

UNCLASSIFIED

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

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>
---	--

COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	1,284.022	120.501	98.921	105.703	-	105.703	98.756	98.362	111.068	100.900	Continuing	Continuing
0223: <i>Sub Combat System Improvement (ADV)</i>	660.087	53.536	55.442	57.691	-	57.691	58.487	58.546	59.499	60.214	Continuing	Continuing
2033: <i>Adv Submarine Systems Development</i>	569.927	32.508	29.556	36.819	-	36.819	27.662	27.279	38.863	27.829	Continuing	Continuing
2096: <i>Payload Delivery Development</i>	29.885	13.747	2.527	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	46.159
3391: <i>SSN/SSGN Survivability Program</i>	24.123	11.141	11.396	11.193	-	11.193	12.607	12.537	12.706	12.857	Continuing	Continuing
9710: <i>Advanced Submarine Technology Development</i>	0.000	0.886	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.886
9999: <i>Congressional Adds</i>	0.000	8.683	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.683

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 2022 TO FY 2023 (NET INCREASE OF \$+6.782M):

- PROJECT 0223 net increase from FY 2022 to FY 2023 (\$+2.249M) is required to support: 1) efforts to address Large Vertical Array (LVA) noise concerns and to collect baseline and longevity data from multiple LVAs followed by associated experimentation and corrective action, and, 2) the integration of off-hull payloads into the Submarine Warfare Federated Tactical Systems (SWFTS) construct and effort required to define concept of employment in the Advanced Processing Builds (APB) project.
- PROJECT 2033 net increase from FY 2022 to FY 2023 (\$+7.263M) is due to procurements and system assembly/testing in support of LSV-2 Electric Drive Recapitalization as well as Critical System Design efforts and procurement specification development in support of STAFAC Recapitalization.
- PROJECT 2096 net decrease from FY 2022 to FY 2023 (\$-2.527M).
- PROJECT 3391 net decrease from FY 2022 to FY 2023 (\$-0.203M).

DESCRIPTION/JUSTIFICATION BY PROJECT:

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy I BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603561N / <i>Advanced Submarine System Development</i>	
<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 guidance from Fleet Forces and Commander, Submarine Forces for Full Spectrum Warfare. 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 three (3) major efforts: Advanced Processing Builds (APB), 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>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 previously demonstrated Flank Array Demonstration (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> <p>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.</p> <p>Project 2033 is comprised of three budget categories: Strategic Capability Infrastructure, Long Range R&D Investment, and Rapid Technology Development.</p> <p>The major developmental efforts include:</p>		

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Navy		Date: April 2022
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>	
<p>Strategic Capability Infrastructure</p> <ul style="list-style-type: none">- Large Scale Vehicle (LSV)- Large Scale Vehicle Recapitalization- Intermediate Scale Measurement System (ISMS)- High Gain Measurement System (HGMS)- South Tongue of the Ocean (TOTO) Acoustic Measurement Facility (STAFAC) Recapitalization <p>Long Range R&D Investment</p> <ul style="list-style-type: none">- Advanced Material Propeller (AMP) Technology- Advanced Signature Management- Advanced SSN Technologies- Next Generation Thrust (future propulsor/shafting technologies)- Advanced Hull Treatments <p>Rapid Technology Development</p> <ul style="list-style-type: none">- Innovation Technology Transfer <p>PROJECT 2096: Payload Delivery Development, consists of the Payload Handling System (PHS).</p> <p>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.</p> <p>- FY 2022 funding profile decrease reflects the adjustment of funds for the PHS system.</p> <p>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.</p>		

UNCLASSIFIED

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

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>
---	--

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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	151.547	99.782	0.000	-	0.000
Current President's Budget	120.501	98.921	105.703	-	105.703
Total Adjustments	-31.046	-0.861	105.703	-	105.703
• Congressional General Reductions	-	-0.861			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-27.495	0.000			
• SBIR/STTR Transfer	-3.551	0.000			
• Program Adjustments	0.000	0.000	0.000	-	0.000
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000
• Adjustments to Budget Year	-	-	105.703	-	105.703

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

Project: 9999: *Congressional Adds*

Congressional Add: *Improved CAVES Technology*

Congressional Add: *Workforce Partnership Research*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2021	FY 2022
	3.859	0.000
	4.824	0.000
	8.683	0.000
	8.683	0.000

Change Summary Explanation

The FY 2023 funding request was reduced by \$0.625 million to account for the availability of prior year execution balances.

FUNDING CHANGES SINCE THE PREVIOUS PRESIDENT'S BUDGET AT THE OVERALL PE LEVEL:

- FY 2021 net decrease of \$-31.046M includes \$-27.495M from Project 9710 for internal department reprogrammings for higher priority requirements and \$-3.551M for the Small Business Innovative Research (SBIR) transfer.

- FY 2022 net decrease of \$-0.861M is attributed to general Congressional adjustments impacting Projects 2033 and 3391.

INFORMATION AT THE PROJECT LEVEL:

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Navy		Date: April 2022
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>	
<p>PROJECT 0223: FUNDING CHANGES: The FY 2022 (\$55.442M) to FY 2023 (\$57.691M) budget increase (\$+2.249M) is required to support: 1) efforts to address Large Vertical Array (LVA) noise concerns and to collect baseline and longevity data from multiple LVAs followed by associated experimentation and corrective action, and, 2) the integration of off-hull payloads into the Submarine Warfare Federated Tactical Systems (SWFTS) construct and effort required to define concept of employment in the Advanced Processing Builds (APB) project.</p> <p>PROJECT 2033: The FY 2022 to FY 2023 budget increase (\$7.263M) is due to programmed project ramp-ups within the Strategic Infrastructure budget pillar, to include procurements and system assembly/testing in support of LSV-2 Electric Drive recapitalization as well as critical system design and procurement specification development in support of STAFAC acoustic measurement range recapitalization.</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. --- FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.</p>		

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy										Date: April 2022		
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
0223: <i>Sub Combat System Improvement (ADV)</i>	660.087	53.536	55.442	57.691	-	57.691	58.487	58.546	59.499	60.214	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The FY 2022 (\$55.442M) to FY 2023 (\$57.691M) budget increase (\$+2.249M) is required to support: 1) efforts to address Large Vertical Array (LVA) noise concerns and to collect baseline and longevity data from multiple LVAs followed by associated experimentation and corrective action, and, 2) the integration of off-hull payloads into the Submarine Warfare Federated Tactical Systems (SWFTS) construct and effort required to define concept of employment in the Advanced Processing Builds (APB) project.

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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Advanced Processing Build (APB)	43.896	44.192	45.241	0.000	45.241
Articles:	-	-	-	-	-
Description: Advanced Processing Builds (APBs) adhere to a four step process:					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 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, APB-23, etc.) 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, improve software quality, and improve the speed of capability delivery and software improvements. The transformation will be accomplished through a transition to a process comprised of a continuous series of 12-week software increments in a DevSecOps environment. This process better aligns with industry practice and enables the SWFTS systems to leverage industry capability improvements in software configuration management, quality control, 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 synchronized with the production programs. Instead of delivering a stand-alone 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 developed within the latest SWFTS production hardware and software</p>					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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)

baseline as they are ready, on a continuing basis. This speeds release of these capabilities to the Fleet by many months. Step 3 and Step 4 testing regimes will be maintained.

FY 2022 Plans:

- Conduct Step 3 land-based test of APB-21. Analyze results to inform improvements to software, 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 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 SWFTS construct.
- Complete majority of planning, software certification, and Fleet preparation for FY 2023 Step 4 at-sea test.

FY 2023 Base Plans:

- Conduct Step 4 at-sea testing of APB-21 with tactics and training improvements informed by Step 3 land-based testing. Analyze results to inform Fleet customer on recommended tactics and training.
- Transition APB-21 to PEO SUB production programs.
- Complete development of most capabilities for APB-23.
- Refine continuous development (DevSecOps) process and software pipeline in coordination with production program offices.
- Continue providing assistance to team submarine production program offices with evolutionary TI-24 combat system re-architecture to improve cybersecurity and speed delivery
- Continue development of Machine Learning and AI, with emphasis on Deep Learning to solve immediate Fleet needs. Seek system performance improvements and 3rd Offset (automation) capabilities not currently achievable with legacy technology.
- Continue Step 1 and Step 2, and commence Step 3 testing of capabilities as they are ready in response to Fleet requirements consistent with the multi-year capability development road map.

FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>- Implement EW detection improvements against complex signals, and integrate off-hull payloads into the SWFTS construct and concept of employment.</p> <p>FY 2023 OCO Plans: N/A</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: The FY 2022 (\$44.192M) to FY 2023 (\$45.241M) increase (\$+1.049M) is due to the integration of off-hull payloads into the Submarine Warfare Federated Tactical Systems (SWFTS) construct and effort required to define concept of employment in the Advanced Processing Build (APB) project.</p>					
<p>Title: Advanced Sensors</p> <p align="right">Articles:</p> <p>Description: 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>FY 2022 Plans:</p> <ul style="list-style-type: none"> - Continue Open Architecture Telemetry (OAT) development and initiate fabrication of the Advanced Development Model (ADM) array. - Develop, build, and test active and passive sensors in support of Bow Conformal Array (BCA) and SSN(x). <p>FY 2023 Base Plans:</p> <ul style="list-style-type: none"> - Continue OAT development, complete fabrication of the TL-29A OAT ADM array, and initiate TL-29A OAT ADM Integration/Test in preparation of at-sea test in FY 2023. - Continue to develop, build, and test active and passive sensors in support of BCA and SSN(x). <p>FY 2023 OCO Plans: N/A</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: The FY 2022 (\$7.250M) to FY 2023 (\$7.400M) increase (\$+0.150M) is in line with inflation associated with the RDT&EN appropriation.</p>	7.140	7.250	7.400	0.000	7.400
Articles:	-	-	-	-	-
<p>Title: Large Vertical Array (LVA)</p> <p align="right">Articles:</p>	2.500	4.000	5.050	0.000	5.050
Articles:	-	-	-	-	-

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>Description: LVA provides a critically important SONAR to allow the submarine force to sustain acoustic superiority against the most modern submarines. Three submarines currently have LVAs, and more are programmed each year. LVA Development is required to support LVA use in the Fleet, pace the threat, adapt to new Navy strategies, and further develop the revolutionary LVA capability. LVA Development sustains and maintains the LVA2 Advanced Development Model; and plans, conducts and analyzes exercises and tests involving LVA2 and Fleet LVAs. LVA Development supports new software capability development, informs tactics development and testing, and provides training input for both the Submarine Learning Center and embedded training applications on submarines. Additionally, LVA development identifies, investigates, and resolves LVA related issues.</p> <p>FY 2022 Plans:</p> <ul style="list-style-type: none"> - 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 PEO SUB 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. <p>FY 2023 Base Plans:</p> <ul style="list-style-type: none"> - Continue conducting at-sea testing events for LVA2 and analyze at-sea test results. - Analyze SSN 790 LVA3 at-sea test results. - Provide data-based inputs from tests and exercises to signal processing development, Submarine Learning Center, and tactical employment recommendations to Undersea Warfare Development Command (UWDC). - Repair known LVA2 equipment failures. - Assess LVA noise concerns; collect baseline and longevity data from multiple LVAs. Conduct modeling and experimentation to identify causes and corrective action. - Collect array data on faulty or failed array inboard/outboard components if they occur. Document troubleshooting and repair findings for evaluation and provide findings/recommendations to the LVA PEO SUB production programs for Virginia, Ohio, and Columbia Class Submarines. 					

UNCLASSIFIED

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

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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
- Continue the SSN 688i 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 continue designs for a conceptual prototype for SSN 688i Class Submarines. FY 2023 OCO Plans: N/A FY 2022 to FY 2023 Increase/Decrease Statement: The FY 2022 (\$4.000M) to FY 2023 (\$5.050M) increase (\$+1.050M) is required to address LVA noise concerns and to collect baseline and longevity data from multiple LVAs followed by associated experimentation and corrective action.					
Accomplishments/Planned Programs Subtotals	53.536	55.442	57.691	0.000	57.691

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023 Base</u>	<u>FY 2023 OCO</u>	<u>FY 2023 Total</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• RDTEN/0205620N: <i>Surface ASW Cmbt Sys Integr</i>	28.085	28.804	28.999	-	28.999	30.086	29.955	30.400	30.666	Continuing	Continuing
• RDTEN/0603562N/0770: <i>Adv Sub Supp Equip Prog</i>	4.634	4.736	3.835	-	3.835	5.414	5.203	4.892	4.944	Continuing	Continuing

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.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy												Date: April 2022			
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 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total			
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	2.075	0.324	Dec 2020	0.325	Mar 2022	0.350	Dec 2022	-		0.350	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	Alion Sciences : VA	3.267	0.000		0.000		0.000		-		0.000	0.000	3.267	-
APB, LVA, Advanced Sensor Development	C/CPFF	Arete : CA	0.550	0.000		0.000		0.000		-		0.000	0.000	0.550	-
APB, LVA, Advanced Sensor Development	C/CPFF	Chesapeake Science (L-3) : MD	7.551	0.000		0.000		0.000		-		0.000	0.000	7.551	-
APB, LVA, Advanced Sensor Development	C/CPFF	Electric Boat : ME	1.980	0.000		2.125	Mar 2022	2.330	Dec 2022	-		2.330	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	General Dynamics : VA	28.632	2.151	Dec 2020	2.151	Mar 2022	2.225	Dec 2022	-		2.225	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	GA Tech Research Institute : GA	3.541	0.416	Dec 2020	0.415	Jan 2022	0.450	Dec 2022	-		0.450	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	In Depth Engineering : VA	8.385	1.026	Dec 2020	1.025	Mar 2022	1.165	Dec 2022	-		1.165	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	JHU/APL : MD	125.329	11.340	Feb 2021	11.350	Jan 2022	11.825	Dec 2022	-		11.825	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	Lockheed Martin : VA	100.053	10.173	Oct 2020	11.175	Nov 2021	11.905	Dec 2022	-		11.905	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	Lockheed Martin : NY	10.664	0.000		0.000		0.000		-		0.000	0.000	10.664	-
APB, LVA, Advanced Sensor Development	C/CPFF	Metron : VA	10.988	0.810	Dec 2020	0.815	Jan 2022	0.865	Dec 2022	-		0.865	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPAF	NSMA : VA	14.244	0.700	Apr 2021	0.700	Jan 2022	0.750	Jan 2023	-		0.750	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	WR	NSWC/Carderock : MD	36.691	2.792	Jan 2021	2.775	Oct 2021	2.695	Nov 2022	-		2.695	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	WR	NUWC/Newport : RI	126.023	10.020	Oct 2020	9.225	Oct 2021	9.100	Nov 2022	-		9.100	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	WR	ONI : DC	2.295	0.000		0.000		0.000		-		0.000	0.000	2.295	-

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy **Date:** April 2022

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>
--	--	---

Product Development (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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	0.000	2.725	-
APB, LVA, Advanced Sensor Development	C/CPFF	Progeny : VA	9.446	0.700	Mar 2021	0.700	Mar 2022	0.715	Dec 2022	-		0.715	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	PSU/ARL : PA	12.463	0.700	Feb 2021	0.700	Jan 2022	0.715	Dec 2022	-		0.715	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	SAIC : VA	3.555	0.000		0.000		0.000		-		0.000	0.000	3.555	-
APB, LVA, Advanced Sensor Development	C/CPFF	Sedna Digital : VA	19.284	2.160	Nov 2020	2.175	Feb 2022	2.175	Dec 2022	-		2.175	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	WR	SSC/San Diego : CA	1.963	0.000		0.000		0.000		-		0.000	0.000	1.963	-
APB, LVA, Advanced Sensor Development	MIPR	U.S. Army Research Lab : MD	1.700	0.000		0.000		0.000		-		0.000	0.000	1.700	-
APB, LVA, Advanced Sensor Development	MIPR	U.S. Army/MITRE : NJ	4.595	0.000		0.000		0.000		-		0.000	0.000	4.595	-
APB, LVA, Advanced Sensor Development	MIPR	U.S. Hanscom AFB/ MIT Lincoln Labs : MA	26.154	2.760	Dec 2020	2.775	Feb 2022	2.975	Dec 2022	-		2.975	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	UT/ARL : TX	35.862	2.144	Dec 2020	2.145	Jan 2022	2.255	Dec 2022	-		2.255	Continuing	Continuing	Continuing
APB, LVA, Advanced Sensor Development	C/CPFF	VAR : VAR*	35.299	3.500	Dec 2020	2.951	Nov 2021	3.226	Dec 2022	-		3.226	Continuing	Continuing	Continuing
Subtotal			635.314	51.716		53.527		55.721		-		55.721	Continuing	Continuing	N/A

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

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy **Date:** April 2022

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 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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	0.000	4.291	-
Program Management Support - Acquisition, Business & Finance	C/CPAF	BAE Systems : MD	12.665	0.000		0.000		0.000		-		0.000	0.000	12.665	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	CGI Federal : VA	6.818	0.000		0.000		0.000		-		0.000	0.000	6.818	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	KMS Solutions* : VA	0.000	1.761	Dec 2020	1.850	Mar 2022	1.900	Dec 2022	-		1.900	Continuing	Continuing	Continuing
Program Office Travel	Allot	NAVSEA PEO IWS5 : DC	0.999	0.059	Nov 2020	0.065	Oct 2021	0.070	Oct 2022	-		0.070	Continuing	Continuing	Continuing
Subtotal			24.773	1.820		1.915		1.970		-		1.970	Continuing	Continuing	N/A

Remarks
 *In addition to program office support, KMS Solutions provide technical planning, systems engineering, and test support. KMS Solutions also provide Subject Matter Experts (SMEs) as members of the Advanced Processing Build (APB) 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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	660.087	53.536	55.442	57.691	-	57.691	Continuing	Continuing	N/A

Remarks

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy **Date:** April 2022

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>
--	--	---

Project 0223	FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				FY 2027			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Advanced Processing Build (APB) Development Pipeline	APB Development Pipeline																											
Advanced Processing Build (APB-19)	■ Transition to PEO SUB Production Programs																											
Advanced Processing Build (APB-21)	△ Step-4 At-Sea □ Transition to PEO SUB Production Programs																											
Advanced Processing Build (APB-23)	△ Step-4 At-Sea Test □ Transition to PEO SUB Production Programs																											
Advanced Processing Build (APB-25)	△ Step-4 At-Sea Test □ Transition to PEO SUB Production Programs																											
Advanced Sensors	TL-29A OAT Development				TL-29A OAT ADM Fabrication				ADM Integration/Test ADM At-Sea Test				△ ADM At-Sea Test				□ Transition ADM to PEO SUB Production Program				OAT Development Improvements							
	Hull Array Sensor Development																											
	BCA Assessments/ Concept Designs																											
Large Vertical Array (LVA)	USS Maryland Test Planning/Testing/Analysis																□ Transition to PEO SUB Production Programs											
	688i LVA Feasibility Study																											

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy		Date: April 2022
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>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 0223				
Advanced Processing Build (APB): APB Development Pipeline	1	2021	4	2027
APB-19: Transition to PEO SUB Production Programs	1	2021	1	2021
APB-21: At-Sea Test	1	2023	1	2023
APB-21: Transition to PEO SUB Production Programs	2	2023	2	2023
APB-23: At-Sea Test	1	2025	1	2025
APB-23: Transition to PEO SUB Production Programs	2	2025	2	2025
APB-25: At-Sea Test	1	2027	1	2027
APB-25: Transition to PEO SUB Production Programs	2	2027	2	2027
Advanced Sensors: Hull Array Sensor Development	1	2021	4	2027
Advanced Sensors: Bow Conformal Array Assessments/Concept Designs	1	2021	4	2021
Advanced Sensors: TL-29A OAT Development	1	2021	2	2022
Advanced Sensors: TL-29A OAT ADM Fabrication	3	2022	2	2023
Advanced Sensors: TL-29A OAT ADM Integration/Test	3	2023	1	2024
Advanced Sensors: TL-29A OAT ADM At-Sea Test	2	2024	2	2024
Advanced Sensors: TL-29A OAT ADM Transition	3	2024	3	2024
Advanced Sensors: OAT Development Improvements	4	2024	4	2027
Large Vertical Array (LVA): USS Maryland Test Planning/Testing/Analysis	1	2021	4	2024
Large Vertical Array (LVA): USS Maryland Transition to PEO SUB Production Program	4	2024	4	2024
Large Vertical Array (LVA): 688i LVA Feasibility Study	1	2022	4	2027

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy										Date: April 2022		
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
2033: <i>Adv Submarine Systems Development</i>	569.927	32.508	29.556	36.819	-	36.819	27.662	27.279	38.863	27.829	Continuing	Continuing
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 and construction 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:

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy	Date: April 2022
--	-------------------------

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>
--	--	---

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
- Advanced Energy (Submarine Main Storage Battery - NiZn alternative chemistry)
- Advanced Signature Management

Rapid Technology Development

- Innovative Technology Transfer

FY22 to FY23 increase due to programmed project ramp-ups within the Strategic Infrastructure budget pillar, to include procurements and system assembly/testing in support of LSV-2 Electric Drive recapitalization as well as critical system design, procurement specification development and component level prototyping in support of STAFAC acoustic measurement range recapitalization. Recapitalization of strategic infrastructure will ensure readiness for current and future submarines.

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

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Strategic Capability R&D Infrastructure	20.589	20.336	30.723	0.000	30.723
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 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.					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<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. Project provides a lifecycle replacement of acoustic measurement system and inserts new capabilities and data transfer technology required to support the measurement and assessment of COLUMBIA and other future submarine platforms to ensure their stealth.</p> <p>FY 2022 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. Execute testing as required. Complete Steering and Diving system installation and testing. In support of LSV-2 drive recapitalization process, conduct material procurements and 1st article builds and testing for new electric drive modules (inverters and converters). Continue Electronic Drive Control Electronics (EDCE) redesign, testbed update, and system sustainment planning.</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 and other fleet needs. Continue 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>STAFAC Recapitalization: Continue critical system design in preparation for Critical Design Review (CDR) milestone. Begin initial procurement specification efforts.</p> <p>FY 2023 Base Plans: LSV-2: Execute LSV-2 drive recapitalization process (to complete end of FY24). Initiate the procurement, manufacture and testing of a full shipset of modernized electric drive module components (inverters and converters). Continue updates to Electronic Drive Control Electronics (EDCE) testbed and continue EDCE and motor drive sustainment initiatives.</p>					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy				Date: April 2022	
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)					
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, VIRGINIA, SSNX, ONR, and other fleet needs.					
HGMS: Operate and maintain HGMS acoustic test range underwater and shore-based facilities in support of highly accurate acoustic data from LSV2 operations.					
STAFAC Recapitalization: Finalize procurement specifications and initiate component lab test and integration.					
FY 2023 OCO Plans: N/A					
FY 2022 to FY 2023 Increase/Decrease Statement: Increase due to procurements and system assembly/testing in support of LSV-2 Electric Drive Recapitalization as well as procurement specification finalization and prototyping in support of STAFAC Recapitalization.					
Title: Long Range R&D					
Articles:					
Description: Develop advanced technologies and tools to increase current and future submarine capabilities, lower 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.					
FY 2022 Plans: ADVANCED HULL TREATMENTS: Evaluate at sea performance of advanced hull treatment (VCS Hull A). Conduct assessment of installation procedures, adhesion and durability following sea trial on VIRGINIA Class					
	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
	11.619	8.920	5.796	0.000	5.796
	-	-	-	-	-

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>Submarine (VCS Hull B). Install two large 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 for specific platform of interest, review Fleet feedback from operations. Complete development and review of Technical Data Package Development for ASM in support of FY22 at-sea system demonstration. Project Arrangements: Continue data analysis on shore-based testing/modeling results. Continue collaborative partnership with ONR's Own Ship Acoustic Monitoring (OSAM) Program, integrating the Audient software algorithm into ship systems for continued testing in FY22 and out. Continue collaborative planning for deferred Partner Underwater Electro-Magnetic (UEM) Measurement Trials in FY26.</p> <p>NEXT GENERATION THRUST (NGT): Conduct initial demonstration of Integrated Shafting and Propulsor (IS&P) assembly on LSV-2. Begin concept design for a full-scale (SSN) demo of an IS&P assembly. Continue development of most promising NGT concepts and begin development of Generation 1 of the New SSN propulsor design. Continue tool design improvement initiatives in support of new SSN propulsion technology development. Continue scale-model planning, testing, and upgrades to testing facilities.</p> <p>ADVANCED MATERIAL PROPELLER (AMP): Complete instrumentation and installation of full-scale AMP propeller on partner submarine and conduct Sea Trial of full-scale AMP propeller on partner submarine. Conduct follow-on testing and analysis of full-scale propeller data per International Project Arrangement.</p> <p>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. Test and calibrate a measurements platform that can be mounted in the Large Cavitation Channel (LCC) test facility that will enable precision flow measurements over large surface areas.</p> <p>ADVANCED ENERGY: Continue NSWC Crane testing on small format COTS NiZn batteries. Leverage Congressional Add investment which procured prototype Medium Format batteries and initiate testing upon</p>					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>receipt. Leverage ONR ManTech NiZn Battery manufacturing demonstration and conduct testing on resultant prototype Large Format NiZn cells.</p> <p>FY 2023 Base Plans: ADVANCED HULL TREATMENTS: Evaluate at sea performance of advanced hull treatment (VCS Hull C).</p> <p>ADVANCED SIGNATURE MANAGEMENT (ASM): Prototyping Efforts: Continue to Develop ASM Concept of Operation (CONOP)/procedural guidance and integration into Ship Systems. Project Arrangements: Continue data analysis of FY22 At Sea Demonstration and shore-based testing/modeling results. Continue collaborative partnership with ONR's OSAM Program, integrating the Audient software algorithm into ship systems for continued testing in FY23. ONR and NAVSEA collaborative OSAM FNC begins in FY23 with transition to the fleet planned in FY27. Continue collaborative planning for deferred Partner Underwater Electro-Magnetic (UEM) Measurement Trials in FY24.</p> <p>NEXT GENERATION THRUST (NGT): Continue concept design for a full-scale demo of an Integrated Shafting and Propulsor (IS&P) assembly. Continue development of Generation 1 of the New SSN propulsor design. Continue tool design improvement initiatives in support of New SSN propulsion technology development. Continue scale-model planning, testing, and upgrades to testing facilities.</p> <p>ADVANCED MATERIAL PROPELLER (AMP): Continue follow-on destructive testing and analysis of full-scale propeller data per follow-on Project Arrangement.</p> <p>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. Perform surface flow measurements of surfaces of interest in the LCC with the measurement test bed.</p> <p>ADVANCED ENERGY: Complete NSWC Crane testing on small format COTS NiZn batteries. Continue operational life cycle testing on Medium Format batteries. Continue testing regime on Large Format NiZn cells.</p> <p>FY 2023 OCO Plans:</p>					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy				Date: April 2022		
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
N/A						
FY 2022 to FY 2023 Increase/Decrease Statement: Decrease due AMP project ramp down into post sea-trial analysis and Advanced Hull Treatment project completion of material procurement and installation phase on test platform.						
Title: Rapid Technology Development		0.300	0.300	0.300	0.000	0.300
		Articles:	-	-	-	-
Description: Conduct Navy and joint demonstrations of advanced technologies 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.						
FY 2022 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.						
FY 2023 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 2023 OCO Plans: N/A						
FY 2022 to FY 2023 Increase/Decrease Statement: Minor increase due to miscellaneous program adjustments.						
Accomplishments/Planned Programs Subtotals		32.508	29.556	36.819	0.000	36.819

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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>

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

<u>Line Item</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u> <u>Base</u>	<u>FY 2023</u> <u>OCO</u>	<u>FY 2023</u> <u>Total</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• OPN/0941: <i>Submarine Support Equipment</i>	64.632	88.284	109.299	-	109.299	111.230	66.566	60.119	62.946	Continuing	Continuing

Remarks

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

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 (UARCs), 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.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy **Date:** April 2022

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>
--	--	---

Product Development (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total			
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
Product Development	C/FFP	DRS Technologies : Milwaukee, WI	6.530	3.310	Feb 2021	0.000		7.000	Nov 2022	-		7.000	0.000	16.840	-
Product Development	WR	NSWC Crane : Crane, IN	0.640	0.295	Dec 2020	0.301	Dec 2021	0.307	Dec 2022	-		0.307	0.000	1.543	-
Product Development	C/CPFF	Rolls Royce Marine : Walpole, MA	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	-
Product Development	WR	NSWC PHILLY : Philly, PA	0.715	0.385	Nov 2020	0.375	Nov 2021	0.383	Nov 2022	-		0.383	Continuing	Continuing	Continuing
Product Development	WR	NRL : Washington, DC	3.007	0.102	Nov 2020	0.104	Nov 2021	0.106	Dec 2022	-		0.106	0.000	3.319	-
Product Development	SS/CPFF	HII : Newport News, VA	23.214	1.670	Jan 2021	1.671	Jan 2022	1.704	Jan 2023	-		1.704	Continuing	Continuing	Continuing
Product Development	SS/CPFF	EB : Groton, CT	84.678	4.785	Jan 2021	3.521	Jan 2022	3.591	Jan 2023	-		3.591	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Carderock, MD	105.658	4.421	Nov 2020	5.907	Nov 2021	5.166	Nov 2022	-		5.166	Continuing	Continuing	Continuing
Product Development	FFRDC	ARL/PSU : State College, PA	11.150	1.313	Apr 2021	1.339	Apr 2022	1.692	Feb 2023	-		1.692	Continuing	Continuing	Continuing
Product Development	FFRDC	JHU/APL : Laurel, MD	24.921	0.255	Apr 2021	0.260	Apr 2022	0.265	Feb 2023	-		0.265	Continuing	Continuing	Continuing
Product Development	Various	Various : Various	36.998	0.296	Jan 2021	0.302	Jan 2022	0.308	Feb 2023	-		0.308	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Newport, RI	81.358	0.098	Mar 2021	0.000	Nov 2021	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	FFRDC	APL/University of Washington : Seattle, WA	0.000	0.000		0.521	Nov 2021	0.531	Dec 2022	-		0.531	0.000	1.052	-
Product Development	SS/CPFF	Leidos : Reston, Va	0.000	0.000		0.535	Feb 2022	1.567	Nov 2022	-		1.567	0.000	2.102	-
Subtotal			379.069	16.930		14.836		22.620		-		22.620	Continuing	Continuing	N/A

Remarks
 FY21 to FY22 decrease for DRS due to FY22 pause of LSV Recap efforts with DRS, project completes in FY23
 FY21 to FY22 increase for NSWC Carderock due to ramp up in effort due to STAFAC Recapitalization
 FY22 to FY23 increase for Leidos in support of STAFAC Recap component testing and significant jump from zero to 7M for DRS Technologies
 FY22 to FY23 increase for DRS to complete fabrication and delivery of full LSV motor drive ship set
 Various/VAR is used to group multiple activities with small funding levels.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy **Date:** April 2022

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>
--	--	---

Support (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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	18.646	1.420	Mar 2021	1.140	Mar 2022	1.163	Jan 2023	-		1.163	Continuing	Continuing	Continuing
Government Engineering Support	WR	Various : Various	8.305	0.379	Oct 2020	0.587	Oct 2021	0.599	Oct 2022	-		0.599	Continuing	Continuing	Continuing
Travel	WR	NAVSEA HQ : Not Specified	1.415	0.108	Oct 2020	0.110	Oct 2021	0.090	Oct 2022	-		0.090	Continuing	Continuing	Continuing
Subtotal			28.366	1.907		1.837		1.852		-		1.852	Continuing	Continuing	N/A

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

Test and Evaluation (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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	4.200	2.000	Nov 2020	1.800	Nov 2021	1.836	Nov 2022	-		1.836	0.000	9.836	-
Developmental Test & Evaluation	SS/CPFF	EB : Groton, CT	35.194	4.147	Jan 2021	3.979	Jan 2022	2.856	Jan 2023	-		2.856	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NSWC/PHILLY : PHILLY, PA	9.824	0.493	Dec 2020	0.503	Nov 2021	0.513	Nov 2022	-		0.513	0.000	11.333	9.104
Developmental Test & Evaluation	Various	Various : Various	10.096	0.703	Apr 2021	0.717	Mar 2022	0.731	Mar 2023	-		0.731	0.000	12.247	6.372
Developmental Test & Evaluation	WR	NUWC : Newport, RI	32.715	0.510	Nov 2020	0.426	Nov 2021	0.435	Nov 2022	-		0.435	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NSWC : Carderock, MD	64.669	4.462	Nov 2020	4.099	Nov 2021	4.590	Nov 2022	-		4.590	Continuing	Continuing	Continuing
Developmental Test & Evaluation	SS/CPFF	HII : Newport News, VA	5.794	0.606	Jan 2021	0.618	Jan 2022	0.630	Jan 2023	-		0.630	Continuing	Continuing	Continuing
Developmental Test & Evaluation	SS/CPFF	JHU/APL : Laurel, MD	0.000	0.750	Apr 2021	0.741	Apr 2022	0.756	Apr 2023	-		0.756	0.000	2.247	-
Subtotal			162.492	13.671		12.883		12.347		-		12.347	Continuing	Continuing	N/A

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy **Date:** April 2022

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>
--	--	---

Test and Evaluation (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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
 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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	569.927	32.508	29.556	36.819	-	36.819	Continuing	Continuing	N/A

Remarks

UNCLASSIFIED

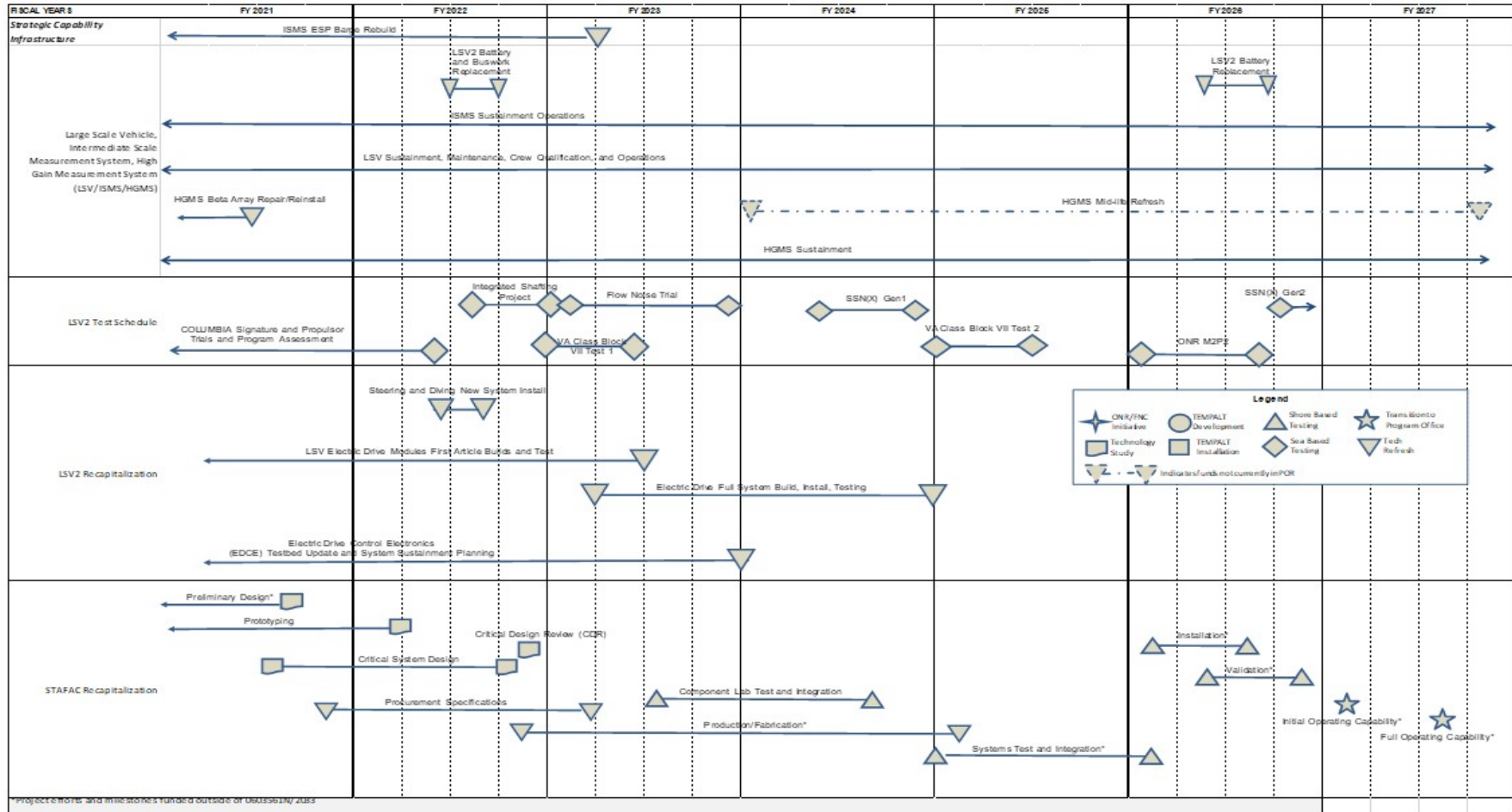
Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy

Date: April 2022

Appropriation/Budget Activity
1319 / 4

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

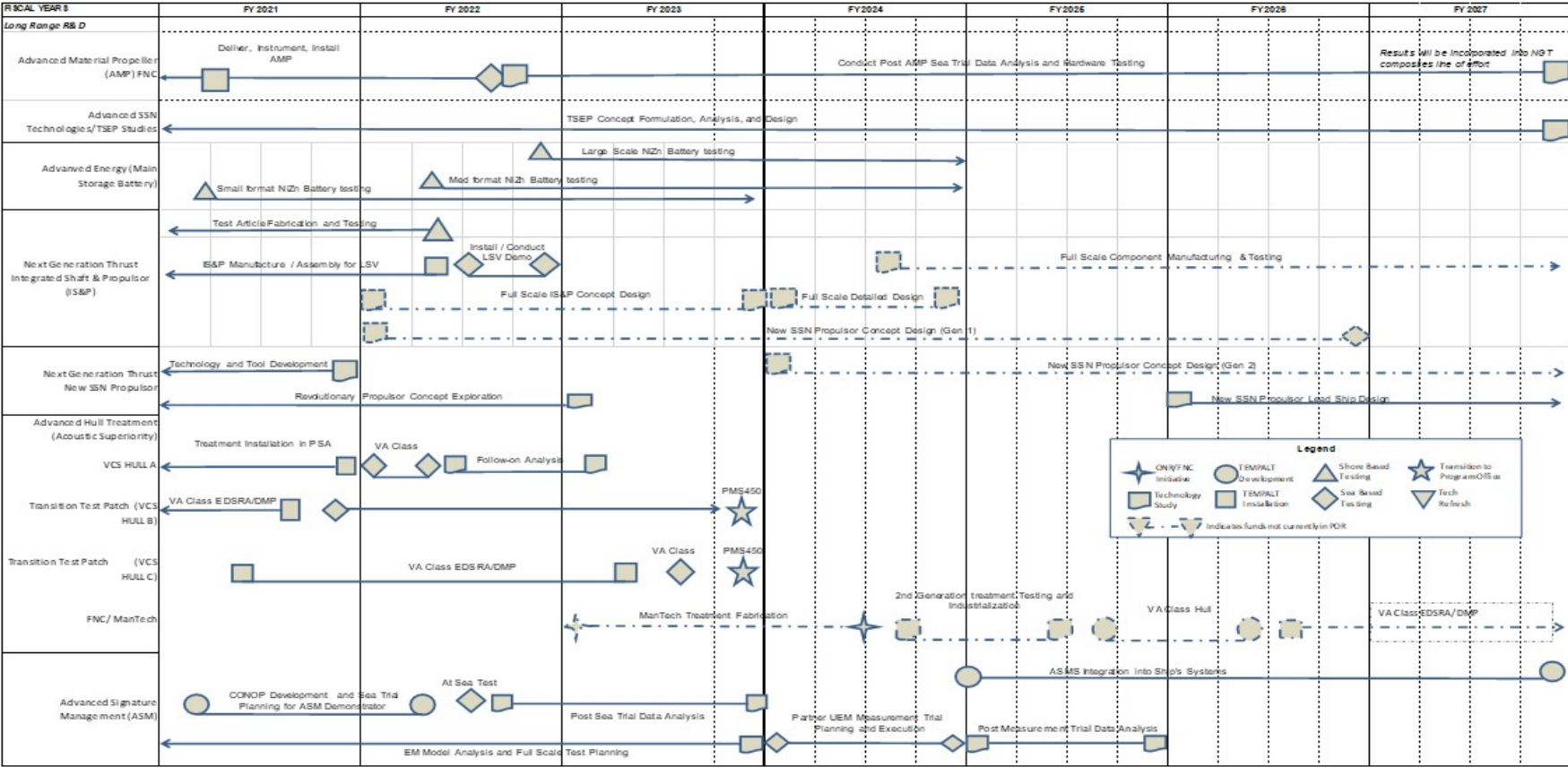
Project (Number/Name)
2033 / Adv Submarine Systems Development



UNCLASSIFIED

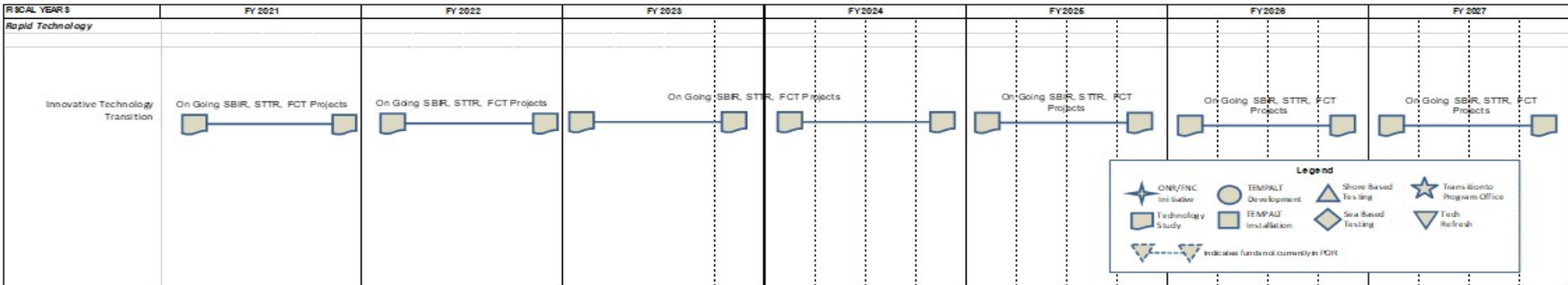
Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy **Date:** April 2022

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>
--	--	---



UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy		Date: April 2022
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>



UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy **Date:** April 2022

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	2021	2	2023
Strategic Capability Infrastructure: ISMS /LSV/HGMS - LSV Sustainment, Maintenance, Crew Qualification and Operations	1	2021	4	2027
Strategic Capability Infrastructure: ISMS /LSV/HGMS - LSV Battery and Buswork Replacement	3	2022	3	2022
Strategic Capability Infrastructure: ISMS /LSV/HGMS - LSV Battery Replacement (4 year replacement cycle)	2	2026	3	2026
Strategic Capability Infrastructure: ISMS/LSV/HGMS - ISMS Range Sustainment Operations	1	2021	4	2027
Strategic Capability Infrastructure: ISMS/LSV/HGMS - HGMS Mid-Life Refresh	1	2024	4	2027
Strategic Capability Infrastructure: ISMS/LSV/HGMS - HGMS Sustainment	1	2021	4	2027
Strategic Capability Infrastructure: LSV2 Test Schedule - COLUMBIA Signature and Propulsor Trials and Program Assessment	1	2021	2	2022
Strategic Capability Infrastructure: LSV2 Test Schedule - Integrated Shafting	3	2022	4	2022
Strategic Capability Infrastructure: LSV2 Test Schedule - VA Block VII Test 1 & 2	1	2023	2	2025
Strategic Capability Infrastructure: LSV Test Schedule - ONR M2P2	1	2026	3	2026
Strategic Capability Infrastructure: LSV2 Test Schedule - SSN(X) Gen 1 Prop	2	2024	4	2024
Strategic Capability Infrastructure: LSV2 Test Schedule - SSN(X) Gen 2 Prop	4	2026	4	2026
Strategic Capability Infrastructure: LSV2 Recapitalization - LSV2 Steering and Diving New System Install Replacement	2	2022	3	2022
Strategic Capability Infrastructure: LSV2 Recapitalization - Electric Drive Modules First Article Builds and Test	1	2021	4	2023

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy **Date:** April 2022

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>
--	--	---

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Strategic Capability Infrastructure: LSV2 Recapitalization - Electric Drive Full System Build, Install, Testing	2	2023	4	2024
Strategic Capability Infrastructure: LSV2 Recapitalization - Electronic Drive Control Electronics (EDCE) Test bed Update and System Sustainment Planning	1	2021	4	2023
Strategic Capability Infrastructure: STAFAC Recapitalization - Prototyping	1	2021	2	2022
Strategic Capability Infrastructure: STAFAC Recapitalization - Critical System Design	3	2021	3	2022
Strategic Capability Infrastructure: STAFAC Recapitalization - Procurement Specifications	4	2021	1	2023
Strategic Capability Infrastructure: STAFAC Recapitalization - Critical Design Review	3	2022	3	2022
Strategic Capability Infrastructure: STAFAC Recapitalization - Component Lab Test and Integration	3	2023	3	2024
Long Range R&D: Advanced Material Propeller (AMP) - Deliver instrument and install AMP propeller	1	2021	3	2022
Long Range R&D: Advanced Material Propeller (AMP) - At-sea test on partner submarine	3	2022	3	2022
Long Range R&D: Advanced Material Propeller (AMP) - Post-sea trial data analysis and hardware testing	4	2022	4	2027
Long Range R&D: SSN(X) - Advanced SSN Technologies/TSEP Studies - TSEP concept formulation, analysis, and design	1	2021	4	2027
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) -Test Article fabrication and testing	1	2021	2	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - IS&P Manufacture/Assembly for LSV	1	2021	2	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Install/Conduct LSV Demo	3	2022	4	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Full Scale IS&P Concept Design	1	2022	4	2023

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy **Date:** April 2022

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>
--	--	---

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 Detailed Design	1	2024	4	2024
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Full Scale Component Manufacturing & Testing	3	2024	4	2027
Long Range R&D: Next Generation Thrust New SSN Propulsor - Technology and Tool Dev	1	2021	4	2021
Long Range R&D: Next Generation Thrust New SSN Propulsor - New SSN Propulsor Concept Design (Gen 1)	1	2022	4	2026
Long Range R&D: Next Generation Thrust New SSN Propulsor - New SSN Propulsor Concept Design (Gen 2)	1	2024	4	2027
Long Range R&D: Next Generation Thrust New SSN Propulsor - Revolutionary Propulsor Concept Exploration	1	2021	1	2023
Long Range R&D: Next Generation Thrust New SSN Propulsor - New SSN Propulsor Lead Ship Design	1	2026	4	2027
Long Range R&D: Advanced Hull Treatments - Treatment Installation and PSA	1	2021	4	2021
Long Range R&D: Advanced Hull Treatments VA Class Sea Based Testing	1	2022	2	2022
Long Range R&D: Advanced Hull Treatments - Follow-on Analysis	2	2022	1	2023
Long Range R&D: Transition Test Patch (VCS HULL B) - VA Class EDSRA/DMP	1	2021	3	2021
Long Range R&D: FNC/ManTech - ManTech Treatment Fabrication	1	2023	2	2024
Long Range R&D: FNC/ManTech - 2nd Gen Treatment Testing and Industrialization	3	2024	2	2025
Long Range R&D: FNC/ManTech - 2nd Gen Treatment - TEMPALT Development	2	2025	2	2026
Long Range R&D: FNC/ManTech - 2nd Gen Treatment VA Class EDSRA/DMP	3	2026	4	2027
Long Range R&D: Transition Test Patch (VCS HULL C) - VA Class EDSRA/DMP	2	2021	2	2023
Long Range R&D: Transition Test Patch (VCS HULL C) - VA Class Sea Based Testing	3	2023	3	2023
Long Range R&D: Transition Test Patch (VCS HULL C) - Transition to VA Class	4	2023	4	2023
Long Range R&D: Advanced Signature Management - On-going ASMS Integration into Ship Systems	2	2023	4	2027

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy **Date:** April 2022

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>
--	--	---

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Long Range R&D: Advanced Signature Management - CONOP Dev and Sea Trial Planning for Demo	1	2021	2	2022
Long Range R&D: Advanced Signature Management - At Sea Test	3	2022	3	2022
Long Range R&D: Advanced Signature Management - Post Sea Trials Data Analysis	3	2022	4	2023
Long Range R&D: Advanced Signature Management - EM Model Testing/Analysis and Full Scale Test Planning	1	2021	4	2023
Long Range R&D: Advanced Signature Management - Partner UEM Measurement Trial, Planning/Execution	1	2024	4	2024
Long Range R&D: Advanced Signature Management - Post Measurement Trial Data Analysis	1	2025	4	2025
Rapid Technology Development: Innovative Technology Transition - Conduct assessment of technology initiatives, SBIR transition work, STTR, Foreign Comparative Tests	1	2021	4	2027

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy										Date: April 2022		
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
2096: <i>Payload Delivery Development</i>	29.885	13.747	2.527	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	46.159
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Decrease in funds from FY22 to FY23 is due to a change in approach for the Program

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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Payload Handling System (PHS)	13.747	2.527	0.000	0.000	0.000
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					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
of technology and final design packages to industry for future multi-unit procurement and application on future VIRGINIA Class and other future submarines.					
Long lead-time material purchases began in FY20 and continued into FY21. This material will be dispositioned by the end of FY22. 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.					
FY 2022 Plans: -Completion of VIRGINIA Class build-to-print Technical Data Package (TDP)					
FY 2023 Base Plans: N/A					
FY 2023 OCO Plans: N/A					
FY 2022 to FY 2023 Increase/Decrease Statement: Decrease in funds from FY22 to FY23 is due to a change in approach for the Program					
Accomplishments/Planned Programs Subtotals	13.747	2.527	0.000	0.000	0.000

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.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy **Date:** April 2022

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>
--	--	--

Product Development (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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	3.226	3.504	Oct 2020	0.275	Oct 2021	0.000		-		0.000	0.000	7.005	-
Product Development	WR	NSWC PD : Philadelphia, PA	12.125	5.220	Oct 2020	0.850	Oct 2021	0.000		-		0.000	0.000	18.195	-
Product Development (1)	WR	NUWC KPT : Keyport, WA	7.264	1.528	Oct 2020	0.600	Oct 2021	0.000		-		0.000	0.000	9.392	-
Product Development (1)	WR	PSNS : Bremerton, WA	3.241	1.138	Oct 2020	0.492	Oct 2021	0.000		-		0.000	0.000	4.871	-
Product Development	WR	NSWC CD : West Bethesda, MD	1.359	1.720	May 2021	0.000		0.000		-		0.000	0.000	3.079	-
Product Development	WR	NRL : Washington, DC	0.255	0.000		0.000		0.000		-		0.000	0.000	0.255	-
Product Development	FFRDC	ARL/PSU : Arlington, VA	0.285	0.000		0.000		0.000		-		0.000	0.000	0.285	-
Product Development	WR	NSWC DD : Dahlgren, VA	0.026	0.000		0.000		0.000		-		0.000	0.000	0.026	-
Product Development	C/CPFF	DIUx : Mountain View, CA	0.050	0.000		0.000		0.000		-		0.000	0.000	0.050	-
Product Development	WR	PNSY : Portsmouth, NH	0.597	0.000		0.000		0.000		-		0.000	0.000	0.597	-
Subtotal			28.428	13.110		2.217		0.000		-		0.000	0.000	43.755	N/A

Remarks
(1) Decrease in funds from FY22 to FY23 is due to a change in approach for the Program

Management Services (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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	0.182	0.047	Oct 2020	0.050	Oct 2021	0.000		-		0.000	0.000	0.279	-

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy		Date: April 2022
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>

	FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				FY 2027			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>Payload Handling System (PHS)</i>																												
PHS Milestones: Detailed Design																												
PHS Milestones: Final Design Review																												
PHS Milestones: Material Busy																												
PHS Milestones: Drawing Development (DWG)																												
PHS Milestones: VIRGINIA Class Build to Print TDP Ready																												
PHS Milestones: Final disposition of material																												
VPM Integration: Group 1 Execution Plan Undersea Dominance Payload Integration (UDPI)																												
VPM Integration: Block VI Tech Baseline Lockdown																												
Snakehead LDUUV Plan: Award																												
Snakehead LDUUV Plan: Phase 2 Vehicle Design & Fabrication																												

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy		Date: April 2022
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	2021	1	2022
PHS Milestones: Final Design Review	1	2021	1	2021
PHS Milestones: Material Busy	1	2021	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: Group 1 Execution Plan Undersea Dominance Payload Integration (UDPI)	1	2021	4	2022
VPM Integration: Block VI Tech Baseline Lockdown	2	2022	2	2022
Snakehead LDUUV Plan: Award	2	2021	2	2021
Snakehead LDUUV Plan: Phase 2 Vehicle Design & Fabrication	2	2022	4	2022

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy										Date: April 2022		
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
3391: <i>SSN/SSGN Survivability Program</i>	24.123	11.141	11.396	11.193	-	11.193	12.607	12.537	12.706	12.857	Continuing	Continuing
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: SSN/SSGN Survivability Program	11.141	11.396	11.193	0.000	11.193
Articles:	-	-	-	-	-
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.					
FY 2022 Plans: S3P will 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. Work includes: - Conducting analytical and technical work on Tactical Submarine Evolution Plan and future SSN/SSGN survivability design basis.					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<ul style="list-style-type: none"> - Conducting emerging threat, acoustic, and non-acoustic vulnerability assessment projects including sea tests in stealth requirements and countermeasure concepts. - Collecting and analyzing current submarine operational data to determine and mitigate vulnerabilities driven by operational profiles - Conduct at-sea tests to evaluate Countermeasures development concepts. - Details may be provided in a classified setting. <p>FY 2023 Base Plans: S3P will 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. Work includes:</p> <ul style="list-style-type: none"> - Conducting analytical and technical work on Tactical Submarine Evolution Plan and future SSN/SSGN survivability design basis. - Conducting emerging threat, acoustic, and non-acoustic vulnerability assessment projects including sea tests in stealth requirements and countermeasure concepts. - Collecting and analyzing current submarine operational data to determine and mitigate vulnerabilities driven by operational profiles - Conduct at-sea tests to evaluate Countermeasures development concepts. - Details may be provided in a classified setting. <p>FY 2023 OCO Plans: N/A</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Decrease from FY22 to FY23 is due to several budgets corrections driven primarily by Total Force Manpower savings issue 22116</p>					
Accomplishments/Planned Programs Subtotals	11.141	11.396	11.193	0.000	11.193

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

N/A

Remarks

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy												Date: April 2022			
Appropriation/Budget Activity 1319 / 4				R-1 Program Element (Number/Name) PE 0603561N / Advanced Submarine System Development				Project (Number/Name) 3391 / SSN/SSGN Survivability Program							
Product Development (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total			
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
Product Development	MIPR	CNA : Alexandria, VA	1.510	0.400	Jan 2021	1.582	Jan 2022	0.900	Jan 2023	-		0.900	Continuing	Continuing	Continuing
Product Development	SS/CPFF	MIT-LL : Cambridge, MA	1.427	1.043	Oct 2020	1.500	Oct 2021	1.100	Oct 2022	-		1.100	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JHU/APL : Laurel, MD	4.779	3.067	Oct 2020	0.286	Oct 2021	0.400	Jul 2023	-		0.400	Continuing	Continuing	Continuing
Product Development	SS/CPFF	UT/ARL : Austin, TX	1.867	0.000		0.645	Oct 2021	0.600	Aug 2023	-		0.600	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Newport, RI	2.900	2.265	Oct 2020	0.925	Oct 2021	1.000	Apr 2023	-		1.000	Continuing	Continuing	Continuing
Product Development	MIPR	NRL : Washington, DC	0.790	0.161	Dec 2020	0.000		0.750	Dec 2022	-		0.750	Continuing	Continuing	Continuing
Product Development	C/BA	NSMA : Not Specified	2.602	0.000		0.650	Mar 2022	0.600	Dec 2022	-		0.600	Continuing	Continuing	Continuing
Product Development	SS/CPFF	Sonolysts : Groton, CT	0.600	1.930	Oct 2020	1.703	Oct 2021	1.430	Sep 2023	-		1.430	Continuing	Continuing	Continuing
Product Development	WR	NSWCPD : Philadelphia, PA	0.000	0.205	Dec 2020	0.164	Oct 2021	0.164	Oct 2022	-		0.164	0.000	0.533	-
Product Development	SS/CPFF	Lockheed : Not Specified	0.000	0.050	Dec 2021	0.125	Mar 2022	0.125	Jan 2023	-		0.125	0.000	0.300	-
Subtotal			16.475	9.121		7.580		7.069		-		7.069	Continuing	Continuing	N/A
Support (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total			
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
Travel and Corporate	WR	NAVSEA HQ : Not Specified	0.740	0.021	Oct 2020	0.020	Oct 2021	0.050	Oct 2022	-		0.050	Continuing	Continuing	Continuing
Subtotal			0.740	0.021		0.020		0.050		-		0.050	Continuing	Continuing	N/A

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy												Date: April 2022				
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)								
1319 / 4				PE 0603561N / Advanced Submarine System Development				3391 / SSN/SSGN Survivability Program								
Test and Evaluation (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total				
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	
Developmental Test & Evaluation	WR	NSWC : Carderock, MD	5.918	1.639	Oct 2020	0.548	Apr 2022	1.784	Apr 2023	-		1.784	Continuing	Continuing	Continuing	
Developmental Test & Evaluation	SS/CPFF	JHU/APL : Laural, MD	0.000	0.000		2.881	Apr 2022	1.930	Jul 2023	-		1.930	0.000	4.811	-	
Subtotal			5.918	1.639		3.429		3.714		-		3.714	Continuing	Continuing	N/A	
Management Services (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total				
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	
Management Services	SS/CPFF	NSMA : Not Specified	0.990	0.360	Oct 2020	0.367	Dec 2021	0.360	Dec 2022	-		0.360	Continuing	Continuing	Continuing	
Subtotal			0.990	0.360		0.367		0.360		-		0.360	Continuing	Continuing	N/A	
Project Cost Totals			24.123	11.141		11.396		11.193		-		11.193	Continuing	Continuing	N/A	
Remarks																

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy		Date: April 2022
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>

	FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				FY 2027			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Assessments																												
Operational Survivability Assessment																												
Acoustic Assessment																												
Non-Acoustic Assessment																												
Vulnerability Validation																												
Vulnerability SEA Test Validation Program (1-2 per year)																												
Countermeasures																												
Countermeasure Validation (2-3 per year)																												
Advanced Submarine Signature Management/Countermeasures																												
Sea Test Validation Program (1 per year)																												
Signature Vulnerability Assessment (1 per year)																												

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy		Date: April 2022
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	2021	4	2027
Acoustic Assessment	1	2021	4	2027
Non-Acoustic Assessment	1	2021	4	2027
Vulnerability Validation				
Vulnerability SEA Test Validation Program (1-2 per year)	1	2021	4	2027
Countermeasures				
Countermeasure Validation (2-3 per year)	1	2021	4	2027
Advanced Submarine Signature Management/Countermeasures				
Sea Test Validation Program (1 per year)	1	2021	4	2027
Signature Vulnerability Assessment (1 per year)	1	2022	4	2027

UNCLASSIFIED

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

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>
--	--	---

COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
9710: <i>Advanced Submarine Technology Development</i>	0.000	0.886	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.886
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Advanced Submarine Technology Development	0.886	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: See classified addendum for details					
FY 2022 Plans: N/A					
FY 2023 Base Plans: N/A					
FY 2023 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	0.886	0.000	0.000	0.000	0.000

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

N/A

Remarks

D. Acquisition Strategy

N/A

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy **Date:** April 2022

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>
--	--	---

Product Development (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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	0.886	Dec 2020	0.000		0.000		-		0.000	0.000	0.886	-
Subtotal			0.000	0.886		0.000		0.000		-		0.000	0.000	0.886	N/A
Project Cost Totals			0.000	0.886		0.000		0.000		-		0.000	0.000	0.886	N/A

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

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Navy		Date: April 2022
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>

FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				FY 2027			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

Proj 9710

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

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy		Date: April 2022
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

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy										Date: April 2022		
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>			
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	0.000	8.683	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.683
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

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. The program plans to support these efforts by providing the government, UARC and industry propulsor design workforce with improved computational models, simulation tools, small scale physical models and advanced manufacturing capabilities; by continuing government, industry and workforce partnership to mature the technology and manufacturing readiness levels of new submarine hull treatments; and by working with industry partners, UARCs, and the Fleet to support launch and recovery (L&R) testing and demonstrations which will enhance the fidelity of future UUV torpedo tube L&R modeling, and ensure the warfare center and industry workforce is postured with the tools and experience required to support the growing size and scope of the Fleet's UUV inventory.

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

	FY 2021	FY 2022
Congressional Add: Improved CAVES Technology	3.859	0.000
<p>FY 2021 Accomplishments: - Initiated 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"> - Began fabrication of inner and outer de-coupler test coupons used to determine if new design materials improve performance over legacy materials. - Stood 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. <p>FY 2022 Plans: - Complete studies and analysis for different CAVES LVA configurations.</p> <ul style="list-style-type: none"> - Conduct acoustic and shock testing on de-coupler test coupons and analyze test results. 		

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022	
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>	
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	
- Continue studies to reduce, or to further assess the impact of, CAVES LVA flow-noise and provide recommendations to reduce impact.			
Congressional Add: Workforce Partnership Research	4.824	0.000	
FY 2021 Accomplishments: - 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. - 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. - 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).			
FY 2022 Plans: Continue efforts utilizing FY21 funding: Support Next Generation Thrust project government, UARC and industry propulsor design workforce with improved computational models, simulation tools, small scale physical models and advanced manufacturing capabilities to enhance their ability to meet the demanding performance objectives required by 21st century threats. Continue government, industry and workforce partnership to maturing the technology and manufacturing readiness levels of new submarine hull treatments and industrialize the production of prototype architectures. FY21 efforts also included 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	8.683	0.000	
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
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>

D. Acquisition Strategy
N/A

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Navy **Date:** April 2022

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>
--	--	--

Product Development (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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			
C643: Product Development	TBD	Seemann's Composites Inc : Gulf Port, MS	0.000	0.600	Aug 2021	0.000		0.000		-		0.000	0.000	0.600	-
C643: Product Development	WR	NSWC Carderock : Bethesda, MD	0.000	0.940	Apr 2021	0.000		0.000		-		0.000	0.000	0.940	-
C643: Product Development	FFRDC	ARL/UT : Austin, TX	0.000	1.440	Apr 2021	0.000		0.000		-		0.000	0.000	1.440	-
C643: Product Development	FFRDC	ARL/PSU : State College, PA	0.000	1.004	Nov 2021	0.000		0.000		-		0.000	0.000	1.004	-
C643: Product Development	C/IDIQ	General Atomics : San Diego, CA	0.000	0.640	Sep 2021	0.000		0.000		-		0.000	0.000	0.640	-
C619: Product Development	MIPR	DMEA : McClellan, CA	0.000	2.609	Jul 2021	0.000		0.000		-		0.000	0.000	2.609	-
C619: Product Development	WR	NUWC Newport : Newport, RI	0.000	0.325	Jun 2021	0.000		0.000		-		0.000	0.000	0.325	-
C619: Product Development	C/BA	NSWC Carderock : Bethesda, MD	0.000	0.575	Jun 2021	0.000		0.000		-		0.000	0.000	0.575	-
C619: Product Development	Various	VAR : VAR	0.000	0.350	Aug 2021	0.000		0.000		-		0.000	0.000	0.350	-
Subtotal			0.000	8.483		0.000		0.000		-		0.000	0.000	8.483	N/A

Support (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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			
C643: Government Engineering Support	WR	NSWC Carderock : Bethesda, MD	0.000	0.200	May 2021	0.000		0.000		-		0.000	0.000	0.200	-
Subtotal			0.000	0.200		0.000		0.000		-		0.000	0.000	0.200	N/A

Remarks
Government Field Activity support utilized for award of direct cite procurements.

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Navy		Date: April 2022
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>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 9999				
C643: Workforce Partnership Research: Very Large Test Apparatus (VLTA) Physical Model Upgrades	3	2021	4	2022
C643: Workforce Partnership Research: Propulsor Inflow Modeling and Simulation Capability Improvement	3	2021	4	2022
C643: Workforce Partnership Research: Low Technology Readiness Level (TRL) Treatment Industrialization and 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