Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy											Date: February 2020	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0603561N *I Advanced Submarine System Development*							
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
Total Program Element	1,121.718	103.267	115.717	185.356	-	185.356	153.975	170.801	182.010	185.635	Continuing	Continuing
0223: *Sub Combat System Improvement (ADV)*	566.242	44.640	51.151	55.418	-	55.418	56.795	58.797	59.851	61.026	Continuing	Continuing
2033: *Adv Submarine Systems Development*	533.664	29.894	34.282	33.580	-	33.580	27.291	23.389	23.851	24.331	Continuing	Continuing
2096: *Payload Delivery Development*	8.538	10.969	10.801	17.975	-	17.975	12.362	13.636	10.289	10.495	Continuing	Continuing
3391: *SSN/SSGN Survivability Program*	8.203	8.116	9.483	11.511	-	11.511	12.008	11.544	12.795	13.051	Continuing	Continuing
9710: *Advanced Submarine Technology Development*	0.000	0.000	0.000	66.872	-	66.872	45.519	63.435	75.224	76.732	Continuing	Continuing
9999: *Congressional Adds*	5.071	9.648	10.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.719

Note

Project 9710 was previously funded in FY 2019 under Program Element 0604250D8Z (Advanced Innovative Technologies) Project 250 (Advanced Innovative Technologies). This is a Navy new start.

A. Mission Description and Budget Item Justification

The FY 2021 funding request was reduced by $1.160 million to account for the availability of prior year execution balances.

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 2020 TO FY 2021 (NET INCREASE OF $+69.639M):
- PROJECT 0223 increase from FY 2020 to FY 2021 ($+4.267M) was driven by the following: 1) The realignment of responsibilities, starting in FY 2021, for the development of Interactive Multi-Sensor Analysis Training (IMAT) software from the Undersea Warfare Development Center (UWDC) to the NAVSEA Undersea Systems Program Office. The IMAT program provides performance support and training systems for extremely difficult cognitive tasks involved in Anti-Submarine Warfare (ASW) with resulting products incorporated directly into the Advanced Processing Build (APB) development program. 2) The increased effort to begin the transition, starting in FY 2021, to a Continuous Integration/Continuous Delivery (CI/CD) pipeline approach for APB software within a DevSecOps delivery framework.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603561N *I Advanced Submarine System Development*

- PROJECT 2033 net decrease from FY 2020 to FY 2021 ($-0.702M) is the result of Large Scale Vehicle (LSV-2) Recapitalization planned program funding increase and under execution reduction.
- PROJECT 2096 increase from FY 2020 to FY 2021 ($+7.174M) reflects increased effort required to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of the Payload Handling System (PHS) in the VIRGINIA Class Block VI Technical Baseline.
- PROJECT 3391 increase from FY 2020 to FY 2021 ($+2.028M) was required for Advanced Signature Management/Countermeasures development (classified).
- PROJECT 9710 increase from FY 2020 to FY 2021 ($+66,872) was driven by the deferral of the start of this Project from FY 2020 to FY 2021.
- PROJECT 9999 decrease from FY 2020 to FY 2021 ($-10.0M) reflects the Congressionally directed add for 'Small Business Technology Insertion' in FY 2020.

DESCRIPTION/JUSTIFICATION BY PROJECT:

PROJECT 0223: The Submarine Combat System Improvement (Advanced) (Non-ACAT) Project researches, develops, and tests new sonar, combat system, imaging, and electronic warfare software and develops, tests, and prototypes new sonar arrays for Program Executive Office Submarine (PEO SUB) programs, delivering approximately thirty (30) new capabilities every other year. This Project supports Navy Submarine Acoustic Superiority and Technology Insertion Initiatives through the application of advanced development and testing of sensors and sensor processing systems supporting tactical control systems improvements. Improvements are supportive of 'A Cooperative Strategy for 21st Century Sea Power and the Chief of Naval Operations (CNO) Design for Maintaining Maritime Superiority'; addressing all components to include Strengthen Naval Power At and From Sea, Achieve High Velocity Learning, Strengthen Our Navy Team for the Future, and Expand and Strengthen Our Network of Partners. This Project addresses threats posed by China, Russia, Iran, Korea and Terrorism (CRIKT), improved lethality of U.S. Submarine Forces and 3rd Offset Capabilities in the Unmanned and Automated Systems domains.

Project 0223 is comprised of four (4) major efforts: Advanced Processing Builds (APB), Flank Array Demonstration (FAD), Advanced Sensors, and Large Vertical Array (LVA).

APB develops, tests and transitions capabilities for:
- 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

Flank Array Demonstration (FAD) conducts testing and analysis on the existing Large Vertical Array (LVA) and supports maintenance and correction of identified problems on the array.

Advanced Sensors develops new technologies for Hull Mounted and Towed Arrays. Hull Mounted improvements support submarine applications only. Towed array improvements are shared to support surface and surveillance applications.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603561N *I Advanced Submarine System Development*

Large Vertical Array (LVA) leverages demonstrated FAD developments to conduct critical testing and analysis needed to improve array performance and develop sensor employment tactics. It will introduce new electronic hardware and new software applications to enhance array and signal processing performance. These improvements will be incorporated in future LVA builds for VIRGINIA class SSNs and OHIO and COLUMBIA classes of SSBNs.

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, lowering the technical/cost risks of integrating new technologies prior to acquisition, and speeding the delivery of capability and lethality into 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 R&D infrastructure assets that are critical to the long-term design, assessment and construction of modern, stealthy submarine platforms.

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

The major developmental efforts include:

Strategic Capability Infrastructure
- Large Scale Vehicle (LSV)
- Intermediate Scale Measurement System (ISMS)

Long Range R&D Investment
- Precision Submarine Maneuvering and Control
- Advanced Material Propeller (AMP) Technology
- Advanced SSN Technologies
- Next Generation Thrust (future propulsor/shafting technologies)
- Advanced Hull Treatments

Rapid Technology Development
- Innovation Technology Transfer

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

Payload Delivery Development is a non-acquisition program used for the integration of large deployable and retrievable payloads with submarines. RDT&EN funding will be used to design, manufacture, and field 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. 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 (VACL) Payload Modules (Block V and VI) and will be in coordination with the Tactical Submarine Evolution Plan (TSEP) objectives for VACL Block VII and/or SSNx. The prototype system capability will also provide immediate solutions to urgent war-fighter needs. Experimentation will be conducted with the Fleet (i.e., Commander, Naval Submarine Forces (COMSUBFOR), Unmanned Undersea Vehicle Squadron One (UUVRON ONE), etc.), 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.

- FY 2021 funding profile is increased to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of PHS in the VIRGINIA Class Block VI Technical Baseline.

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

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

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	105.809	148.756	166.138	-	166.138
Current President's Budget	103.267	115.717	185.356	-	185.356
Total Adjustments	-2.542	-33.039	19.218	-	19.218
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-43.039			
• Congressional Rescissions	-	-			
• Congressional Adds	-	10.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.542	0.000			
• Program Adjustments	0.000	0.000	19.125	-	19.125
• Rate/Misc Adjustments	0.000	0.000	0.093	-	0.093

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603561N *I Advanced Submarine System Development*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Small Business Technology Insertion*	0.000	10.000
Congressional Add: *Littoral Water Threats*	4.824	0.000
Congressional Add: *Lightweight Composite Research*	4.824	0.000
Congressional Add Subtotals for Project: 9999	9.648	10.000
Congressional Add Totals for all Projects	9.648	10.000

Change Summary Explanation

FUNDING CHANGES SINCE THE PREVIOUS PRESIDENT'S BUDGET AT THE OVERALL PE LEVEL:
- FY 2019 net decrease of $-2.542M reflects the Small Business Innovative Research (SBIR) transfer.
- FY 2020 net decrease of $-33.039M included Congressionally directed program adjustments as follows: $-0.575M to Project 2033 for contract delays; $-3.135M to Project 2096 for material purchases growth early to need; $-0.640M to Project 3391 for project delays; $-38.689 to Project 9710 for unjustified new start and lack of acquisition strategies; $+10.000M to Project C308 for small business technology insertion.
- FY 2021 net increase of $+19.218M included: $+1.130M increase to Project 0223 for the initiation of Interactive Multi-sensor Analysis Training (IMAT) software development starting in FY 2021; $+6.999M increase to Project 2033 for Large Scale Vehicle-2 Recapitalization; $+5.626M increase to Project 2096 for Payload Handling System (PHS); $+6.530M increase to Project 9710 to complete Project 1 production design schedule; and a $-1.160M offset to Project 2033 to account for the availability of prior year execution balances.

INFORMATION AT THE PROJECT LEVEL:

PROJECT 0223:

FUNDING: The FY 2020 ($51.151M) to FY 2021 ($55.418M) budget increase ($+4.267M) was driven by the addition of $+1.130M to realign the responsibility and funding, starting in FY 2021, for the development of Interactive Multi-Sensor Analysis Training (IMAT) software from the Undersea Warfare Development Center (UWDC) to the NAVSEA Undersea Systems Program Office; $+0.500M for additional Large Vertical Array (LVA) development efforts; $+0.140M for additional Advanced Sensor development efforts; $+2.872M for additional Advanced Processing Build (APB) development efforts; and a decrease of $-0.375M for Flank Array Demonstration (FAD). Details on each Project 0223 program's budget increase/decrease from FY 2020 to FY 2021 are as follows:

APB - FY 2020 to FY 2021 increase ($+4.002M) is comprised of two factors:

1) $+1.130M driven by the realignment of responsibility and funding, starting in FY 2021, for the development of software from the UWDC to the NAVSEA Undersea Systems Program Office. The Navy determined that this development effort was best managed by the NAVSEA Undersea Systems Program Office due to its close alignment with other tactical aids, analysis, and training products developed under its APB program. The IMAT program provides performance support and training systems for extremely difficult cognitive tasks involved in Anti-Submarine Warfare (ASW). IMAT products will be incorporated into the APB program.

2) $+2.872M driven by the requirement to fully transition, starting in FY 2021, to a Continuous Integration/Continuous Delivery (CI/CD) pipeline approach for APB software within a DevSecOps delivery framework. Program Executive Office for Submarines (PEO SUB) has begun a transition to CI/CD DevSecOps for Submarine Warfare Federated Tactical Systems (SWFTS) as has the APB program.

FAD - FY 2020 to FY 2021 decrease ($-0.375M) is in accordance with original program plans. Efforts cease after FY 2020 with the development/capabilities transitioned to the future LVA development efforts.

Advanced Sensors - FY 2020 to FY 2021 increase ($+0.140M) is in line with inflation associated with the RDT&EN appropriation.

LVA - FY 2020 to FY 2021 increase ($+0.500M) is consistent with program plans. The LVA development program is required to pace the threat of evolutionary quieting of adversary submarines. At-sea testing and analyses in FY 2020 will inform a ramp-up in FY 2021 and beyond to develop sensor and processing hardware improvements, and signal processing and tactics for each planned submarine platform.

SCHEDULE CHANGES:
- APB-19 At-Sea Test and Transition to PEO SUB Production Programs events accelerated one quarter each (from 3Q20 to 2Q20 and 4Q20 to 3Q20 respectively) due to new streamlined approach to Step-3 testing.
- APB-21 At-Sea Test and Transition to PEO SUB Production Programs events accelerated one year each (from 3Q22 to 3Q21 and 4Q22 to 4Q21 respectively) due to the transition to a more agile process (CI/CD DevSecOps) approach to software development and delivery for APB.
- APB-23 At-Sea Test and Transition to PEO SUB Production Programs events accelerated approximately one year each (from 3Q24 to 2Q23 and 4Q24 to 3Q23 respectively) due to the transition to a more agile process (CI/CD DevSecOps) approach to software development and delivery for APB.

PROJECT 2096:

FY 2020 funding profile received a Congressional Mark- ($3.135M)
FY 2021 funding profile is increased to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of PHS in the VIRGINIA Class Block VI Technical Baseline.

PROJECT 3391:

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603561N *I Advanced Submarine System Development*

S3P top-line resourcing increases to conduct Advanced Signature Management/Countermeasures development.

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

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
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)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0223: *Sub Combat System Improvement (ADV)*	566.242	44.640	51.151	55.418	-	55.418	56.795	58.797	59.851	61.026	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

FY 2020 TO FY 2021 BUDGET REQUEST INCREASE: Increase from FY 2020 to FY 2021 ($+4.267M) was driven by the following: 1) The realignment of responsibilities, starting in FY 2021, for the development of Interactive Multi-Sensor Analysis Training (IMAT) software from the Undersea Warfare Development Center (UWDC) to the NAVSEA Undersea Systems Program Office. The IMAT program provides performance support and training systems for extremely difficult cognitive tasks involved in Anti-Submarine Warfare (ASW) with resulting products incorporated directly into the Advanced Processing Build (APB) development program. 2) The increased effort to begin the transition, starting in FY 2021, to a Continuous Integration/Continuous Delivery (CI/CD) pipeline approach for APB software within a DevSecOps delivery framework.

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) 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, Korea and Terrorism (CRIKT). 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 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Processing Build (APB)	39.515	41.776	45.778	0.000	45.778
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: Advanced Processing Builds (APBs) adhere to a four Step process: Step-1: Algorithm/technology assessment by peer review panels of Subject Matter Experts (SME) to down-select technologies and assist developers with technical guidance. Step-2: Algorithm/technology testing with open and closed data sets to further down-select and refine capabilities prior to integration and testing. Step-3: Land-based system-level testing stimulated by the Submarine Multi-Mission Team Trainer (SMMTT), in a realistic tactical environment. Step-4: At-sea testing on an operational submarine. 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-17, APB-19) 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. Beginning with APB-21, APB will adopt a Continuous Integration/Continuous Delivery (CI/CD) DevSecOps software development and delivery process in concert with Program Executive Office for Submarines (PEO SUB) and Submarine Warfare Federated Tactical Systems (SWFTS) production and fielding plans. ***FY 2020 Plans:*** - Continue refining candidate capabilities for inclusion in APB-21. - Integrate advanced capabilities through DevSecOps software pipeline in coordination with production program offices. - Conduct Step-3 land-based testing of APB-21. - Conduct Step-4 at-sea test of APB-19. Analyze results to inform improvements, tactics and training. - Continue development and testing new Electronic Warfare (EW) capabilities in a land-based development environment. - Continue development of electronic maneuver warfare capabilities.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continue development of a Sonar Tactical Decision Aid (STDA) common to submarine, surface, and surveillance applications. Continue to export development products to Surface programs. - Continue studies on the use of Machine Learning and Artificial Intelligence (AI), with emphasis on Deep Learning and Big Data Analytics. Continue collaboration with the Digital Warfare Office and Project Maven to increase expertise and speed of development. Seek system performance improvements and 3rd Offset (automation) capabilities not currently achievable with legacy technology. - Continue development of automated technologies targeting particular vulnerabilities. - 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 developed in FY 2019. - Increase enterprise implementation of classified information exchange network to a larger group. - Update multi-year capability development road map developed in FY 2019.					
FY 2021 Base Plans: - Begin refinement of candidate capabilities for inclusion in APB-23. - Conduct Step-4 at-sea test of APB-21. Analyze results to inform improvements, tactics and training. - Continue studies on the use of Machine Learning and Artificial Intelligence (AI), with emphasis on Deep Learning and Big Data Analytics. Continue collaboration with the Digital Warfare Office and Project Maven to increase expertise and speed of development. 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 to be updated in FY 2020. - Implement EW detection improvements against complex signals, and integrate off-hull payloads into the Submarine Warfare Federated Tactical Systems (SWFTS) construct. - Begin integration of Interactive Multi-Sensor Analysis Training (IMAT) software capabilities with APB common Tactical Decision Aids (TDAs). Begin to adapt software architecture to a container-based approach to facilitate rapid updates and sharing with the Surface and Air communities.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: FY 2020 to FY 2021 increase ($+4.002M) is comprised of two factors:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
1) $+1.130M driven by the realignment of responsibility and funding, starting in FY 2021, for the development of Interactive Multi-Sensor Analysis Training (IMAT) software from the Undersea Warfare Development Center (UWDC) to the NAVSEA Undersea Systems Program Office. The Navy determined that this development effort was best managed by the NAVSEA Undersea Systems Program Office due to its close alignment with other tactical aids, analysis, and training products developed under its APB program. The IMAT program provides performance support and training systems for extremely difficult cognitive tasks involved in Anti-Submarine Warfare (ASW). IMAT products will be incorporated into the APB program. 2) $+2.872M driven by the requirement to fully transition, starting in FY 2021, to a Continuous Integration/ Continuous Delivery (CI/CD) pipeline approach for APB software within a DevSecOps delivery framework. Program Executive Office for Submarines (PEO SUB) has begun a transition to CI/CD DevSecOps for Submarine Warfare Federated Tactical Systems (SWFTS) as has the APB program.					
Title: Flank Array Demonstration (FAD)	1.325	0.375	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: - Provide on-site support for the maintenance, troubleshooting and repair of faulty or failed array inboard/ outboard components. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2020 to FY 2021 decrease ($-0.375M) is in accordance with original program plans. Efforts cease after FY 2020 with the development/capabilities transitioned to the future LVA development efforts.					
Title: Advanced Sensors	3.800	7.000	7.140	0.000	7.140
Articles:	-	-	-	-	-
FY 2020 Plans: - Complete Open Architecture Telemetry (OAT) component development, system architecture, and associated Installation Control Drawings (ICDs).					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Conduct array environmental, calibration, and Lake Pend Oreille (LPO) testing of array modules. - Begin procurement and fabrication of a full length OAT array Advanced Development Model (ADM). - Continue development of the High Speed Signal Path. - Continue development of active and passive sensor concepts to support performance requirements for the Bow Conformal Array (BCA). - Complete test panel design and procurement of material. - Initiate detailed design of BCA ADM. ***FY 2021 Base Plans:*** - Complete OAT development, and continue fabrication of OAT ADM array. - Test the active and passive sensor design concept panel for the new BCA and provide detailed design efforts. Additional BCA testing is necessary to validate studies conducted in FY 2019-2020, and to collect data that will be used to improve the acoustic performance of the BCA ADM. - Complete active and passive studies for BCA. Conduct acoustic test tank and environmental panel testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2020 to FY 2021 increase ($+0.140M) is in line with inflation associated with the RDT&EN appropriation.					
Title: Large Vertical Array (LVA)	0.000	2.000	2.500	0.000	2.500
Articles:	-	-	-	-	-
Description: Large Vertical Array (LVA) development is a follow-on effort to the exploratory work conducted under the Flank Array Demonstration (FAD) program. ***FY 2020 Plans:*** - Conduct critical at-sea testing events for LVA2 and SSN 790 and analyze at-sea test results. This testing/ analysis is necessary to integrate enhanced signal processing capability for LVAs and to collect data that will be used to improve LVA tactical performance. These processing upgrades are directly applicable to improving the forward fit and backfit LVA production programs for Virginia, Ohio, and Columbia Class Submarines. ***FY 2021 Base Plans:*** - Continue with the conduct of at-sea testing events for LVA2 and SSN 790 and analyze at-sea test results.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Provide on-site support for the maintenance, troubleshooting, and repair of faulty or failed array inboard/ outboard components. Document troubleshooting and repair findings for evaluation by engineering team and provide findings/recommendations to the forward fit and backfit LVA production programs for Virginia, Ohio, and Columbia Class Submarines. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2020 to FY 2021 increase ($+0.500M) is consistent with program plans. The LVA development program is required to pace the threat of evolutionary quieting of adversary submarines. At-sea testing and analyses in FY 2020 will inform a ramp-up in FY 2021 and beyond to develop sensor and processing hardware improvements, and signal processing and tactics for each planned submarine platform.					
Accomplishments/Planned Programs Subtotals	44.640	51.151	55.418	0.000	55.418

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0205620N: *Surface ASW Cmbt Sys Integr*	25.478	29.572	29.348	-	29.348	29.849	30.441	31.046	31.666	Continuing	Continuing

Remarks

D. Acquisition Strategy

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

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

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Step-4: At-sea testing on an operational submarine.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	C/CPFF	Adaptive Methods : VA	1.725	0.050	Dec 2018	0.300	Dec 2019	0.324	Dec 2020	-		0.324	Continuing	Continuing	Continuing
Product Development	C/CPFF	Alion Sciences : VA	3.267	0.000		0.000		0.000		-		0.000	0.000	3.267	Continuing
Product Development	C/CPFF	Arete : CA	0.550	0.000		0.000		0.000		-		0.000	0.000	0.550	-
Product Development	C/CPFF	Chesapeake Science (L-3) : MD	7.551	0.000		0.000		0.000		-		0.000	0.000	7.551	Continuing
Product Development	C/CPFF	Electric Boat : ME	1.855	0.125	Feb 2019	0.000		0.000		-		0.000	0.000	1.980	Continuing
Product Development	C/CPFF	General Dynamics : VA	24.829	1.811	Dec 2018	1.992	Dec 2019	2.151	Dec 2020	-		2.151	Continuing	Continuing	Continuing
Product Development	C/CPFF	GA Tech Research Institute : GA	3.076	0.080	May 2019	0.385	Dec 2019	0.416	Dec 2020	-		0.416	Continuing	Continuing	Continuing
Product Development	C/CPFF	In Depth Engineering : VA	7.085	0.350	Dec 2018	0.950	Jan 2020	1.026	Dec 2020	-		1.026	Continuing	Continuing	Continuing
Product Development	C/CPFF	JHU/APL : MD	111.461	5.983	Dec 2018	10.500	Dec 2019	11.340	Dec 2020	-		11.340	Continuing	Continuing	Continuing
Product Development	C/CPFF	Lockheed Martin : VA	80.324	10.235	Dec 2018	9.419	Oct 2019	10.173	Dec 2020	-		10.173	Continuing	Continuing	Continuing
Product Development	C/CPFF	Lockheed Martin : NY	10.064	0.000		0.000		0.000		-		0.000	0.000	10.064	Continuing
Product Development	C/CPFF	Metron : VA	8.938	1.300	Dec 2018	0.750	Jan 2020	0.810	Dec 2020	-		0.810	Continuing	Continuing	Continuing
Product Development	C/CPAF	NSMA : VA	13.094	0.650	Jan 2019	0.650	Feb 2020	0.702	Jan 2021	-		0.702	Continuing	Continuing	Continuing
Product Development	WR	NSWC/Carderock : MD	31.842	2.492	Nov 2018	2.585	Oct 2019	2.792	Nov 2020	-		2.792	Continuing	Continuing	Continuing
Product Development	WR	NUWC/Newport : RI	106.425	9.176	Nov 2018	9.360	Oct 2019	10.020	Nov 2020	-		10.020	Continuing	Continuing	Continuing
Product Development	WR	ONI : DC	2.295	0.000		0.000		0.000		-		0.000	0.000	2.295	Continuing
Product Development	WR	ONR : VA	2.725	0.000		0.000		0.000		-		0.000	0.000	2.725	Continuing
Product Development	C/CPFF	Progeny : VA	8.552	0.244	Dec 2018	0.650	Jan 2020	0.702	Dec 2020	-		0.702	Continuing	Continuing	Continuing
Product Development	C/CPFF	PSU/ARL : PA	10.680	1.133	Dec 2018	0.650	Jan 2020	0.702	Dec 2020	-		0.702	Continuing	Continuing	Continuing
Product Development	C/CPFF	SAIC : VA	3.555	0.000		0.000		0.000		-		0.000	0.000	3.555	Continuing
Product Development	C/CPFF	Sedna Digital : VA	15.400	1.884	Dec 2018	2.000	Nov 2019	2.160	Dec 2020	-		2.160	Continuing	Continuing	Continuing
Product Development	WR	SSC/San Diego : CA	1.963	0.000		0.000		0.000		-		0.000	0.000	1.963	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	MIPR	U.S. Army Research Lab : MD	1.700	0.000		0.000		0.000		-		0.000	0.000	1.700	Continuing
Product Development	MIPR	U.S. Army/MITRE : NJ	4.595	0.000		0.000		0.000		-		0.000	0.000	4.595	Continuing
Product Development	MIPR	U.S. Hanscom AFB/ MIT Lincoln Labs : MA	21.778	1.820	Oct 2018	2.556	Dec 2019	2.760	Dec 2020	-		2.760	Continuing	Continuing	Continuing
Product Development	C/CPFF	UT/ARL : TX	31.931	1.946	Dec 2018	1.985	Jan 2020	2.144	Dec 2020	-		2.144	Continuing	Continuing	Continuing
Product Development	C/CPFF	VAR : VAR*	27.743	3.611	Dec 2018	4.635	Dec 2019	5.376	Dec 2020	-		5.376	Continuing	Continuing	Continuing
		Subtotal	545.003	42.890		49.367		53.598		-		53.598	Continuing	Continuing	N/A

Remarks

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

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
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	Continuing
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	Continuing
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	CGI Federal* : VA	3.400	1.692	Nov 2018	1.726	Jan 2020	0.000		-		0.000	0.000	6.818	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	TBD (CGI Federal Follow On)* : TBD	0.000	0.000		0.000		1.761	Dec 2020	-		1.761	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Office Travel	Allot	NAVSEA PEO IWS5 : DC	0.883	0.058	Nov 2018	0.058	Jan 2020	0.059	Nov 2020	-		0.059	Continuing	Continuing	Continuing
		Subtotal	21.239	1.750		1.784		1.820		-		1.820	Continuing	Continuing	N/A

Remarks

*In addition to program office support, CGI Federal provides technical planning, systems engineering, and test support. CGI Federal also provides Subject Matter Experts (SMEs) as members of AN/SQQ-89 Surface Ship Undersea Warfare (USW) Combat System Advanced Capability Build (ACB) technical Peer Review Working Groups and Integrated Product Teams (IPTs) in support of designing and refining candidate technologies for inclusion into ACB deliveries.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	566.242	44.640		51.151		55.418		-		55.418	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
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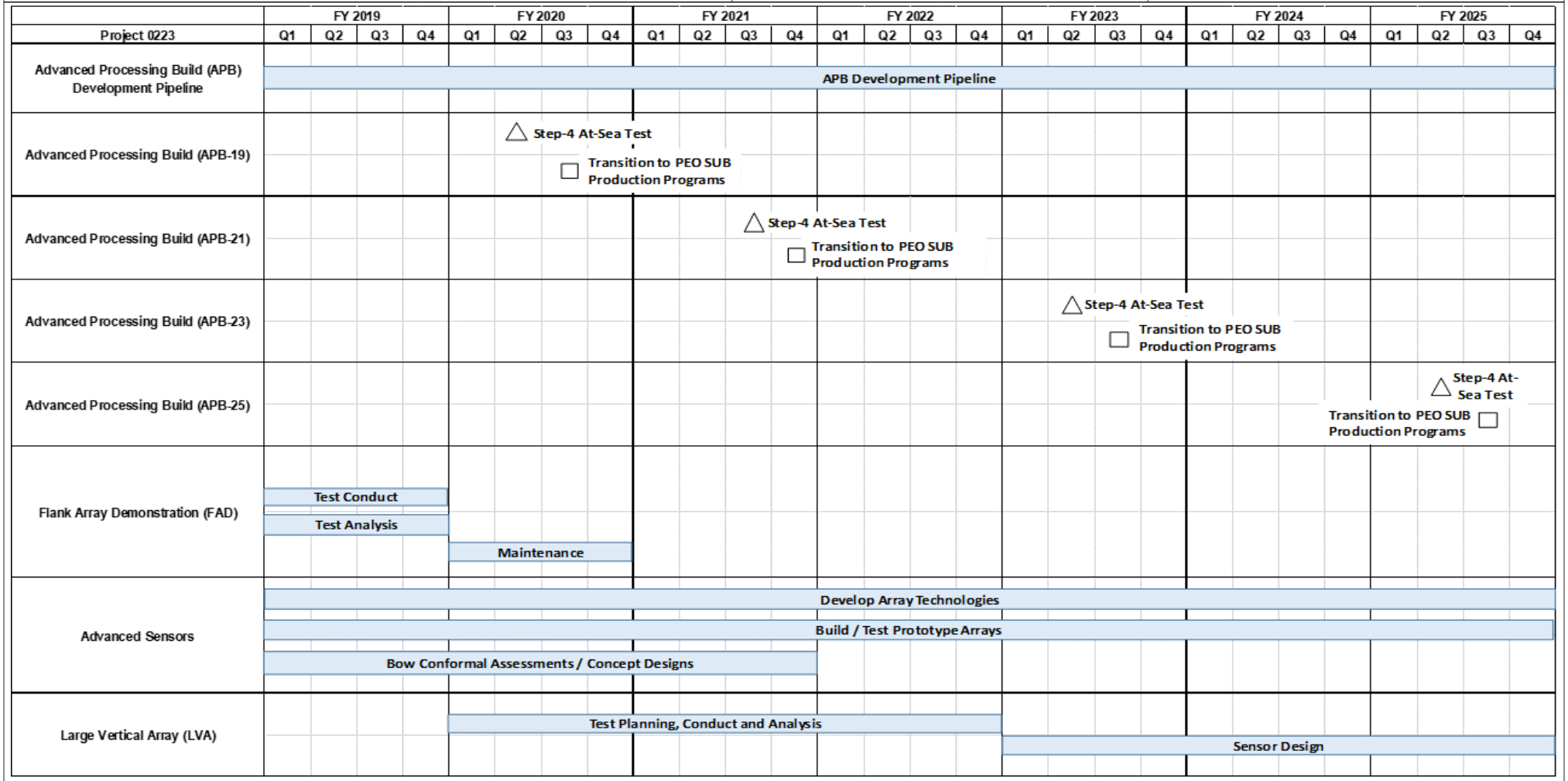

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0223				
Advanced Processing Build (APB): APB Development Pipeline	1	2019	4	2025
APB-19: At-Sea Test	2	2020	2	2020
APB-19: Transition to PEO SUB Production Programs	3	2020	3	2020
APB-21: At-Sea Test	3	2021	3	2021
APB-21: Transition to PEO SUB Production Programs	4	2021	4	2021
APB-23: At-Sea Test	2	2023	2	2023
APB-23: Transition to PEO SUB Production Programs	3	2023	3	2023
APB-25: At-Sea Test	2	2025	2	2025
APB-25: Transition to PEO SUB Production Programs	3	2025	3	2025
Flank Array Demonstration (FAD): Test Conduct	1	2019	4	2019
Flank Array Demonstration (FAD): Test Analysis	1	2019	4	2019
Flank Array Demonstration (FAD): Maintenance	1	2020	4	2020
Advanced Sensors: Develop Array Technologies	1	2019	4	2025
Advanced Sensors: Build / Test Prototype Arrays	1	2019	4	2025
Advanced Sensors: Bow Conformal Assessments / Concept Designs	1	2019	4	2021
Large Vertical Array (LVA): Test Planning, Conduct and Analysis	1	2020	4	2022
Large Vertical Array (LVA): Sensor Design	1	2023	4	2025

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COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2033: *Adv Submarine Systems Development*	533.664	29.894	34.282	33.580	-	33.580	27.291	23.389	23.851	24.331	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, lowering the technical/cost risks of integrating new technologies prior to acquisition, and speeding the delivery of capability and lethality into 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 R&D infrastructure assets that are critical to the long-term design, assessment and construction of modern, stealthy submarine platforms.

Project 2033 is comprised of three 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 submarine R&D assets that enable the design and manufacture of the stealthiest submarines in the world, without the requirement to develop and test at full scale, which is inordinately expensive and risky. Long-range R&D investment is the maturation and prototyping at full scale of long-range (5-10 years) technologies, to enable their readiness for incorporation into existing and future submarines. The objective is to achieve high technology readiness (TRL-7) of the targeted technology so that it can be incorporated into the baseline submarine design during the detailed design contract award. 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/ 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 Allies such as the United Kingdom and Australia, as well as other international partners, which target core technology maturation, future submarine component concept designs, etc.
Major technology developmental efforts within this budget submission include:

Strategic Capability R&D Infrastructure (at ARD Bayview, ID)

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- Large Scale Vehicle (LSV)
- Intermediate Scale Measurement System (ISMS)
- Large Scale Vehicle Recapitalization

Long Range R&D
- Advanced Hull Treatments
- Next Generation Thrust (future propulsor/shafting technologies)
- Advanced Material Propeller
- Advanced SSN Technologies
- Precision Submarine Maneuvering and Control
- Advanced Signature Management

Rapid Technology Development
- Innovative Technology Transfer

Overall, FY21 funding level reflects a minor decrease in overall budget from FY20. Funding within the Strategic Capability Infrastructure pillar decreased slightly due to the planned funding ramp for the LSV Electric Drive recapitalization project, while funding within the Long Range R&D pillar increased proportionally based upon planned project ramp ups. Noteworthy programmatic budget changes in this year's budget exhibits include: (1) LSV-2 Electric Drive recapitalization completes component level build and test, and begins system level integration and testing; (2)
Advanced Hull Treatments completes a prototype installation aboard a VA class and commences the installation process for follow-on VA class demonstration; (3) Next Generation Thrust conducts a large scale demonstration of a multi-material, Integrated Shaft and Propulsor on LSV-2 and continues modeling and analysis in support of Next Generation Propulsor design development; (4) Advanced Material Propeller project conducts a full-scale sea trial aboard an international partner submarine, followed by a data analysis phase; (5) Investments continue on studies, small-scale analysis and technology maturation efforts in support of Advanced SSN Technology development/maturation; (6) The Precision Submarine Maneuvering and Control (PSMC) project continues Concept Development /Refinement phase to identify technologies to improve submarine low speed maneuvering in support of emerging missions/payloads; (7) Advanced Signature Management project will remain in ASSD (2033) for continuity of technology development.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Strategic Capability R&D Infrastructure	17.164	22.796	21.269	0.000	21.269
Articles:	-	-	-	-	-
Description: Sustains Navy R&D capability for continued operations of the Large Scale Vehicle and Intermediate Scale Measurement System (ISMS) test facility 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					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
validation provided by the model experiments has provided significant cost and schedule savings by allowing prototyping at scale, vice with first-of-hull assets. ***FY 2020 Plans:*** LSV: Support advanced acoustic array hardware and systems maintenance. Replace LSV-2 propulsion battery. Conduct LSV-2 core ship systems maintenance, maintain crew qualification, ensure compliance with all LSVSAFE and general regulations, maintain and operate acoustic data systems and all required shore support systems. Support ship and system alterations to safely conduct COLUMBIA signature and propulsor trials. Complete critical COLUMBIA propulsor R&D trials. Finish design and testing and begin selected procurements of hardware for LSV-2 electric drive replacement. Begin LSV-2 recapitalization process: Initiate procurements for shipset of modernized electric drive module components (inverters and converters). Complete system design for Electronic Drive Control Electronics (EDCE) tech refresh and conduct supporting procurement and manufacturing. Conduct component design and initiate procurement for electric drive shaft bearing, flex coupling, and slip ring data transmission system tech refresh. Continue planning for systems integration and testing. Develop new LSV 2 propulsion battery system, using COTs architecture. Conduct system design, testing, and long lead time material procurement. ISMS: Continue ongoing system refurbishment and replacement on ISMS. Operate and maintain ISMS acoustic test range underwater and shore-based facilities. Continue support of structural acoustics, target strength and radiated noise measurements in support of COLUMBIA, ONR, and other fleet needs. Begin refurbishment of Experimental Support Platform (ESP) Barge. ***FY 2021 Base Plans:*** LSV: Support advanced acoustic array hardware and systems maintenance, conduct LSV-2 core ship systems maintenance, maintain crew qualification, ensure compliance with all LSVSAFE and general regulations, maintain and operate acoustic data systems and all required shore support systems. Conduct triannual LSV Independent Assessment audit.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Support ship and system alterations to safely conduct composite shaft trials. Continue LSV-2 recapitalization process: Complete first-article testing of drive components and continue procurements for shipset (inverters and converters). Complete system design for Electronic Drive Control Electronics (EDCE) tech refresh, complete and approve software updates, assemble system and prepare for testing. Define and design shaft, bearing, and data transmission upgrades. Complete propulsion battery system, assembly, testing and installation. 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 PMS 397, ONR, and other fleet needs. Complete refurbishment of Experimental Support Platform (ESP) Barge restoring capability to ISMS range for full maintenance, repair, and test support. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The overall decrease from FY20 to FY21 is the result of planned LSV2 Recapitalization funding phasing. LSV2 Recapitalization is a discrete project within Strategic Capability Infrastructure and will phase out upon completion, leaving the Strategic Capability Infrastructure budget in its typical long-term range.					
Title: Long Range R&D	8.144	11.214	11.950	0.000	11.950
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 enhanced 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 VA and COLUMBIA Class platforms, as well as future submarine classes. The budget line continues to develop technologies for					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
alternative propulsion/propulsor designs to enhance submarine performance, maneuverability and stealth while reducing submarine acquisition costs. Lastly, this long-range R&D 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 2020 Plans:*** ADVANCED HULL TREATMENTS. Support installation and subsequent operational testing of advanced hull treatment on a VA class submarine (VCS Hull A). Complete the industrialization of ONR advanced treatment and perform testing necessary to increase TRL. Complete OPALT package and install a small ONR advanced treatment test patch on a VA class submarine (VCS Hull B) to proof installation procedures and test adhesiveness and durability of the treatment material. Complete OPALT package and order material for a larger ONR advanced treatment patch installation on a VA Class submarine (VCS Hull C) that will be sized to allow performance testing. ADVANCED SIGNATURE MANAGEMENT (ASM): ASM Prototype: Continue FY19 system and concept development work on ASM demonstrator. Demonstrate the interoperability / compatibility of existing SM systems. Complete shore based modeling and system testing of prototype system and initiate formal Technical Data Package development for TEMPALT. Project Arrangements: Continue shore-based testing/modeling and collaborative planning for deferred Partner measurement trials. NEXT GENERATION THRUST. Further develop most promising NGT concepts and continue design tool improvement initiatives. Complete fatigue validation and final assembly of composite shaft assembly for LSV-2 demonstration in FY21. AMP. Instrument and install full-scale AMP propeller on partner submarine in preparation for at-sea trial/data collection.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
ADVANCED SSN TECHNOLOGIES. Continue assessment of new technologies for future submarines in support of the Tactical Submarine Evolution Plan (TSEP) and conduct studies to assess potential impacts on platform capability. Identify enabling technologies and platform integration barriers. Initiate development on critical, long-lead technologies/materials. PRECISION SUBMARINE MANEUVERING AND CONTROL (PSMC). Continue development of PSMC concepts and evaluations of supporting technology requirements. Initiate concept designs. Conduct initial modeling predictions in support of performance characterization, and follow-up model updates. Incorporate insights from advanced Submarine Control project and associated water-born barge demo conducted in FY19.					
FY 2021 Base Plans: ADVANCED HULL TREATMENT. Conduct assessment of installation procedures, adhesion and durability following sea trial on VCS Hull B. Install two large ONR advanced hull treatment patches (one on each side) of a VA class submarine (VCS Hull C) undergoing an availability in Portsmouth Naval Shipyard. ADVANCED SIGNATURE MANAGEMENT (ASM): ASM Prototype: Develop initial ASM Concept of Operation (CONOP)/procedural guidance. Complete development and review of Technical Data Package Development for ASM TEMPALT in support of FY22 at-sea system demonstration. Project Arrangements: Continue data analysis on shore-based testing/modeling results. Continue collaborative planning for deferred Partner UEM Measurement Trials in FY22. NEXT GENERATION THRUST. Conduct initial demonstration of Integrated Shafting and Propulsor (IS&P) assembly on LSV-2. Initiate follow-up "Generation 2" IS&P design of composite shaft concept. Begin concept design for a full-scale (SSN) demo of an IS&P assembly. Continue development of most promising NGT concepts and continue tool design improvement initiatives in support of New SSN propulsion technology development. AMP. Conduct Sea Trial. Conduct follow-on destructive testing and analysis of full-scale propeller data per follow-on Project Arrangement. ADVANCED SSN TECHNOLOGIES. Continue assessment of new technologies for future submarines in support of the Tactical Submarine Evolution Plan (TSEP) and continue studies to assess potential impacts on platform					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
capability. Continue studies on enabling technologies and platform integration barriers. Continue development on critical, long-lead technologies/materials. PRECISION SUBMARINE MANEUVERING AND CONTROL Conduct refinement of PSMC concepts, and complete evaluations of supporting technology requirements. Initiate component design and initial testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increases in the Long Term R&D budget are due to project investments for next-generation thrust/propulsor and advanced submarine technology work.					
Title: Rapid Technology Development	4.586	0.272	0.361	0.000	0.361
Articles:	-	-	-	-	-
Description: Conducts Navy and joint demonstrations of advanced technologies and payloads to assess the operational value of the technologies/systems under consideration, and speed transition of operational capabilities. Objective is to develop, demonstrate, and evaluate technology projects in an 18-30 month period, transitioning successful, high-interest / high-impact systems to the acquisition community and subsequently the fleet. ***FY 2020 Plans:*** INNOVATIVE TECHNOLOGY TRANSITION. Continued to leverage products and analysis from Small Business (SBIR/STTR), Independent Research and Development (IR&D), and Foreign Comparative Testing efforts to identify/ develop innovative submarine and USW technology transition project candidates. FY20 planned projects include Shaft Laser Peening (Corrosion Control), and Composite Canister System (Payload flexibility), Towed Array Signal Path Improvement. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Modest increase in the Rapid Technology Development RDT&E budget are due to increased investment in Towed Array Signal Path Improvement.					
Accomplishments/Planned Programs Subtotals	29.894	34.282	33.580	0.000	33.580

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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 initiation as new POR capabilities. Concept Formulation (CONFORM) contracts with the only two submarine design/construction shipyards, General Dynamics Electric Boat (GDEB) and Huntington Ingalls Industries (HII) Newport News Shipbuilding facilitate this process. Use of topic-specific Broad Agency Announcement (BAA) solicitations to advance submarine advanced technology work. Engagement with industry to build vendor base and support development of R&D products for enhanced submarine capability via competitively awarded Small Business Innovation Research (SBIR) and Broad Agency Agreement (BAA) contracts to support advanced Hull Mechanical & Electrical (HM&E) technology and payload systems. For the period from FY 18- FY 20,SUB073 is utilizing three separate Determination and Findings (D&F's); one with Sandia National Labs to design, build, integrate, and test Battery Casualty Detection Systems (BCDS), a second with Oak Ridge National Laboratory (ORNL) to explore advanced transition technologies; and additive manufacturing techniques relevant to submarine applications for the Navy; and a third with Oakridge National Laboratory (ORNL) Y12 to explore advanced manufacturing and metallurgies for submarine propulsors.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
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*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	C/FFP	DRS Technologies : Milwaukee, WI	0.000	1.000	Apr 2019	6.873	Mar 2020	6.870	Feb 2021	-		6.870	0.000	14.743	-
Product Development	C/FFP	Moog : East Aurora, NY	0.900	0.400	Aug 2019	0.000		0.000		-		0.000	0.000	1.300	-
Product Development	C/CPFF	Seeman's Composite, : Gulfport, MS	0.000	0.200	Sep 2019	0.000		0.000		-		0.000	0.000	0.200	-
Product Development	WR	NSWC Crane : Crane, IN	0.440	0.200	Nov 2019	0.000		0.000		-		0.000	0.000	0.640	-
Product Development	C/CPFF	Rolls Royce Marine : Walpole, MA	0.000	0.100	Sep 2019	0.100	Jun 2020	0.102	Jun 2021	-		0.102	0.000	0.302	-
Product Development	WR	NSWC PHILLY : Philly, PA	0.165	0.275	Nov 2019	0.275	Nov 2019	0.281	Nov 2020	-		0.281	Continuing	Continuing	Continuing
Product Development	WR	NRL : Washington, DC	2.707	0.300	Nov 2019	0.000		0.000		-		0.000	0.000	3.007	-
Product Development	SS/CPFF	SupShips : Groton, CT	2.958	0.000		0.000		0.000		-		0.000	0.000	2.958	-
Product Development	SS/CPFF	HII : Newport News, VA	17.064	3.000	Apr 2019	3.150	Apr 2020	1.976	Apr 2021	-		1.976	Continuing	Continuing	Continuing
Product Development	SS/CPFF	EB : Groton, CT	77.686	2.387	Apr 2019	4.605	Apr 2020	5.281	Apr 2021	-		5.281	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Carderock, MD	99.743	2.730	Apr 2019	3.185	Apr 2020	3.221	Apr 2021	-		3.221	Continuing	Continuing	Continuing
Product Development	SS/CPFF	ARL/PSU : State College, PA	9.968	0.585	Apr 2019	0.597	Apr 2020	0.609	Apr 2021	-		0.609	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JHU/APL : Laurel, MD	24.421	0.250	Apr 2019	0.250	Apr 2020	0.255	Apr 2021	-		0.255	Continuing	Continuing	Continuing
Product Development	Various	Various : Various	36.500	0.296	Apr 2019	0.202	Apr 2020	0.296	Apr 2021	-		0.296	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Newport, RI	78.978	1.830	Mar 2019	0.550	Mar 2020	1.020	Mar 2021	-		1.020	Continuing	Continuing	Continuing
Product Development	WR	ONR : Arlington, VA	10.224	0.000		1.700	May 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/CPFF	Progeny : Manassas VA	0.695	0.000	May 2019	0.000		0.000		-		0.000	0.000	0.695	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
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*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	MIPR	Oakridge Lab : Oakridge, TN	0.000	0.000		0.550	Apr 2020	0.000		-		0.000	0.000	0.550	-
		Subtotal	362.449	13.553		22.037		19.911		-		19.911	Continuing	Continuing	N/A

Remarks

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

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	SS/CPFF	Various : Various	16.296	1.350	Mar 2019	1.000	Mar 2020	1.020	Mar 2021	-		1.020	Continuing	Continuing	Continuing
Government Engineering Support	WR	Various : Various	7.570	0.364	Mar 2019	0.371	Mar 2020	0.379	Mar 2021	-		0.379	Continuing	Continuing	Continuing
Travel	WR	NAVSEA HQ : Not Specified	1.205	0.104	Mar 2019	0.106	Mar 2020	0.108	Mar 2021	-		0.108	Continuing	Continuing	Continuing
Acquisition Workforce	Various	Not Specified : Not Specified	0.293	0.000	Nov 2018	0.000		0.000		-		0.000	0.000	0.293	0.293
		Subtotal	25.364	1.818		1.477		1.507		-		1.507	Continuing	Continuing	N/A

Remarks

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

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	C/CPFF	GDIT : Bayview, ID	1.600	1.600	May 2019	1.000	Mar 2020	2.000	Nov 2020	-		2.000	0.000	6.200	-
Developmental Test & Evaluation	SS/CPFF	EB : Groton, CT	25.308	5.820	May 2019	4.066	May 2020	4.724	May 2021	-		4.724	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
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*	

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWC/PHILLY : PHILLY, PA	9.344	0.240	Dec 2018	0.240	Dec 2019	0.245	Dec 2020	-		0.245	0.000	10.069	9.104
Developmental Test & Evaluation	Various	Various : Various	8.732	0.675	Apr 2019	0.689	Apr 2020	0.703	Apr 2021	-		0.703	0.000	10.799	6.372
Developmental Test & Evaluation	WR	NUWC : Newport, RI	31.165	1.050	Apr 2019	0.500	Apr 2020	0.510	Apr 2021	-		0.510	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NSWC : Carderock, MD	55.258	5.138	Apr 2019	4.273	Apr 2020	3.980	Apr 2021	-		3.980	Continuing	Continuing	Continuing
Developmental Test & Evaluation	SS/CPFF	HII : Newport News, VA	5.794	0.000	Oct 2018	0.000	Apr 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Developmental Test & Evaluation	SS/CPFF	JHU/ARL : Laurel, MD	7.805	0.000	Apr 2019	0.000		0.000		-		0.000	0.000	7.805	0.305
Developmental Test & Evaluation	SS/CPFF	ARL/PSU : State College, PA	0.845	0.000	Oct 2018	0.000		0.000		-		0.000	0.000	0.845	0.720
		Subtotal	145.851	14.523		10.768		12.162		-		12.162	Continuing	Continuing	N/A

Remarks

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

GDIT contract supports engineering services/technical support of LSV, ISMS, and associated infrastructure at Acoustic Research Detachment Bayview Idaho. Increase in value due to LSV recapitalization.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	533.664	29.894		34.282		33.580		-		33.580	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
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*

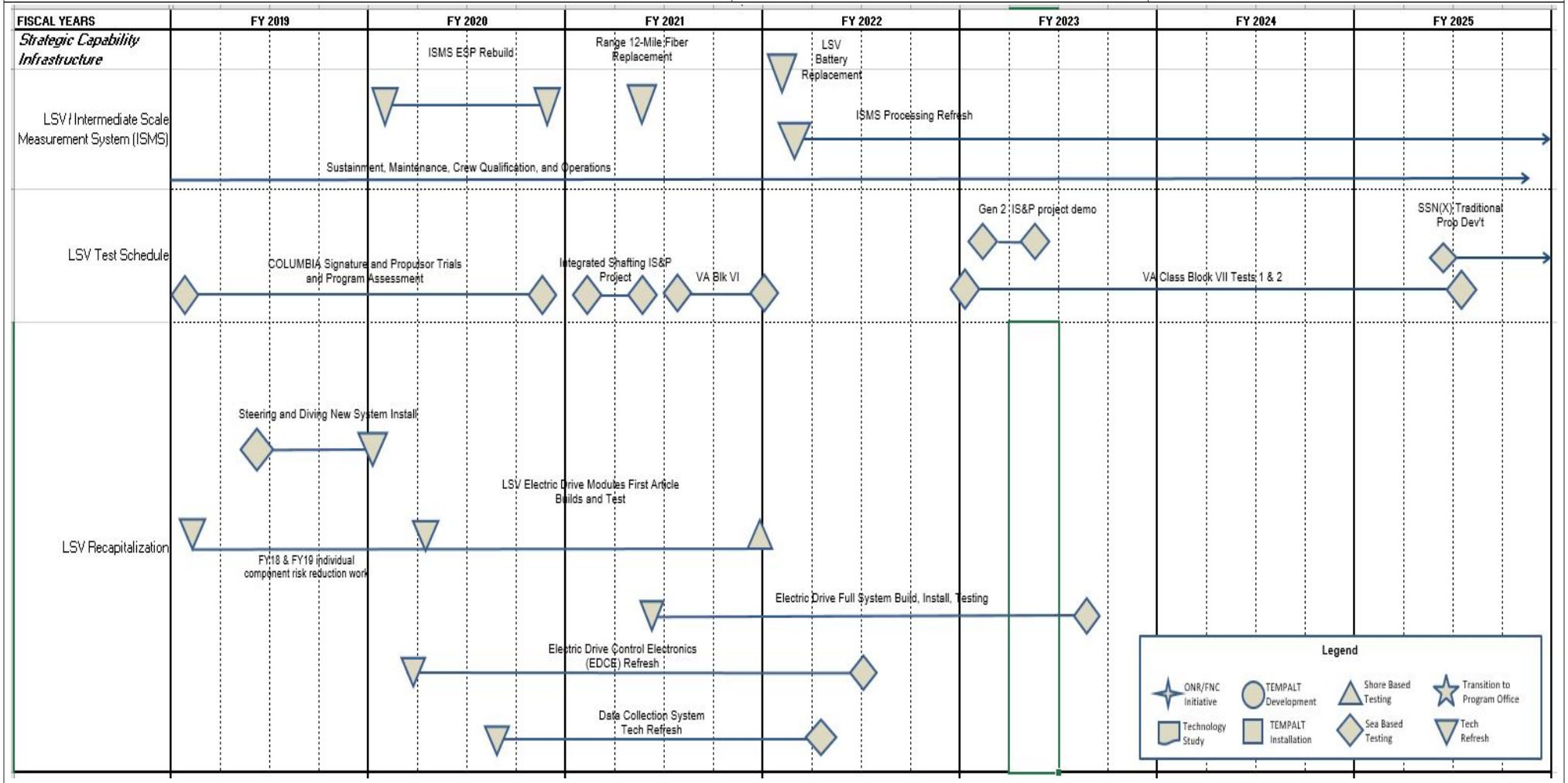

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

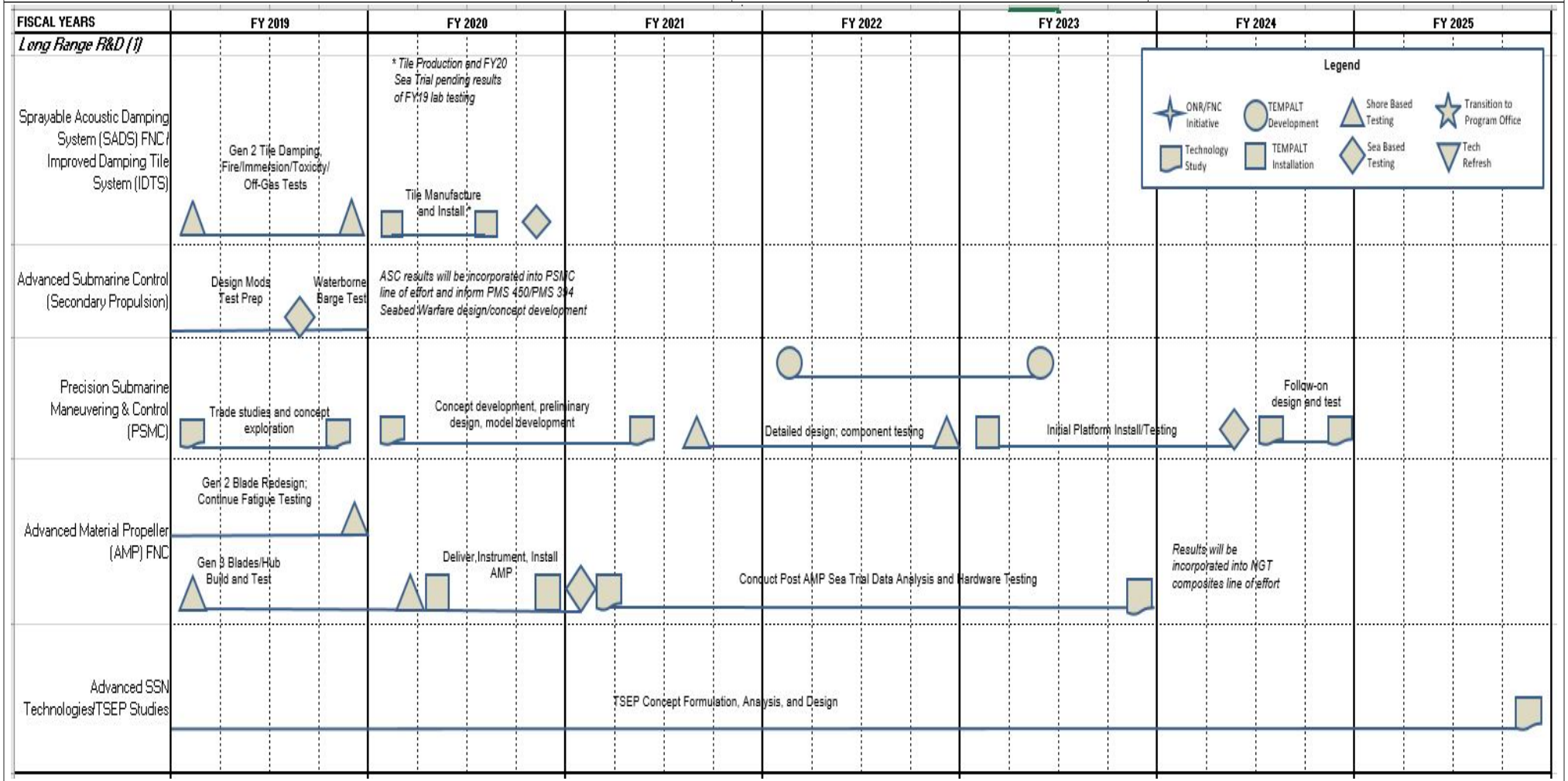

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

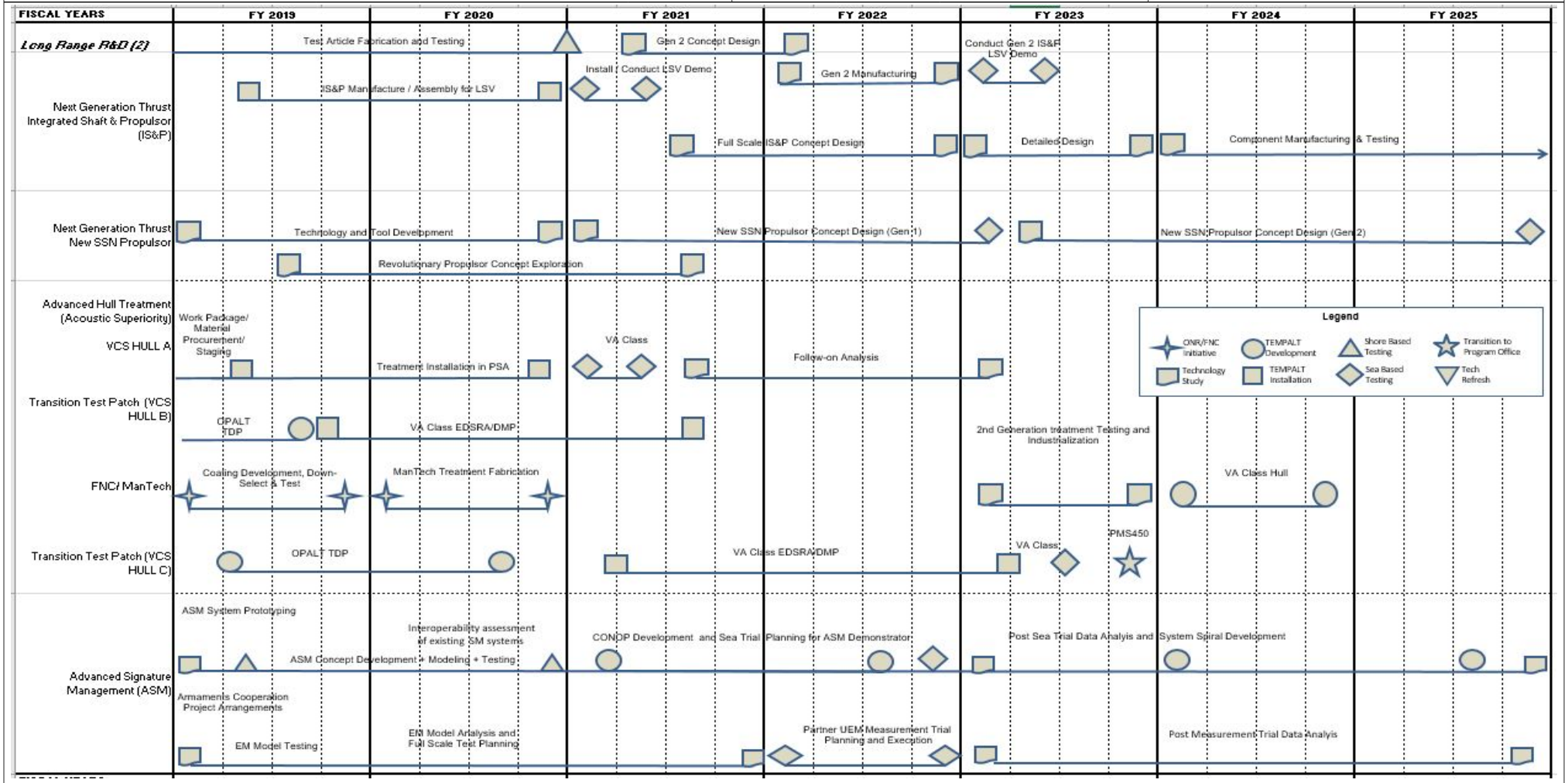

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

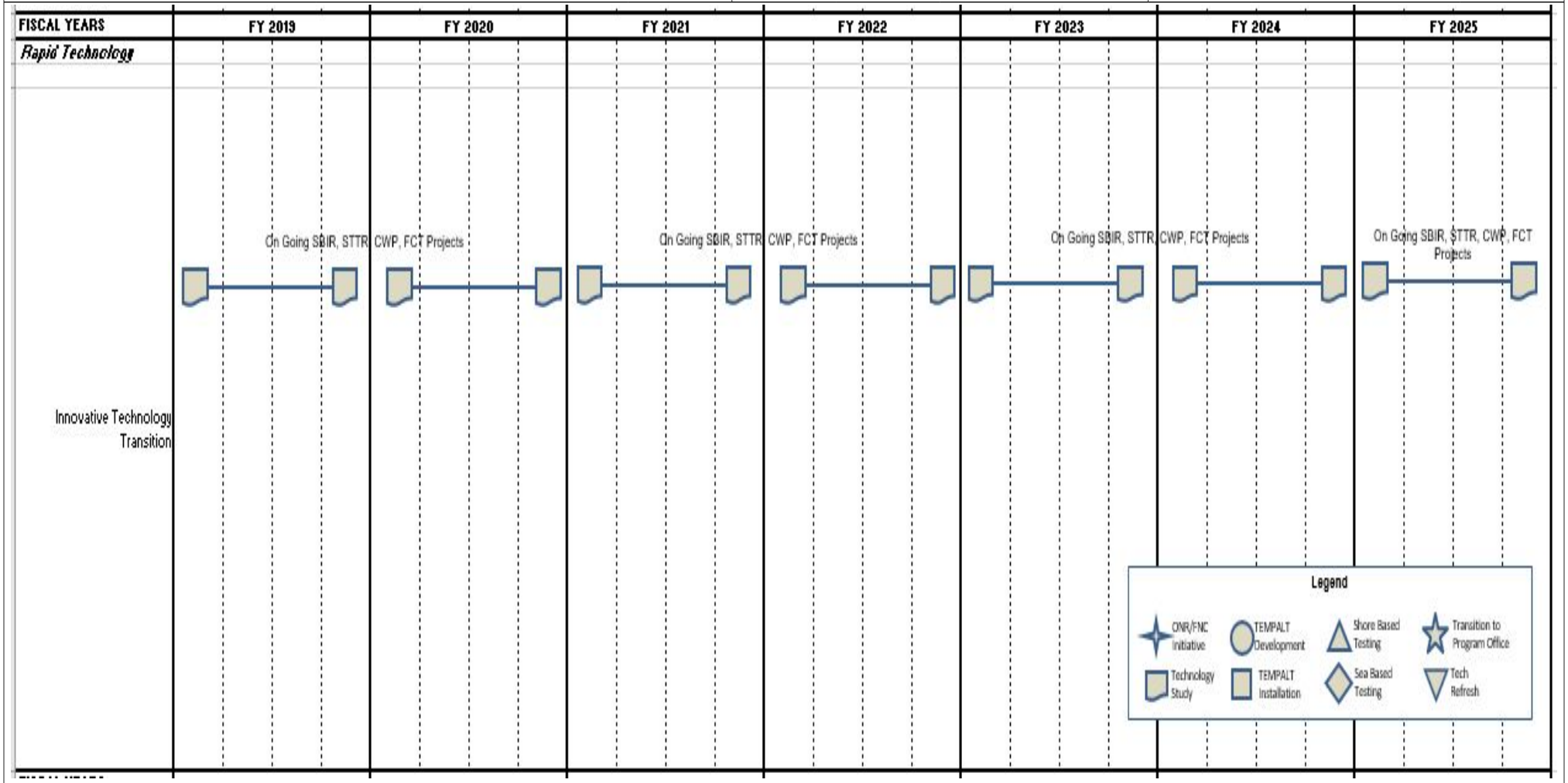

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2033				
Strategic Capability Infrastructure: ISMS/LSV - ISMS ESP Rebuild	1	2020	4	2020
Strategic Capability Infrastructure: ISMS/LSV - Range fiberoptic replacement	2	2021	2	2021
Strategic Capability Infrastructure: ISMS/LSV - ISMS Tech Refresh	1	2022	4	2025
Strategic Capability Infrastructure: ISMS /LSV - Sustainment, Maintenance,Crew Qualification and Operations	1	2019	4	2025
Strategic Capability Infrastructure: ISMS /LSV - Battery Replacement	1	2022	1	2022
Strategic Capability Infrastructure: LSV Test Schedule - COLUMBIA Signature and Propulsor Trials and Program Assessment	1	2019	4	2020
Strategic Capability Infrastructure: LSV Test Schedule - Integrated Shafting	1	2021	2	2021
Strategic Capability Infrastructure: LSV Test Schedule - VA Block VI	3	2021	4	2021
Strategic Capability Infrastructure: LSV Test Schedule - VA Block VII Test 1 & 2	1	2023	3	2025
Strategic Capability Infrastructure: LSV Test Schedule - Gen 2 IS&P Project Demo	1	2023	2	2023
Strategic Capability Infrastructure: LSV Test Schedule - LSV Steering and Diving Replacement	2	2019	1	2020
Strategic Capability Infrastructure: LSV Test Schedule - SSN(X) Traditional Prop Dev	2	2025	4	2025
Strategic Capability Infrastructure: LSV Recapitalization - Individual Component Risk Reduction work	1	2019	2	2020
Strategic Capability Infrastructure: LSV Recapitalization - Electric Drive Modules First Article Builds and Test	2	2020	1	2022
Strategic Capability Infrastructure: LSV Recapitalization - Electric Drive Full System Build,Install,Testing	2	2021	3	2023
Strategic Capability Infrastructure: LSV Recapitalization - Electronic Drive Control Electronics (EDCE) Refresh	2	2020	3	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Strategic Capability Infrastructure: LSV Recapitalization - Data Collection System Refresh	3	2020	2	2022
Long Range R&D: SADS/IDTS - Gen 2 Tile Damping, Fire/Immersion/Toxicity/off-gas tests	1	2019	4	2019
Long Range R&D: SADS/IDTS -Tile Manufacture and Install	1	2020	3	2020
Long Range R&D: Advanced Submarine Control - (ASC) - Conduct in-water barge test and operational pressure test	1	2019	3	2019
Long Range R&D: Advanced Submarine Control - (ASC) - Complete analysis of pump-jet barge test and technical assessment of direct drive motor design.	3	2019	4	2019
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - Conduct Trade Studies and Concept Exploration	1	2019	4	2019
Long Range R&D: Precision Submarine Maneuvering and Control - Conduct concept development,	1	2020	2	2021
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - Conduct component detailed design and testing.	3	2021	4	2022
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - TEMPALT Dev	1	2022	2	2023
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - Conduct Initial Platform Introductions and testing	1	2023	2	2024
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - Follow-on Design and Test	3	2024	4	2024
Long Range R&D: Advanced Material Propeller (AMP) - Redesign manufacture and fatigue test Mod Gen 2 blade	1	2019	4	2019
Long Range R&D: Advanced Material Propeller (AMP) - Manufacture and test Gen 3 blades and hub	1	2019	2	2020
Long Range R&D: Advanced Material Propeller (AMP) - Deliver instrument and install AMP propeller	2	2020	4	2020
Long Range R&D: Advanced Material Propeller (AMP) - At-sea test on partner submarine	1	2021	1	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Long Range R&D: Advanced Material Propeller (AMP) - Post-sea trial data analysis and hardware testing	1	2021	4	2023
Long Range R&D: SSN(X) - Advanced SSN Technologies/TSEP Studies - TSEP concept formulation, analysis, and design	1	2019	4	2025
Long Range R&D: Next Generation Thrust (NGT) -Test Article fabrication and testing	1	2019	4	2020
Long Range R&D: Next Generation Thrust (NGT) - New SSN Propulsor Concept Design (GEN 2)	2	2021	1	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - IS&P Maufacture/Assembly for LSV	2	2019	4	2020
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor I(S&P) - Install/Conduct LSV Demo	1	2023	2	2023
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Gen 2 Manufacturing	1	2022	4	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Conduct Gen 2 IS&P LSV Demo	1	2023	2	2023
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Full Scale IS&P Concept Design	3	2021	4	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Detailed Design	1	2023	4	2023
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Component Manufacturing & Testing	1	2024	4	2025
Long Range R&D: Next Generation Thrust New SSN Propulsor - Technology and Tool Dev	1	2019	4	2020
Long Range R&D: Next Generation Thrust New SSN Propulsor - New SSN Propulsor Concept Design (Gen 1)	3	2021	4	2022
Long Range R&D: Next Generation Thrust New SSN Propulsor - New SSN Propulsor Concept Design (Gen 2)	1	2023	4	2025
Long Range R&D: Next Generation Thrust New SSN Propulsor - Revolutionary Propolsor Concept Exploration	3	2019	3	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Long Range R&D: Advanced Hull Treatments - Develop VCS Hull A OPALT work package, conduct advanced procurement and material staging.	2	2019	2	2019
Long Range R&D: Advanced Hull Treatments - Treatment Installation and PSA	1	2019	4	2020
Long Range R&D: Advanced Hull Treatments VA Class	1	2021	2	2021
Long Range R&D: Advanced Hull Treatments - Follow-on Analysis	3	2021	1	2023
Long Range R&D: Transition Test Patch (VCS HULL B) - OPALT TPD	1	2019	3	2019
Long Range R&D: Transition Test Patch (VCS HULL B) - VA Class EDSRA/DMP	4	2019	3	2021
Long Range R&D: FNC/ManTech - Coating Dev, Down Select - Test	1	2019	4	2019
Long Range R&D: FNC/ManTech - ManTech Treatment Fabrication	1	2020	4	2020
Long Range R&D: FNC/ManTech - 2nd Gen Treatment Testing and Industrialization	1	2023	4	2023
Long Range R&D: FNC/ManTech - VA Class Hull	1	2024	4	2024
Long Range R&D: Transition Test Patch (VCS HULL C) -OPALT TDP	2	2019	3	2020
Long Range R&D: Transition Test Patch (VCS HULL C) - VA Class EDSRA/DMP	2	2021	1	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 -Concept Development, Modeling and Test Analysis	1	2019	4	2020
Long Range R&D: Advanced Signature Management - CONOP Dev and Sea Trial Planning for Demo	1	2021	3	2022
Long Range R&D: Advanced Signature Management - At Sea Test	4	2022	4	2022
Long Range R&D: Advanced Signature Management - Post Sea Trials Data Analysis and System Spiral Dev	1	2023	4	2025
Long Range R&D: Advanced Signature Management - EM Model Testing/Analysis and Full Scale Test Planning	1	2019	1	2020
Long Range R&D: Advanced Signature Management - Partner UEM Measurement Trial, Planning/Execution	1	2022	4	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Long Range R&D: Advanced Signature Management - Post Measurement Trial Data Analysis	1	2023	4	2025
Rapid Technology Development: Innovative Technology Transition - Conduct assessment of technology initiatives, SBIR transition work, STTR, CWP, Foreign Comparative Tests	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
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COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2096: *Payload Delivery Development*	8.538	10.969	10.801	17.975	-	17.975	12.362	13.636	10.289	10.495	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

FY 2021 funding profile is increased to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of PHS in the VIRGINIA Class Block VI Technical Baseline.

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. 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 immediate solutions to urgent war-fighter needs. Experimentation will be conducted with the Fleet (i.e., Commander, Naval Submarine Forces (COMSUBFOR), Unmanned Undersea Vehicle Squadron One (UUVRON ONE), etc.), 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.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Payload Handling System (PHS)	10.969	10.801	17.975	0.000	17.975
Articles:	-	-	-	-	-
Description: PHS includes the development, integration and demonstration of a single prototype "middle-ware" handling system used to deploy and retrieve large undersea vehicles, payloads, and offboard systems from submarines. Funding will be used to design, manufacture, and field a prototype to facilitate the raising, lowering and articulation of payloads into and out of submarine large ocean interfaces (e.g. missile tubes) to increase war fighting capabilities. PHS will initially be integrated and demonstrated on an SSGN platform to foster and					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
assess early technology (vertical stowage, launch and recovery capability) integration and operational concept/ employment. Subsequently, PHS includes efforts to transfer the technology and final design to industry for future multi-unit procurement and application on future VIRGINIA Class and other submarines. Payloads currently planned for vertical launch, recovery, and stowage include the U.S. Navy's Family of Unmanned Systems up to large size (e.g. SNAKEHEAD) and future block of Shallow Water Combat Submersibles (SWCS) to support Special Operations Forces (SOF) capabilities. The modularity of hosting these payloads within a tube loaded canister allows for the PHS and/or payload(s) to be swapped out with other payloads (e.g. missiles) while forward deployed dependent upon mission tasking of the submarine. Long lead- time material purchases begin in FY20 and continue into FY21. Planned FY20 efforts include continued detailed analysis and design for subsystem elements, interface control documentation, drawings. Planned FY21 efforts include beginning PHS prototype system manufacturing, commencing test planning development and completion of detailed analysis. ***FY 2020 Plans:*** Continue NRE to conduct Final Design Review (FDR), continue detail design efforts and commence SSGN Temporary Alteration (TEMPALT) package development, execute material purchases. Prototype system manufacturing commences. - Continue the following detailed design efforts: * Refining System Arrangements, Structural and Shock Modeling Analyses, and Interface Control Document * Power Distribution Element (PDE) design completion * Hydraulic System Element (HSE) design completion * Control & Monitoring Element (CME) design completion * Payload Handling Element (PHE) design completion * System Schematic and Diagram Development - Continue VIRGINIA Class build-to-print Technical Data Package (TDP) development - Continue Peculiar Support Equipment (PSE) design development					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Commence Long Lead Time and Other Material Sourcing and Purchasing for Hydraulic Actuators (15 to 18 month lead times) - Commence SSGN Temporary Alteration (TEMPALT) package development - Commence contract planning to support Payload Canister manufacturing - Commence contract planning for Single-Stage Hydraulic Actuators - Award contract for Multi-Stage Hydraulic Actuator					
FY 2021 Base Plans: PHS Prototype System manufacturing continues to include payload canister steel fabrication and weldments. PSE fabrication will be completed and commence along with identification of component level testing requirements to support system assembly. - Commence development and submit SSGN TEMPALT package - Commence prototype fabrication - Commence prototype material purchases - Continue VIRGINIA Class build-to-print Technical Data Package (TDP) development - Commence Peculiar Support Equipment (PSE) Design - Commence PSE material purchases - Commence PSE fabrication - Commence Final Design Review (FDR) - Award Payload Canister Manufacturing contract - Award contract for Single- Stage Hydraulic Actuators - Commence Test Plan Development - Continue SSGN Temporary Alteration (TEMPALT) package development - Continue Long Lead Time and other material sourcing and purchasing for miscellaneous components - Conduct Fabrication Readiness Review (FRR)					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY21 funding profile is increased to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of PHS in the VIRGINIA Class Block VI Technical Baseline.					
Accomplishments/Planned Programs Subtotals	10.969	10.801	17.975	0.000	17.975

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Project will transition to VIRGINIA Class as part of the Block VI technical baseline. PHS capability will be included as part of block VI ship deliveries. Block V ships will be backfitted with PHS capability post-delivery starting with SSN-806.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development (1)	WR	NUWC NPT : Newport, RI	0.805	1.166	Oct 2018	1.266	Oct 2019	2.134	Oct 2020	-		2.134	Continuing	Continuing	Continuing
Product Development	WR	NSWC PD : Philadelphia, PA	2.540	4.625	Oct 2018	5.235	Oct 2019	4.408	Oct 2020	-		4.408	Continuing	Continuing	Continuing
Product Development (1)	WR	NUWC KPT : Keyport, WA	2.065	2.742	Oct 2018	2.129	Oct 2019	5.587	Oct 2020	-		5.587	Continuing	Continuing	Continuing
Product Development (1)	WR	PSNS : Bremerton, WA	0.666	1.144	Oct 2018	1.621	Oct 2019	5.449	Oct 2020	-		5.449	Continuing	Continuing	Continuing
Product Development	WR	NSWC CD : West Bethesda, MD	0.439	0.875	Oct 2018	0.045	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	WR	NRL : Washington, DC	0.255	0.000	Oct 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	FFRDC	ARL/PSU : Arlington, VA	0.285	0.000	Oct 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	WR	NSWC DD : Dahlgren, VA	0.026	0.000	Oct 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	C/CPFF	DIUx : Mountain View, CA	0.050	0.000	Nov 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	WR	PNSY : Portsmouth, NH	0.597	0.000	Oct 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	7.728	10.552		10.296		17.578		-		17.578	Continuing	Continuing	N/A

Remarks

(1) Increased funding for Product Development in FY21 is for PHS Prototype System manufacturing.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Allot	NAVSEA HQ : Washington DC	0.087	0.045	Oct 2018	0.046	Oct 2019	0.047	Oct 2020	-		0.047	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Management Services	C/CPAF	NTT Data : McLean, VA	0.723	0.372	Dec 2018	0.459	Dec 2019	0.350	Dec 2020	-		0.350	Continuing	Continuing	Continuing
Need Item Text	C/BA	Not Specified : Not Specified	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	0.810	0.417		0.505		0.397		-		0.397	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	8.538	10.969		10.801		17.975		-		17.975	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

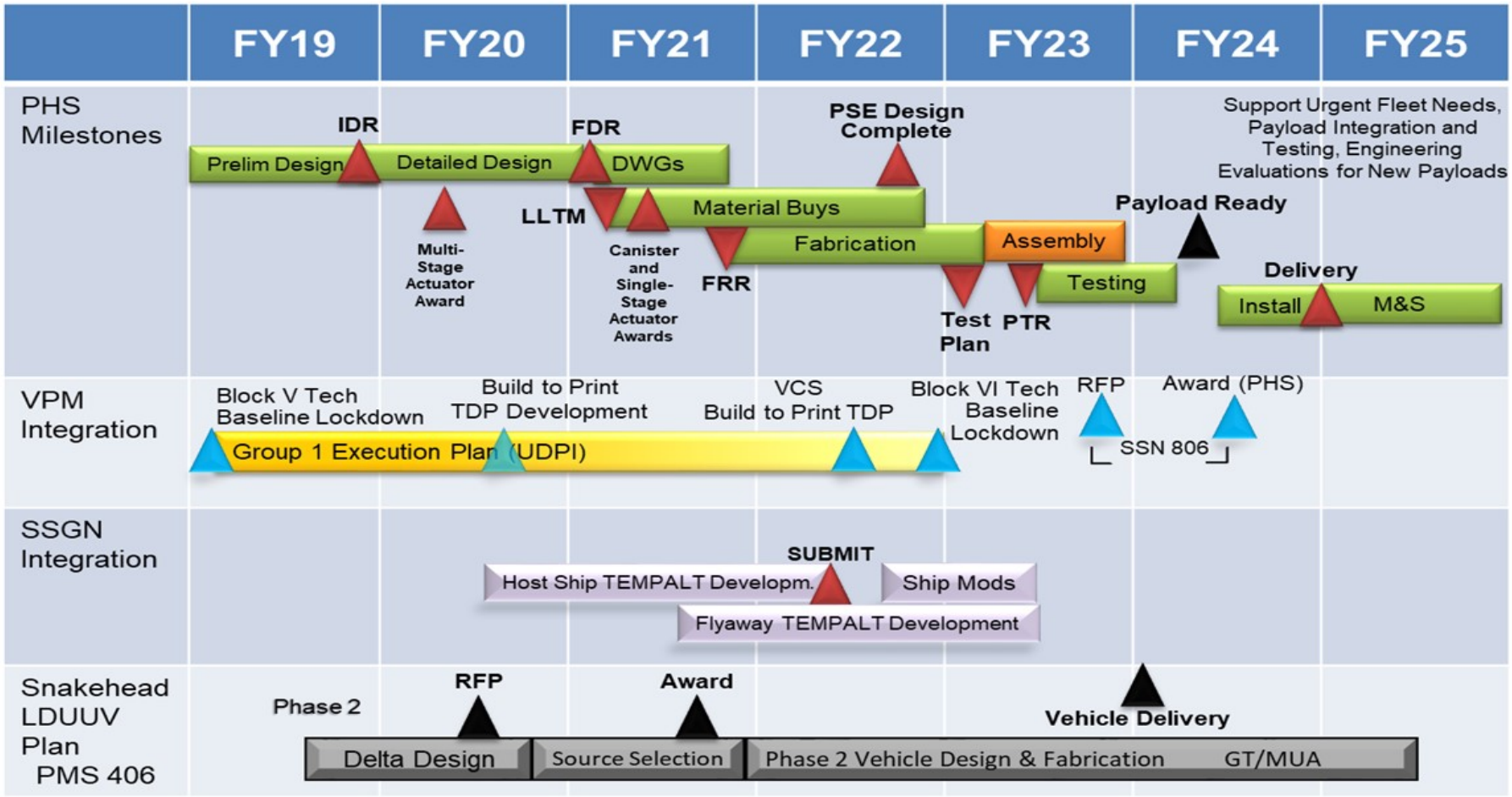

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Payload Handling System (PHS)				
PHS Milestones: Preliminary Design	1	2019	3	2019
PHS Milestones: Initial Design Review	3	2019	3	2019
PHS Milestones: Detailed Design	4	2019	3	2020
PHS Milestones: Final Design Review	1	2021	1	2021
PHS Milestones: Drawing Development (DWG)	1	2021	3	2021
PHS Milestones: PSE Design Complete	3	2022	3	2022
PHS Milestones: Long Lead Time Material Buys	2	2020	1	2022
PHS Milestones: VIRGINIA Class Build to Print TDP Ready	2	2022	2	2022
PHS Milestones: Fabrication Readiness Review	4	2021	4	2021
PHS Milestones: Fabrication	4	2021	1	2023
PHS Milestones: Assembly	2	2023	4	2023
PHS Milestones: Payload Ready	2	2024	2	2024
PHS Milestones: Test Plan	1	2023	1	2023
PHS Milestones: Prototype Test Review	2	2023	2	2023
PHS Milestones: Testing	3	2023	1	2024
PHS Milestones: Install	3	2024	4	2024
PHS Milestones: Delivery	4	2024	4	2024
PHS Milestones: Maintaining Protoype	3	2025	4	2025
VPM Integration: Block V Tech Baseline Lockdown	1	2019	1	2019
VPM Integration: VIRGINIA Class Build to Print TDP Development	2	2020	2	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
VPM Integration: Group 1 Execution Plan Undersea Dominance Payload Integration (UDPI)	1	2019	2	2023
VPM Integration: Block VI Tech Baseline Lockdown	2	2023	2	2023
VPM Integration: RFP - SSN 806	4	2023	4	2023
VPM Integration: PHS Award (PHS) for SSN 806	3	2024	3	2024
SSGN Integration: TEMPALT Development	3	2020	2	2022
SSGN Integration: TEMPALT Submitted	2	2022	2	2022
SSGN Integration: Ship Mods	3	2022	2	2023
Snakehead LDUUV Plan: Phase 2 Delta Design	3	2020	4	2020
Snakehead LDUUV Plan: RFP	1	2021	1	2021
Snakehead LDUUV Plan: Source Selection	1	2021	4	2021
Snakehead LDUUV Plan: Award	4	2022	4	2022
Snakehead LDUUV Plan: Phase 2 Vehicle Design & Fabrication	1	2022	4	2023
Snakehead LDUUV Plan: Vehicle Delivery	4	2024	4	2024
Snakehead LDUUV Plan: GT/MUA	4	2024	1	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
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*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3391: *SSN/SSGN Survivability Program*	8.203	8.116	9.483	11.511	-	11.511	12.008	11.544	12.795	13.051	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 increases in FY20 and FY21 add signature countermeasures to the S3P portfolio allowing S3P to address documented gaps in survivability on current submarines.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: SSN/SSGN Survivability Program	8.116	9.483	11.511	0.000	11.511
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 2020 Plans:

- S3P will continue to address gaps in stealth and survivability for the current SSN/SSGN force to include responding to fleet questions on current tactical vulnerabilities and completion of an annual Operational Survivability Assessment.
- Continue analytical and technical work on TSEP and future SSN/SSGN survivability design basis.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- S3P will conduct acoustic, non-acoustic, and non-traditional ASW vulnerability assessment projects, and will conduct sea tests in stealth requirements and countermeasure concepts. - Complete two tactical decision concept projects for current fleet operations. - S3P will conduct one (1) at-sea test to include foreign partners where available for Advanced Signature Countermeasures development. - Details may be provided in a classified setting. ***FY 2021 Base Plans:*** - S3P will continue to address gaps in stealth and survivability for the current SSN/SSGN force to include responding to fleet questions on current tactical vulnerabilities and completion of an annual Operational Survivability Assessment. - Continue analytical and technical work on TSEP and future SSN/SSGN survivability design basis. - S3P will conduct emerging threat, acoustic, non-acoustic vulnerability assessment projects, and will conduct sea tests in stealth requirements and countermeasure concepts. - Complete two tactical decision concept projects for current fleet operations. - S3P will conduct two (2) at-sea tests to include foreign partners where available for Advanced Signature Countermeasures development. - Details may be provided in a classified setting. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21, S3P top-line resourcing increases to conduct Advanced Signature Management/Countermeasures development.					
Accomplishments/Planned Programs Subtotals	8.116	9.483	11.511	0.000	11.511

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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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.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	MIPR	CNA: : Alex, VA	0.562	0.448	Jan 2019	0.500	Jan 2020	0.700	Jan 2021	-		0.700	Continuing	Continuing	Continuing
Product Development	SS/CPFF	MIT-LL : Cambridge, MA	0.200	0.627	Oct 2018	0.600	Oct 2019	0.750	Oct 2020	-		0.750	Continuing	Continuing	Continuing
Product Development	SS/CPFF	Raytheon : Portmouth, RI	0.429	0.229	Dec 2019	0.450	Sep 2020	0.400	Sep 2021	-		0.400	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JHU/APL : Laurel, MD	2.042	1.737	Jul 2019	1.000	Jul 2020	2.350	Jul 2021	-		2.350	Continuing	Continuing	Continuing
Product Development	SS/CPFF	UT/ARL : Austin, TX	0.367	0.700	Aug 2019	0.800	Aug 2020	0.600	Aug 2021	-		0.600	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Newport, RI	0.900	1.000	Apr 2019	1.000	Apr 2020	1.000	Apr 2021	-		1.000	Continuing	Continuing	Continuing
Product Development	MIPR	NRL : Washington, DC	0.090	0.300	Dec 2018	0.400	Dec 2019	0.750	Dec 2020	-		0.750	Continuing	Continuing	Continuing
Product Development	C/BA	NSMA : Not Specified	0.782	0.900	Dec 2018	0.920	Dec 2019	0.600	Dec 2020	-		0.600	Continuing	Continuing	Continuing
Product Development	SS/CPFF	Sonalysts : Groton, CT	0.050	0.200	Dec 2019	0.350	Sep 2020	1.500	Sep 2021	-		1.500	Continuing	Continuing	Continuing
Product Development	WR	SPAWAR : Charleston, SC	0.050	0.100	Aug 2019	0.050	Aug 2020	0.050	Aug 2021	-		0.050	Continuing	Continuing	Continuing
		Subtotal	5.472	6.241		6.070		8.700		-		8.700	Continuing	Continuing	N/A

Remarks

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

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel and Corporate	WR	NAVSEA HQ : Not Specified	0.040	0.340	Oct 2018	0.360	Oct 2019	0.040	Oct 2020	-		0.040	Continuing	Continuing	Continuing
		Subtotal	0.040	0.340		0.360		0.040		-		0.040	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWC : Carderock, MD	2.371	1.205	Apr 2019	2.713	Apr 2020	2.411	Apr 2021	-		2.411	Continuing	Continuing	Continuing
		Subtotal	2.371	1.205		2.713		2.411		-		2.411	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Services	SS/CPFF	NSMA : Not Specified	0.320	0.330	Dec 2018	0.340	Dec 2019	0.360	Dec 2020	-		0.360	Continuing	Continuing	Continuing
		Subtotal	0.320	0.330		0.340		0.360		-		0.360	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	8.203	8.116		9.483		11.511		-		11.511	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
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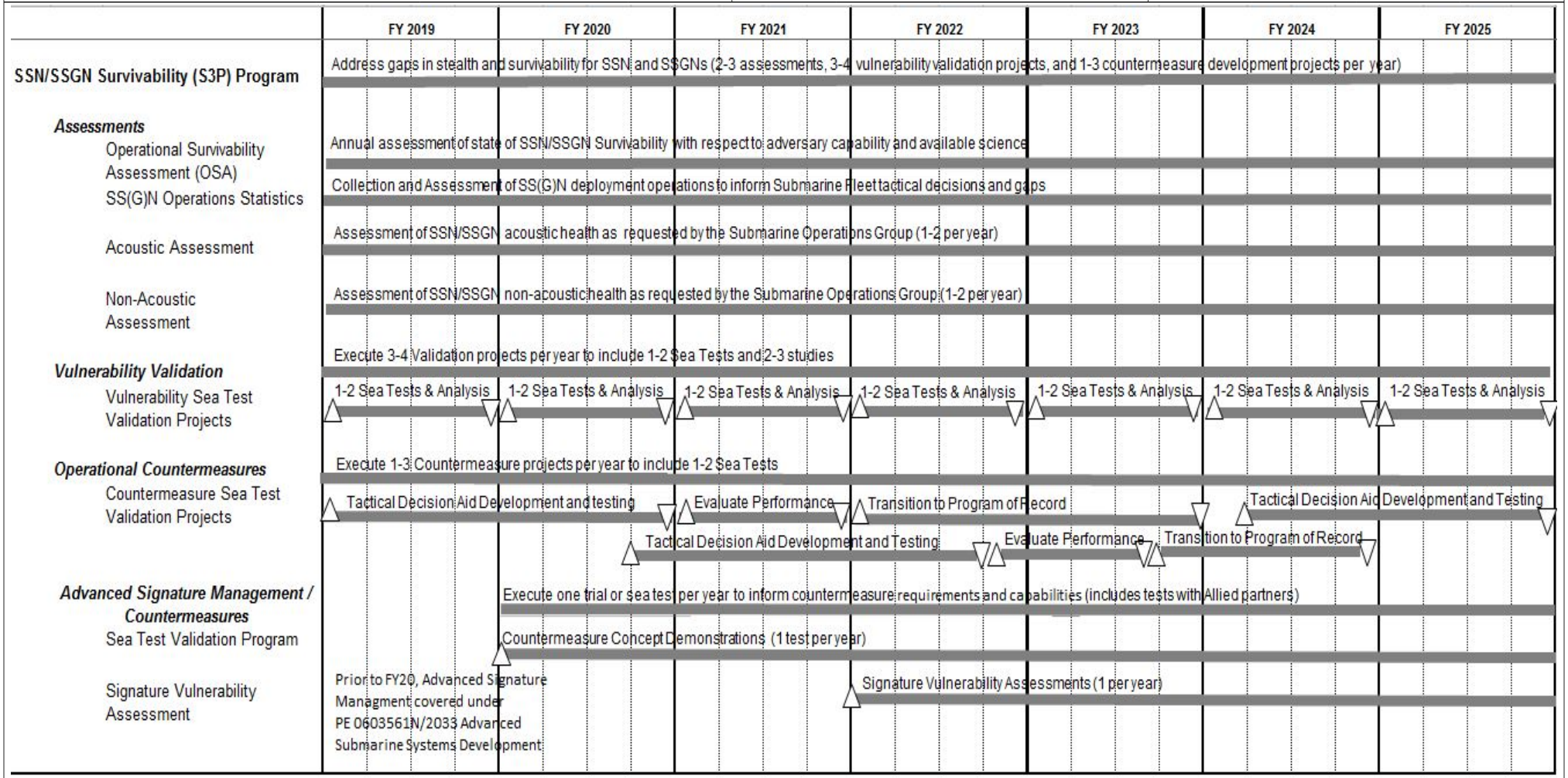

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 3391 / *SSN/SSGN Survivability Program*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Assessments				
Operational Survivability Assessment	1	2019	4	2024
Acoustic Assessment	1	2019	4	2024
Non-Acoustic Assessment	1	2019	4	2024
Vulnerability Validation				
Vulnerability SEA Test Validation Program (1-2 per year)	1	2019	4	2024
Countermeasures				
Countermeasure Validation (2-3 per year)	1	2019	4	2024
Advanced Submarine Signature Management/Countermeasures				
Sea Test Validation Program (1 per year)	1	2020	4	2024
Signature Vulnerability Assessment (1 per year)	1	2022	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / *Advanced Submarine System Development*	Project (Number/Name) 9710 / *Advanced Submarine Technology Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9710: *Advanced Submarine Technology Development*	0.000	0.000	0.000	66.872	-	66.872	45.519	63.435	75.224	76.732	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Project 9710 was previously funded in FY 2019 under Program Element 0604250D8Z (Advanced Innovative Technologies) Project 250 (Advanced Innovative Technologies). This is a Navy new start.

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 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Submarine Technology Development	0.000	0.000	66.872	0.000	66.872
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: N/A					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Details of this project are classified and are submitted to Congress in the classified budget justification books.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	66.872	0.000	66.872

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9710 / *Advanced Submarine Technology Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Classified	Various	N/A : N/A	0.000	0.000		0.000		66.872	Dec 2020	-		66.872	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		66.872		-		66.872	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		66.872		-		66.872	Continuing	Continuing	N/A

Remarks

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

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9710 / *Advanced Submarine Technology Development*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	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.																												

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9710 / *Advanced Submarine Technology Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9710				
Details of this project are classified and are submitted to Congress in the classified budget justification books.	1	2019	1	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / *Advanced Submarine System Development*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	5.071	9.648	10.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.719
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

LITTORAL WATER THREATS. Environmentally characterize the South Florida Ocean Measurement Facility (SFOMF) underwater test range battlespace, upgrade the sensors and infrastructure, and conduct at least two characterization tests of a Virginia Class Submarine to validate model data.

LIGHTWEIGHT COMPOSITE RESEARCH. Continue to develop and demonstrate composite material technologies for future submarines in areas of non-traditional/ advanced materials for hull and platform technologies, propulsors, propellers, and other systems which increase near-term capability and provide cost reduction for in-service and future submarine classes.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Small Business Technology Insertion	0.000	10.000
FY 2019 Accomplishments: N/A		
FY 2020 Plans: Planned areas of technology insertion include: - Advanced Materials: Use of alternative/advanced/multi-materials in new submarine applications via scale model and prototyping projects. - Advanced Energy Systems: Will examine the efficacy, performance and hazards associated with alternate battery chemistries for use in a submarine main storage battery role, and examine new electrical motor/ component technologies for improved capability/reliability. - Advanced Hull Treatments: Will examine the performance and manufacturing readiness of alternative technologies to identify those with the potential to reduce cost, improve stealth and improve hydrodynamic performance. - Advanced Atmospheric Control Systems. Will examine technologies to more effectively monitor and manage atmospheric conditions in a submarine environment. - Stealth: Will examine the availability of new technologies/tools to assess and improve performance.		

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
- SSN Advanced Technologies: Will examine past and current project work conducted under the small business programs on other various technology areas to identify priority candidates for follow-on project work based upon prioritized technology gaps and prior-demonstrated performance.		
Congressional Add: Littoral Water Threats ***FY 2019 Accomplishments:*** Complete 3-D environmental characteristics of the water space and validate models of the operating area. Upgrade SFOMF range infrastructure, including environmental hardware, sensors, data and power cables, and supporting detection/processing algorithms and associated hardware. Update UEM models and develop environmental threat conditions for future submarine designs. Complete analysis of FY18 prototype trial. Perform SFOMF detection array upgrade. Conduct modeling and planning for sea trials on two Virginia Class Submarines. ***FY 2020 Plans:*** Littoral Water Threats-Conduct two deployments and data collections of the water space environmental data collection system. Complete validation of environmental models of the operating areas. Develop a portable magnetic measurement system to be added to the existing environmental system, deploy and test the system in the SFOMF area of operation and in an alternate location. Complete the upgrade of SFOMF sensors and the supporting network.	4.824	0.000
Congressional Add: Lightweight Composite Research ***FY 2019 Accomplishments:*** AMP. Finalize structural acceptance process for the Advanced Material Propeller (AMP), including fatigue testing of Generation 2 composite blades in partner country, data analysis, and finite element analysis. Complete the structural certification and planning for AMP sea trials, obtain approval from cognizant technical authorities that AMP is acceptable for trial, and provide partner country with supporting documentation package. NEXT GEN THRUST. Continue design studies and plan small and/or large scale testing of innovative, advanced material propulsor and shafting technologies. Complete detailed design of a composite shaft. Begin test article fabrication, testing, and composite shaft manufacture. Continue evaluation and design of a next generation propulsor concept utilizing new/non-traditional materials. NEW COMPOSITE APPLICATIONS. Conduct composite material design and demonstration feasibility studies to explore and validate new applications of composite materials on submarines. ***FY 2020 Plans:*** N/A	4.824	0.000
Congressional Adds Subtotals	9.648	10.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / *Advanced Submarine System Development*	Project (Number/Name) 9999 / *Congressional Adds*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	Various	NSWC/CD, : Bethesda, MD	2.375	3.906	Dec 2019	1.500	Apr 2020	0.000		-		0.000	0.000	7.781	-
Product Development	Various	NOVA Southeastern University, : Ft. Lauderdale, FL	2.350	1.300	Dec 2019	0.000		0.000		-		0.000	0.000	3.650	-
Product Development	Various	SPA, : Washington, DC	0.000	0.294	Dec 2019	0.000		0.000		-		0.000	0.000	0.294	-
Product Development	Various	ARL/PSU, : State College, PA	0.000	0.746	Dec 2019	0.000		0.000		-		0.000	0.000	0.746	-
Product Development	Various	SCI, : Gulf Port, MS	0.000	2.436	Dec 2019	0.000		0.000		-		0.000	0.000	2.436	-
Product Development	TBD	Small Business A, : TBD	0.000	0.000		0.100	Apr 2020	0.000		-		0.000	0.000	0.100	-
Product Development	TBD	Small Business B, : TBD	0.000	0.000		0.100	Apr 2020	0.000		-		0.000	0.000	0.100	-
Product Development	TBD	Small Business C, : TBD	0.000	0.000		0.100	Apr 2020	0.000		-		0.000	0.000	0.100	-
Product Development	TBD	Small Business D, : TBD	0.000	0.000		0.200	Apr 2020	0.000		-		0.000	0.000	0.200	-
Product Development	TBD	Small Business E, : TBD	0.000	0.000		0.250	Apr 2020	0.000		-		0.000	0.000	0.250	-
Product Development	TBD	Small Business F, : TBD	0.000	0.000		0.500	Apr 2020	0.000		-		0.000	0.000	0.500	-
Product Development	TBD	Small Business G, : TBD	0.000	0.000		0.500	Apr 2020	0.000		-		0.000	0.000	0.500	-
Product Development	TBD	Small Business H, : TBD	0.000	0.000		0.500	Apr 2020	0.000		-		0.000	0.000	0.500	-
Product Development	TBD	Small Business I, : TBD	0.000	0.000		0.750	May 2020	0.000		-		0.000	0.000	0.750	-
Product Development	TBD	Small Business J, : TBD	0.000	0.000		1.000	May 2020	0.000		-		0.000	0.000	1.000	-
Product Development	TBD	Small Business K, : TBD	0.000	0.000		1.000	May 2020	0.000		-		0.000	0.000	1.000	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / *Advanced Submarine System Development*	Project (Number/Name) 9999 / *Congressional Adds*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	TBD	Small Business L, : TBD	0.000	0.000		2.000	May 2020	0.000		-		0.000	0.000	2.000	-
		Subtotal	4.725	8.682		8.500		0.000		-		0.000	0.000	21.907	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	Various	NTT, : Washington, DC	0.100	0.100	Dec 2019	0.000		0.000		-		0.000	0.000	0.200	-
Product Development	Various	Contractor Support, : Various	0.196	0.192	Jan 2019	0.200	Apr 2020	0.000		-		0.000	0.000	0.588	-
Product Development	Various	Gov Engineering, : Various	0.050	0.050	Jan 2019	0.100	Apr 2020	0.000		-		0.000	0.000	0.200	-
Product Development	WR	NSWC/CD, : Bethesda, MD	0.000	0.000		0.250	Apr 2020	0.000		-		0.000	0.000	0.250	-
Product Development	WR	NSWC/Crane, : Crane, IN	0.000	0.000		0.250	Apr 2020	0.000		-		0.000	0.000	0.250	-
Product Development	SS/CPFF	Electric Boat, : Groton, CT	0.000	0.000		0.250	Apr 2020	0.000		-		0.000	0.000	0.250	-
		Subtotal	0.346	0.342		1.050		0.000		-		0.000	0.000	1.738	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	Various	NTT : Washington, DC	0.000	0.100	Dec 2019	0.000		0.000		-		0.000	0.000	0.100	-
Contractor Engineering Support	Various	Various : Various	0.000	0.196	Jan 2019	0.250	Apr 2020	0.000		-		0.000	0.000	0.446	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	Various	Gov Engineering : Various	0.000	0.328	Jan 2019	0.200	Apr 2020	0.000		-		0.000	0.000	0.528	-
		Subtotal	0.000	0.624		0.450		0.000		-		0.000	0.000	1.074	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	5.071	9.648		10.000		0.000		-		0.000	0.000	24.719	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

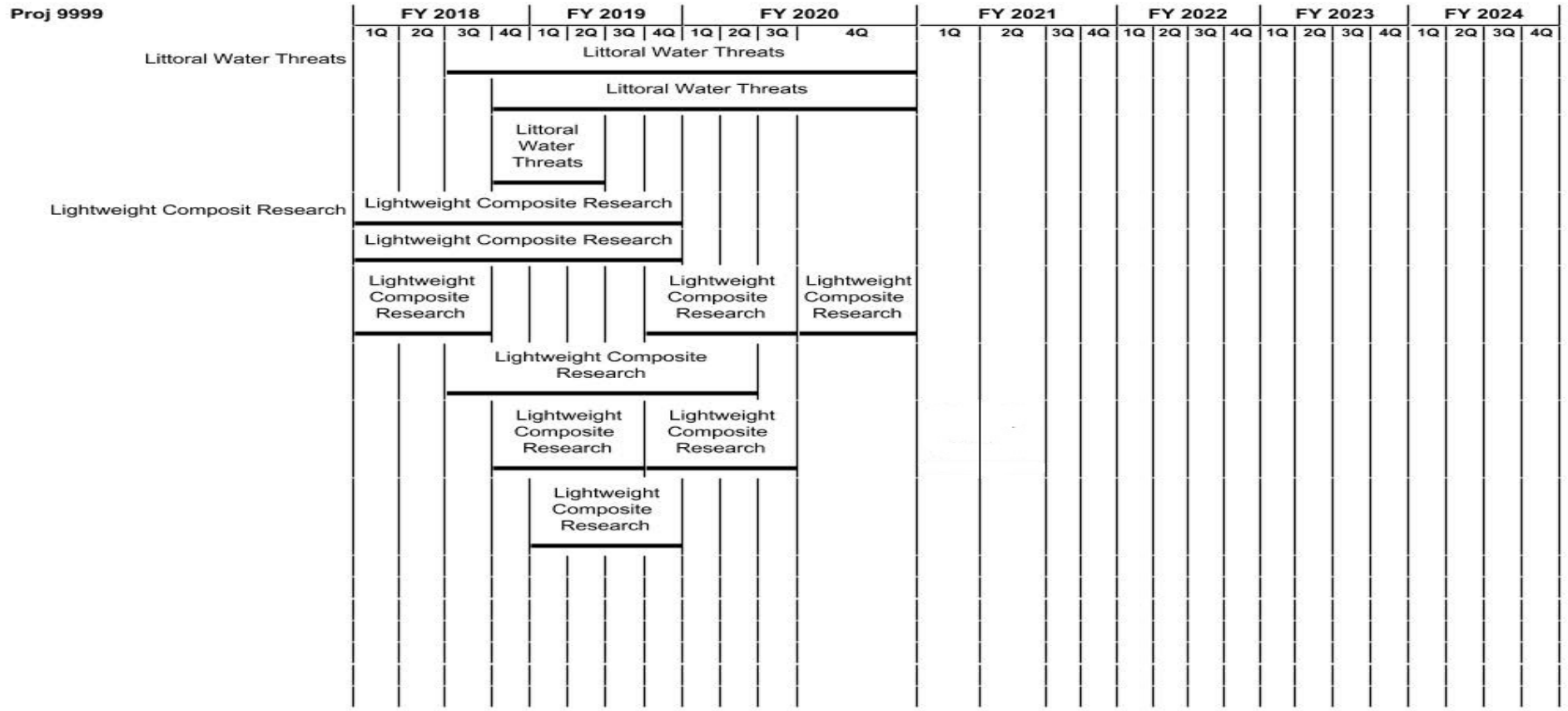

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

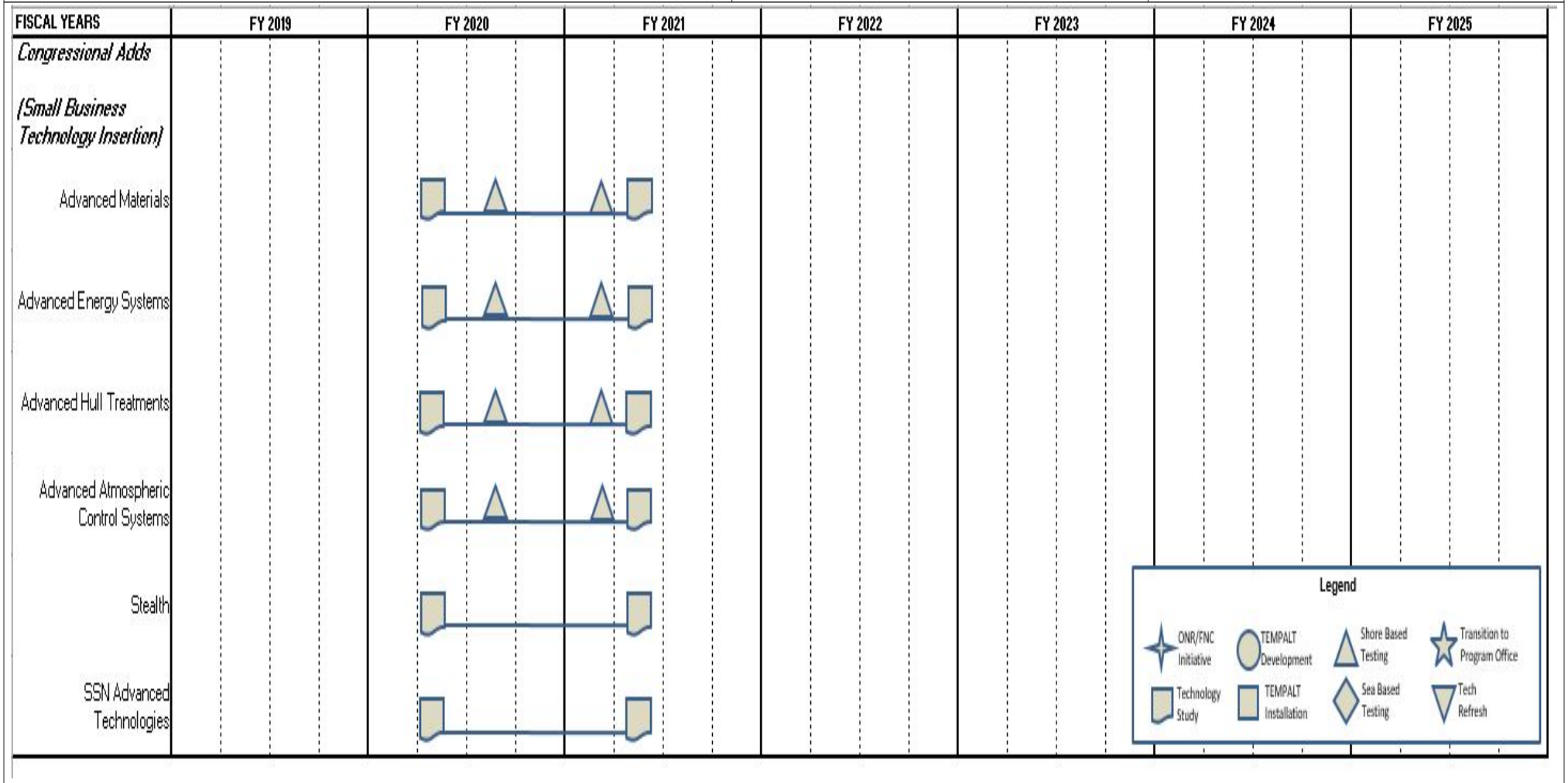

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
Littoral Water Threats: Test RangeSensor and Infrastructure upgrades	3	2019	4	2020
Littoral Water Threats: Test Planning, Execution and Analysis	4	2019	4	2020
Littoral Water Threats: Environmental/UEM Modeling and Characterization	1	2019	2	2019
Lightweight Composite Research: AMP: Complete structural certification process, assemble and test AMP Gen 3 blades and hub	1	2019	4	2019
Lightweight Composite Research: AMP: Deliver and install AMP propeller and supporting documentation to partner country	4	2019	3	2020
Lightweight Composite Research: AMP: At-sea test of AMP on partner submarine	4	2020	4	2020
Lightweight Composite Research: Next Gen Thrust: Complete Test Article design, fabrication and testing	1	2019	3	2020
Lightweight Composite Research: Next Gen Thrust: Complete design for Integrated Shaft and Propulsor	1	2019	3	2019
Lightweight Composite Research: Next Gen Thrust: Manufacture/assemble Integrated Shaft and Propulsor	4	2019	3	2020
Lightweight Composite Research: new Composite Applications: Conduct composite material design and demonstration feasibility studies	1	2019	4	2020
Small Business Technology Insertion: Advanced Materials	2	2020	2	2021
Small Business Technology Insertion: Advanced Energy Systems	2	2020	2	2021
Small Business Technology Insertion: Advanced Hull Treatments	2	2020	2	2021
Small Business Technology Insertion: Advanced Atmospheric Control Systems	2	2020	2	2021
Small Business Technology Insertion: Stealth	2	2020	2	2021
Small Business Technology Insertion: SSN Advanced Technologies	2	2020	2	2021