <p>Planned FY22 efforts include completion of a build to print Technical Data Package (TDP) that can be transferred to industry for manufacturing to support future integration into VIRGINIA Class submarines.</p> <p>FY 2021 Plans:</p> <ul style="list-style-type: none"> - Continued development of a VIRGINIA Class build-to-print Technical Data Package (TDP) - Complete Final Design Review (FDR) <p>FY 2022 Base Plans:</p> <ul style="list-style-type: none"> -Completion of VIRGINIA Class build-to-print Technical Data Package (TDP) <p>FY 2022 OCO Plans:</p> <p>N/A</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement:</p> <p>FY22 funding profile decrease is based upon change in requirements, completion of system design efforts, completion of build to print Technical Data Package (TDP) and final disposition of material procured in FY20/21.</p>					
Accomplishments/Planned Programs Subtotals	10.378	13.885	2.527	0.000	2.527

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

Remarks

D. Acquisition Strategy
Project will transition to multiple unmanned vehicle programs to support VIRGINIA Class integration.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2096 / <i>Payload Delivery Development</i>
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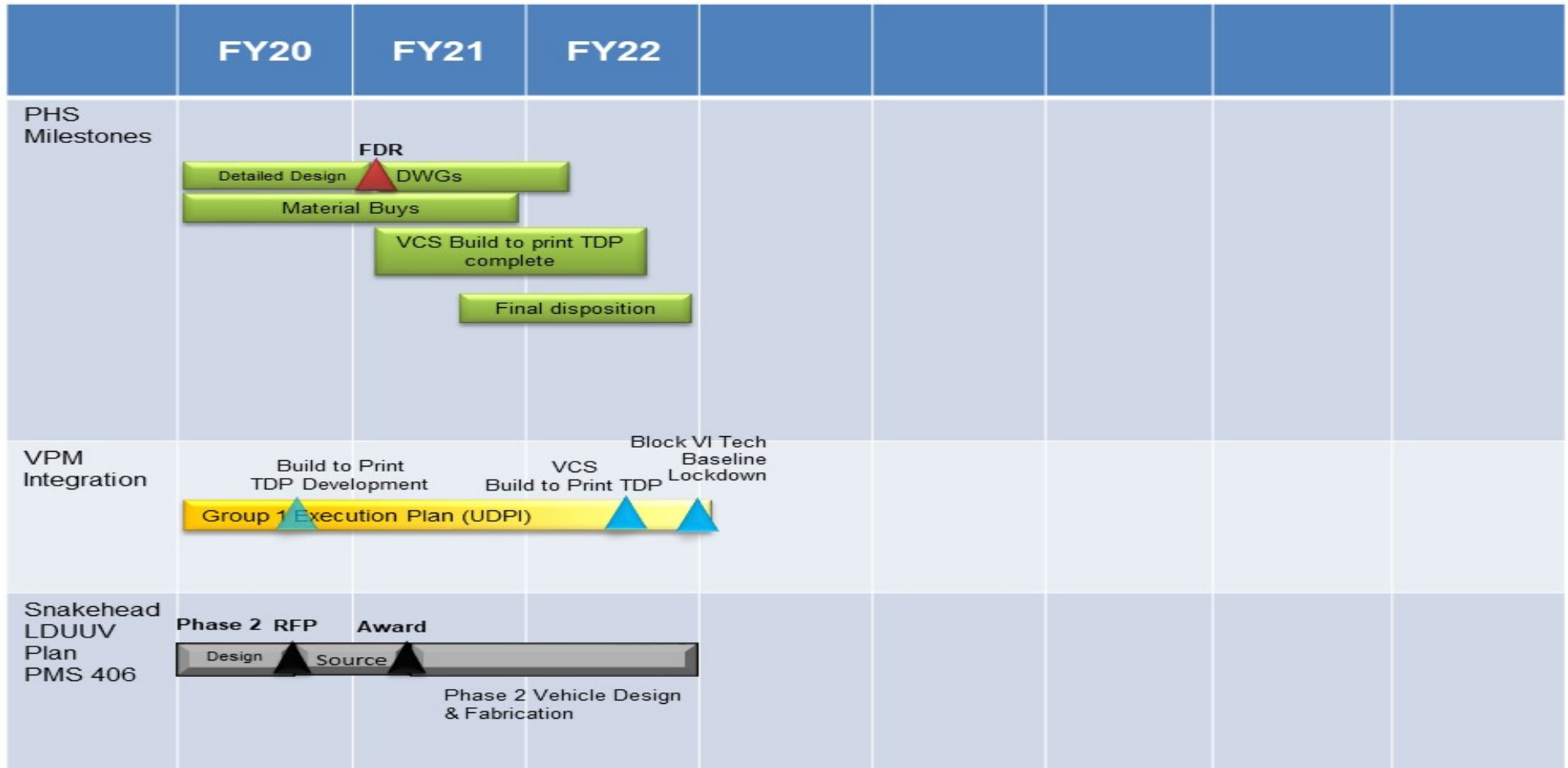
Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Product Development (1)	WR	NUWC NPT : Newport, RI	1.971	1.255	Oct 2019	4.030	Oct 2020	0.275	Oct 2021	-		0.275	-	-	-
Product Development	WR	NSWC PD : Philadelphia, PA	7.165	4.960	Oct 2019	2.378	Oct 2020	0.850	Oct 2021	-		0.850	-	-	-
Product Development (1)	WR	NUWC KPT : Keyport, WA	4.807	2.457	Oct 2019	2.228	Oct 2020	0.600	Oct 2021	-		0.600	-	-	-
Product Development (1)	WR	PSNS : Bremerton, WA	1.810	1.431	Oct 2019	4.632	Oct 2020	0.492	Oct 2021	-		0.492	-	-	-
Product Development	WR	NSWC CD : West Bethesda, MD	1.314	0.045	Oct 2019	0.310	May 2021	0.000		-		0.000	-	-	-
Product Development	WR	NRL : Washington, DC	0.255	0.000	Oct 2019	0.000		0.000		-		0.000	-	-	-
Product Development	FFRDC	ARL/PSU : Arlington, VA	0.285	0.000	Oct 2019	0.000		0.000		-		0.000	-	-	-
Product Development	WR	NSWC DD : Dahlgren, VA	0.026	0.000	Oct 2019	0.000		0.000		-		0.000	-	-	-
Product Development	C/CPFF	DIUx : Mountain View, CA	0.050	0.000	Oct 2019	0.000		0.000		-		0.000	-	-	-
Product Development	WR	PNSY : Portsmouth, NH	0.597	0.000	Oct 2019	0.000		0.000		-		0.000	-	-	-
Subtotal			18.280	10.148		13.578		2.217		-		2.217	-	-	N/A

Remarks
(1) Decreased funding in FY22 is based upon completion of system design efforts, completion of the Technical Data Package (TDP) and final disposition of material procured in FY20/21.

Management Services (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Travel	Allot	NAVSEA HQ : Washington DC	0.132	0.050	Oct 2019	0.047	Oct 2020	0.050	Oct 2021	-		0.050	-	-	-

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2096 / <i>Payload Delivery Development</i>



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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 2096 / <i>Payload Delivery Development</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Payload Handling System (PHS)</i>				
PHS Milestones: Detailed Design	1	2020	1	2022
PHS Milestones: Final Design Review	1	2021	1	2021
PHS Milestones: Material Busy	1	2020	4	2021
PHS Milestones: Drawing Development (DWG)	1	2021	2	2022
PHS Milestones: VIRGINIA Class Build to Print TDP Ready	1	2021	3	2022
PHS Milestones: Final disposition of material	3	2021	4	2022
VPM Integration: VIRGINIA Class Submarine (VCS) Build to Print TDP Development	2	2020	2	2020
VPM Integration: Group 1 Execution Plan Undersea Dominance Payload Integration (UDPI)	1	2020	4	2022
VPM Integration: Block VI Tech Baseline Lockdown	2	2022	2	2022
Snakehead LDUUV Plan: Phase 2 Design	1	2020	3	2020
Snakehead LDUUV Plan: RFP	3	2020	3	2020
Snakehead LDUUV Plan: Source Selection	3	2020	2	2021
Snakehead LDUUV Plan: Award	2	2021	2	2021
Snakehead LDUUV Plan: Phase 2 Vehicle Design & Fabrication	2	2022	4	2022

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy										Date: May 2021		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>				Project (Number/Name) 3391 / <i>SSN/SSGN Survivability Program</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
3391: <i>SSN/SSGN Survivability Program</i>	16.319	9.112	11.460	11.856	-	11.856	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In 2013, OPNAV N97 established SSN/SSGN Survivability Program (S3P) as a separate project area within ASSD to assure SSN/SSGN survivability and the ability of submarines to complete their joint warfighting missions even if covert mobility is compromised. The budget increased in FY21 to complete a realignment of signature countermeasures from ASSD to the S3P portfolio supporting increased effort for TEMPALT development.

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: SSN/SSGN Survivability Program	9.112	11.460	11.856	0.000	11.856
Articles:	-	-	-	-	-
<p>Description: The details of project activities are SECRET or higher. The SSN/SSGN Survivability Program (S3P) provides Director, Undersea Warfare Division (OPNAV N97) with qualitative and quantitative analysis of potential SSN and SSGN submarine vulnerabilities based on technology threats and operational requirements and recommends countermeasure concepts to mitigate these potential vulnerabilities. S3P informs the entire \$10B submarine portfolio with validated analysis which informs risk to submarine survivability and stealth in contested environments. This analysis also informs methods by which stealth can be regained once compromised to execute missions such as weapons employment. S3P conducts technical analysis validated with at-sea testing. The technical analysis is put into an operational context using data from current submarine operations and Fleet war plans. S3P develops technologies and tools to increase the survivability of submarines by recognizing and mitigating sources of acoustic and non-acoustic vulnerabilities that put a submarine at risk when operating in contested waters and the littorals. S3P supports fleet development of Tactics, Techniques, and Procedures (TTPs) that facilitate new or enhance existing warfighting concepts.</p> <p>FY 2021 Plans:</p> <ul style="list-style-type: none"> - S3P will continue to address gaps in stealth and survivability for the current SSN/SSGN force to include responding to fleet questions on current tactical vulnerabilities and completion of an annual Operational Survivability Assessment. - Continue analytical and technical work on TSEP and future SSN/SSGN survivability design basis. 					

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 3391 / <i>SSN/SSGN Survivability Program</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
<ul style="list-style-type: none"> - S3P will conduct emerging threat, acoustic, non-acoustic vulnerability assessment projects, and will conduct sea tests in stealth requirements and countermeasure concepts. - Complete two tactical decision concept projects for current fleet operations. - S3P will conduct two (2) at-sea tests to include foreign partners where available for Advanced Signature Countermeasures development. - Details may be provided in a classified setting. <p><i>FY 2022 Base Plans:</i></p> <ul style="list-style-type: none"> - S3P will continue to address gaps in stealth and survivability for the current SSN/SSGN force to include responding to fleet questions on current tactical vulnerabilities and completion of an annual Operational Survivability Assessment. - Continue analytical and technical work on TSEP and future SSN/SSGN survivability design basis. - S3P will conduct emerging threat, acoustic, non-acoustic vulnerability assessment projects, and will conduct sea tests in stealth requirements and countermeasure concepts. - Complete two tactical decision concept projects for current fleet operations. - S3P will conduct two (2) at-sea tests to include foreign partners where available for Advanced Signature Countermeasures development. - Details may be provided in a classified setting. <p><i>FY 2022 OCO Plans:</i> N/A</p> <p><i>FY 2021 to FY 2022 Increase/Decrease Statement:</i> Increase from FY21 to FY22 supports increased effort for TEMPALT development.</p>					
Accomplishments/Planned Programs Subtotals	9.112	11.460	11.856	0.000	11.856

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

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 3391 / <i>SSN/SSGN Survivability Program</i>

D. Acquisition Strategy

S3P is a non-acquisition activity that investigates, prioritizes, and validates SSN/SSGN survivability issues for peacetime and all phases of war. S3P also proposes and directs development and validation of countermeasure concepts. S3P works to ensure alignment between OPNAV, NAVSEA, ONI, and the Fleet on survivability issues. S3P develops recommendations for stealth requirements to OPNAV N97 and provides technical basis for Tactics, Techniques, and Procedures developed by the Undersea Warfighting Development Command (UWDC). S3P operates under OPNAV N97 and Fleet Flag panel (Operations Review Group) oversight. S3P products and metrics are evaluated by the Submarine Operations Group and Operations Review Group. S3P also recommends technical requirements for all matters of submarine survivability to OPNAV N97.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy											Date: May 2021				
Appropriation/Budget Activity 1319 / 4						R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>					Project (Number/Name) 3391 / <i>SSN/SSGN Survivability Program</i>				

Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Product Development	MIPR	CNA : Alexandria, VA	1.010	0.500	Jan 2020	0.700	Jan 2021	0.971	Jan 2022	-		0.971	-	-	-
Product Development	SS/CPFF	MIT-LL : Cambridge, MA	0.827	0.600	Oct 2019	0.750	Oct 2020	1.163	Oct 2021	-		1.163	-	-	-
Product Development	SS/CPFF	Raytheon : Portsmouth, RI	0.658	0.450	Sep 2020	0.400	Sep 2021	0.000	Sep 2022	-		0.000	-	-	-
Product Development	SS/CPFF	JHU/APL : Laurel, MD	3.779	1.000	Jul 2020	2.319	Jul 2021	0.697	Jul 2022	-		0.697	-	-	-
Product Development	SS/CPFF	UT/ARL : Austin, TX	1.067	0.800	Aug 2020	0.600	Aug 2021	0.612	Aug 2022	-		0.612	-	-	-
Product Development	WR	NUWC : Newport, RI	1.900	1.000	Apr 2020	1.000	Apr 2021	1.020	Apr 2022	-		1.020	-	-	-
Product Development	MIPR	NRL : Washington, DC	0.390	0.400	Dec 2019	0.750	Dec 2020	0.765	Dec 2021	-		0.765	-	-	-
Product Development	C/BA	NSMA : Not Specified	1.682	0.920	Dec 2019	0.600	Dec 2020	0.612	Dec 2021	-		0.612	-	-	-
Product Development	SS/CPFF	Son analysts : Groton, CT	0.250	0.350	Sep 2020	1.500	Sep 2021	1.530	Sep 2022	-		1.530	-	-	-
Product Development	WR	SPAWAR : Charleston, SC	0.150	0.050	Aug 2020	0.050	Aug 2021	0.000	Aug 2022	-		0.000	-	-	-
Subtotal			11.713	6.070		8.669		7.370		-		7.370	-	-	N/A

Remarks

FY21 increase at APL JHU for conducting Advanced Signature Countermeasures technical development and testing.

Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Travel and Corporate	WR	NAVSEA HQ : Not Specified	0.380	0.360	Oct 2019	0.020	Oct 2020	0.051	Oct 2021	-		0.051	-	-	-
Subtotal			0.380	0.360		0.020		0.051		-		0.051	-	-	N/A

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy Date: May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 3391 / <i>SSN/SSGN Survivability Program</i>
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	FY 2020	FY 2021	FY 2022
SSGN Survivability (S3P) Program	Address gaps in stealth and survivability for SSN and SSGNs (2-3 assessments, 3-4 vulnerability validation projects, and 1-3 countermeasure development projects per year)		
Assessments	Annual assessment of state of SSN/SSGN Survivability with respect to adversary capability and available science		
Operational Survivability Assessment (OSA)	Collection and Assessment of SS(G)N deployment operations to inform Submarine Fleet tactical decisions and gaps		
SS(G)N Operations Statistics	Assessment of SSN/SSGN acoustic health (1-2 per year)		
Acoustic Assessment	Assessment of SSN/SSGN non-acoustic health (1-2 per year)		
Non-Acoustic Assessment	3-4 Validation projects per year to include 1-2 Sea Tests and 2-3 studies		
Vulnerability Validation	1-2 Sea Tests & analysis	1-2 Sea Tests & analysis	1-2 Sea Tests & analysis
Vulnerability Sea Test Validation Projects	1-3 Countermeasure projects per year to include 1-2 Sea Tests		
Operational Countermeasures	Tactical Decision Aid Development & Test	Evaluate Performance	Transition Project to POR
Countermeasure Sea Test Validation Projects	Tactical Decision Aid Development and testing		
Advanced Signature Mangement / Countermeasures	Execute one trial or sea test per year to inform countermeasure requirements		
Sea Test Validation Program	Countermeasure Concept Demonstration (1 test per year)		
Signature Vulnerability Assessment	Assessment (1 per year)		

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 3391 / <i>SSN/SSGN Survivability Program</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Assessments				
Operational Survivability Assessment	1	2020	4	2022
Acoustic Assessment	1	2020	4	2022
Non-Acoustic Assessment	1	2020	4	2022
Vulnerability Validation				
Vulnerability SEA Test Validation Program (1-2 per year)	1	2020	4	2022
Countermeasures				
Countermeasure Validation (2-3 per year)	1	2020	4	2022
Advanced Submarine Signature Management/Countermeasures				
Sea Test Validation Program (1 per year)	1	2020	4	2022
Signature Vulnerability Assessment (1 per year)	1	2022	4	2022

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9710 / <i>Advanced Submarine Technology Development</i>
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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
9710: <i>Advanced Submarine Technology Development</i>	0.000	0.000	28.601	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Project 9710 was funded in FY 2019 under Program Element 0604250D8Z (Advanced Innovative Technologies) Project 250 (Advanced Innovative Technologies).

A. Mission Description and Budget Item Justification

Details of this project are classified and are submitted to Congress in the classified budget justification books.

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

	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Advanced Submarine Technology Development	0.000	28.601	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: See classified addendum for details					
FY 2021 Plans: See classified addendum for details					
FY 2022 Base Plans: N/A					
FY 2022 OCO Plans: N/A					
FY 2021 to FY 2022 Increase/Decrease Statement: FY 2021 to FY 2022 had a funding decrease (\$28.601M).					
Accomplishments/Planned Programs Subtotals	0.000	28.601	0.000	0.000	0.000

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

N/A

Remarks

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9710 / <i>Advanced Submarine Technology Development</i>

D. Acquisition Strategy

N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9710 / <i>Advanced Submarine Technology Development</i>
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Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Classified FY21	Various	N/A : N/A	0.000	0.000		28.601	Dec 2020	0.000		-		0.000	-	-	-
Subtotal			0.000	0.000		28.601		0.000		-		0.000	-	-	N/A
Project Cost Totals			0.000	0.000		28.601		0.000		-		0.000	-	-	N/A

Remarks
 Details of this project are classified and are submitted to Congress in the classified budget justification books.

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9710 / <i>Advanced Submarine Technology Development</i>
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Proj 9710	FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
					See Classified Addendum for Details ◆																							

2022DON - 0603561N - 9710

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9710 / <i>Advanced Submarine Technology Development</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 9710				
Details of this project are classified and are submitted to Congress in the classified budget justification books.	1	2021	1	2021

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>
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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
9999: <i>Congressional Adds</i>	12.863	9.647	9.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

C308 Small Business Technology Insertion: Leverage small business experience, insights and capabilities to identify/validate/mature/insert new technology into the capability development process, which will improve submarine stealth, performance, reliability, lethality and life cycle cost.

C619 Improved CAVES Technology: The details of this effort are SECRET. The purpose of this effort is to design, develop, and test advanced technology solutions to improve performance of Conformal Acoustic Velocity Sonar (CAVES) technology in acoustic arrays. The Large Vertical Array (LVA) is a hull-mounted acoustic array using CAVES technology which, with other onboard systems and sonar processing capabilities, allows a submarine to "see" other submarines and surface ships in its vicinity. This effort will evaluate improvements in material systems, biocides, and risk reduction testing for next generation acoustic arrays (CAVES) technology to enhance the submarine Fleet's undersea capability.

C643 Workforce Partnership Research: To fund innovative research and manufacturing partnerships among academia, government, and industry. Such partnerships are needed to translate technological advances to emerging Navy undersea vehicles and systems in cost effective ways, to train a highly skilled workforce, and to support increased and sustained submarine production capacity.

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

	FY 2020	FY 2021
Congressional Add: Small Business Technology Insertion	9.647	0.000
FY 2020 Accomplishments: N/A		
FY 2021 Plans: Continue efforts utilizing FY20 funding:		
- Advanced Materials: Continue to examine use of alternative/advanced/multi-materials in new submarine applications via scale model and prototyping projects.		
- Advanced Energy Systems: Conduct testing at NSWC Crane on prototype battery cells to examine the efficacy, performance and hazards associated with Ni-Zn and assess its suitability as an alternate battery chemistry for use in a submarine main storage battery role.		
- Advanced Hull Treatments: Will examine the performance and manufacturing readiness of alternative technologies to identify those with the potential to reduce cost, improve stealth and improve hydrodynamic performance.		

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9999 / <i>Congressional Additions</i>
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021
<ul style="list-style-type: none"> - Advanced Atmospheric Control Systems. Will examine technologies to more effectively monitor and manage atmospheric conditions in a submarine environment. - Stealth: Continue to examine the availability of new technologies/tools to assess and improve performance. Acquire/install/test upgrades to Carderock wind tunnel facility. Conduct component prototyping on improved acoustic array power supplies, upgraded submarine acoustic tracking system beacons and range navigation buoys, upgraded Underwater Electromagnetic sensors and Impressed Current Cathodic Protection System controller. Continue prototyping on machinery noise reduction technologies. Continue examination of Automated Intelligence and Machine Learning tools to assess suitability for Advanced Signature Management application. - SSN Advanced Technologies: Continue project work in alternate submarine composite applications and submarine laser integration/component development/modeling. 		
<p>Congressional Add: Improved CAVES Technology</p> <p>FY 2020 Accomplishments: N/A</p> <p>FY 2021 Plans: - Initiate studies for different CAVES LVA configurations on current and future classes of submarines in order to ensure required performance of the acoustic arrays.</p> <ul style="list-style-type: none"> - Begin fabrication of inner and outer de-coupler test coupons used to determine if new design materials improve performance over legacy materials. - Stand up CAVES flow-noise Integrated Product Team (IPT) with the objective to address and resolve speed-related noise on SSN 790 and on SSBN LVAs. 	0.000	4.000
<p>Congressional Add: Workforce Partnership Research</p> <p>FY 2020 Accomplishments: N/A</p> <p>FY 2021 Plans: - Program invests in workforce tools and advanced manufacturing techniques in support of future submarine propulsor/propeller/shafting and bearing design and prototyping processes. Funded efforts will advance and expand ongoing activity across Next Generation Thrust lines of effort, such as additive manufacturing, out-of-autoclave manufacturing and other multi-material component development.</p> <ul style="list-style-type: none"> - Examine the performance and manufacturing readiness of alternative technologies with the potential to reduce cost and improve submarine hydrodynamic performance. Mature the technology and manufacturing readiness levels of new hull treatments. 	0.000	5.000

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy	Date: May 2021
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Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021
- UARC support of launch and recovery (L&R) testing and demonstrations (Velociraptor Waltz, Chilemar, Barge Underway Series (BUS) testing, and Full System Testing). This also includes integration efforts of sensors on the Unmanned Underwater Vehicle (UUV).		
Congressional Adds Subtotals	9.647	9.000

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

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>
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Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
C308: Product Development	WR	NSWC Carderock : Bethesda, MD	6.281	0.500	Apr 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	NOVA Southeastern University : Ft. Lauderdale, FL	3.650	0.120	Jul 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Seemann's Composites Inc : Gulf Port, MS	2.436	1.700	Jul 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	ZAF Energy Systems : Joplin, MO	0.000	0.200	Jun 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Ohio Semitronics : Hilliard, OH	0.000	0.500	Jun 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	MSM Industries : Riverside, CA	0.000	0.400	Jun 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Aerolab, LLC : Jessup, MD	0.000	0.570	Jun 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Gavial : Santa Barbara, CA	0.000	0.620	Jun 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	LaVision : Ypsilanti, MI	0.000	0.600	Jun 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Pacific Engineering, Inc : Roca, NE	0.000	0.250	Jun 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Mikel, Inc : Middletown, RI	0.000	0.400	May 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Edro Corporation : East Berlin, CT	0.000	0.250	Jul 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Adaptive Surface Technologies : Cambridge, MA	0.000	0.250	Jun 2020	0.000		0.000		-		0.000	-	-	-
C308: Product Development	Various	Various Small Business L, : Various	0.000	0.668	May 2020	0.000		0.000		-		0.000	-	-	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9999 / <i>Congressional Additions</i>
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Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
C308: Product Development	WR	Naval Research Lab : Washington, DC	0.000	0.250	Apr 2020	0.000		0.000		-		0.000	-	-	-
C643: Product Development	TBD	Seemann's Composites Inc : Gulf Port, MS	0.000	0.000		0.600	Aug 2021	0.000		-		0.000	-	-	-
C643: Product Development	WR	NSWC Carderock : Bethesda, MD	0.000	0.000		0.500	Apr 2021	0.000		-		0.000	-	-	-
C643: Product Development	FFRDC	ARL/UT : Austin, TX	0.000	0.000		1.500	Apr 2021	0.000		-		0.000	-	-	-
C643: Product Development	TBD	Industry-TBD : TBD	0.000	0.000		1.800	Nov 2021	0.000		-		0.000	-	-	-
C643: Product Development	TBD	Industry - TBD : TBD	0.000	0.000		0.400	Sep 2021	0.000		-		0.000	-	-	-
C619: Product Development	MIPR	DMEA : McClellan, CA	0.000	0.000		2.750	Jul 2021	0.000		-		0.000	-	-	-
C619: Product Development	WR	NUWC Newport : Newport, RI	0.000	0.000		0.325	Jun 2021	0.000		-		0.000	-	-	-
C619: Product Development	C/BA	NSWC Carderock : Bethesda, MD	0.000	0.000		0.575	Jun 2021	0.000		-		0.000	-	-	-
C619: Product Development	Various	VAR : VAR	0.000	0.000		0.350	Aug 2021	0.000		-		0.000	-	-	-
Subtotal			12.367	7.278		8.800		0.000		-		0.000	-	-	N/A

Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
C308: Contractor Engineering Support	C/CPFF	NTT-Data : Washington, DC	0.200	0.358	Apr 2020	0.000		0.000		-		0.000	-	-	-
C308: Government Engineering Support	WR	Gov Engineering : Various	0.100	0.250	Apr 2020	0.000		0.000		-		0.000	-	-	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy **Date:** May 2021

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9999 / <i>Congressional Additions</i>
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Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
C308: Government Engineering Support	WR	NSWC Carderock : Bethesda, MD	0.000	0.300	Apr 2020	0.000		0.000		-		0.000	-	-	-
C308: Support	SS/CPFF	Electric Boat : Groton, CT	0.000	0.192	Apr 2020	0.000		0.000		-		0.000	-	-	-
C308: Government Engineering Support	WR	NSWC Philadelphia : Philadelphia, PA	0.000	0.139	Apr 2020	0.000		0.000		-		0.000	-	-	-
C643: Government Engineering Support	WR	NSWC Carderock : Bethesda, MD	0.000	0.000		0.200	May 2021	0.000		-		0.000	-	-	-
Subtotal			0.300	1.239		0.200		0.000		-		0.000	-	-	N/A

Remarks
Government Field Activity support utilized for award of multiple small business procurements.

Test and Evaluation (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
C308: Developmental Test and Evaluation	Various	Various : Various	0.196	0.250	May 2020	0.000		0.000		-		0.000	-	-	-
C308: Developmental Test and Evaluation	SS/CPFF	Electric Boat : Groton, CT	0.000	0.400	May 2020	0.000		0.000		-		0.000	-	-	-
C308: Developmental Test and Evaluation	SS/CPFF	JHU/APL : Laurel, MD	0.000	0.250	May 2020	0.000		0.000		-		0.000	-	-	-
C308: Research and Development	WR	NUWC Newport : Newport, RI	0.000	0.160	May 2020	0.000		0.000		-		0.000	-	-	-
C308: Research and Development	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.070	Jul 2020	0.000		0.000		-		0.000	-	-	-
Subtotal			0.196	1.130		0.000		0.000		-		0.000	-	-	N/A

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 9999				
C308: Small Business Technology Insertion: Advanced Materials	2	2020	2	2021
C308: Small Business Technology Insertion: Advanced Energy Systems	2	2020	2	2021
C308: Small Business Technology Insertion: Advanced Hull Treatments	2	2020	2	2021
C308: Small Business Technology Insertion: Advanced Atmospheric Control Systems	2	2020	2	2021
C308: Small Business Technology Insertion: Stealth	2	2020	2	2021
C308: Small Business Technology Insertion: SSN Advanced Technologies	2	2020	2	2021
C643: Workforce Partnership Research: Very Large Test Apparatus (VLTA) Maintenance	3	2021	1	2022
C643: Workforce Partnership Research: VLTA-scale Hardware Machining Capability	4	2021	4	2022
C643: Workforce Partnership Research: Propulsor Inflow Modeling and Simulation Capability Improvement	3	2021	4	2022
C643: Workforce Partnership Research: Low TRL Treatment Sample Production	3	2021	4	2022
C643: Workforce Partnership Research: Torpedo Tube Launch & Recovery: Barge Testing	3	2021	4	2021
C619: Improved CAVES Technology: CAVES/LVA De-Coupler Studies	3	2021	4	2022
C619: Improved CAVES Technology: CAVES/LVA De-Coupler Test	3	2022	3	2022
C619: Improved CAVES Technology: CAVES/LVA Flow-Noise Studies	3	2021	4	2022