Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy												Date: May 2017
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	893.308	85.496	106.365	100.955	-	100.955	114.588	121.477	106.198	107.488	Continuing	Continuing
0223: *Sub Combat System Improvement (ADV)*	448.761	37.207	42.296	40.828	-	40.828	51.417	50.693	51.754	52.796	Continuing	Continuing
2033: *Adv Submarine Systems Development*	444.547	38.634	55.677	35.795	-	35.795	34.828	35.419	36.164	36.880	Continuing	Continuing
2096: *Payload Delivery Development*	0.000	0.000	8.392	15.738	-	15.738	19.889	26.622	9.391	8.749	Continuing	Continuing
3391: *SSN/SSGN Survivability Program*	0.000	0.000	0.000	8.594	-	8.594	8.454	8.743	8.889	9.063	Continuing	Continuing
9999: *Congressional Adds*	0.000	9.655	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.655

A. Mission Description and Budget Item Justification

This program element 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 program element also supports programs transitioning from Science and Technology (S&T), Defense Advanced Research Projects Agency (DARPA), Independent Research and Development, and Small Business Innovation Research (SBIR) projects.

Project 0223: The Submarine Combat System Improvement (Advanced) (Non-ACAT) Project researches, develops, and tests new sonar, combat system, imaging, and electronic warfare software for Program Executive Office Submarine (PEO SUB) programs and develops, tests, and prototypes new sonar arrays for PEO SUB programs. It delivers about thirty (30) new capabilities every other year to PEO SUB. Project 0223 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. This Project transitions technologies developed by Navy technology bases, the private sector, Office of Naval Research (ONR), Future Naval Capabilities (FNC), and DARPA. The 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.

Prototype hardware/software systems are developed to demonstrate technologically promising system concepts in laboratory and at-sea submarine environments. The focus of hardware systems will be the development and testing of advanced sensor technologies and large array configurations intended to support increased detection ranges and accuracy with increased reliability and lower life cycle costs.

This Project is funded under demonstration and validation, as it develops and integrates hardware for experimental tests related to specific platform applications. The focus of software systems will be sensor processing technology efforts conducted under the Advanced Processing Build (APB) program that develops and demonstrates

improvements to current and future sensor processing/combat control systems improving detection, localization, classification, decision support, counter-detection vulnerability, and other functions essential to mission success.

Technologies and/or capabilities developed under the APB 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). All three programs (ACB, ASB and APB) are managed under a common development organization and 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.

This Project will participate in, and take advantage of, the Tactical Advancements for the Next Generation (TANG) initiative that utilizes Commercial Industrial Design Thinking methodologies to engage the Fleet in generating innovative improvement concepts for Submarine, Surface and Surveillance systems.

Project 0223 is comprised of three major efforts: Advanced Processing Builds (APB), Flank Array Demonstration, and Advance Sensors.

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 develops signal processing, integrates improvements and conducts testing and analysis for large array configurations. Improvements are transitioned to PEO SUB for fielding on the Virginia Class submarines.

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, as well.

Project 2033:
SSN/SSGN Survivability Program (S3P) efforts previously funded under this project (through FY17) will move to Project 3391 in FY18. S3P addresses gaps in stealth and the survivability for current and future SSN/SSGN force.

The Advanced Submarine Systems Development (ASSD) Program is a non-acquisition program that develops and matures technologies for successful integration into future and modernized submarine classes, thus lowering acquisition and life cycle program costs while improving mission capability. ASSD transitions Hull, Mechanical, and Electrical (HM&E) technologies and future naval concepts from Science & Technology (S&T) and Research and Development (R&D) to operational platforms; performs tests and demonstrates submarine design and naval architecture products destined for integration into future submarine classes or backfit into existing fleet assets; develops, initially integrates, and does test validation of leading payload concepts for submarine integration in support of the Design for Undersea Warfare; and operates unique R&D experimentation, modeling, testing and simulation facilities to enhance submarine stealth, maneuverability, capability, and affordability. The

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy	Date: May 2017
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*

program also supports Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR), Office of Naval Research (ONR), Defense Advanced Research Projects Agency (DARPA) programs, and near and mid-term technology insertion to achieve future submarine class total ownership cost reductions, and influence future submarine concept designs and core technologies. Experimentation and demonstration is conducted in a joint warfighting context with other services, (i.e. the U.S. Marines, U.S. Army, and the U.S. Air Force), to enable early assessment of warfighting capabilities, and to contribute to smarter technology selection decisions for potential incremental development. This program also supports Information Exchange Programs and joint Project Agreements (PA) with the United Kingdom, Canada, Australia and other international partners.

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

The major developmental efforts include:

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

Long Range R&D Investment
- Advanced Submarine Control (Secondary Propulsion System)
- Advanced Material Propeller (AMP) Technology
- Innovation Technology Transition (SBIRs/STTRs)
- Next Generation Attack Submarine (SSN(X)) Technologies
- Next Generation (NG) Thrust
- Submarine Signature Management/Acoustic Superiority
- Advanced Hull Coatings
- Next Generation Towed Array Reliability
- Support of ONR Future Naval Capability (FNC) new starts
- Hydraulic Elimination through Electrification

Rapid Prototyping
- Common Unmanned Aerial Vehicle (UAS) Comms
- Fleet Module Autonomous Underwater Vehicle (FMUAV)
- Li-Ion Battery FMAUV Submarine Integration
- Clandestine Delivered Mine (CDM)
- Advanced Weapons Enhanced by Submarine UAS against Mobile targets (AWESUM)/Blackwing Unmanned Aerial System (UAS)
- Submarine Payload Integration
- Electronic Warfare/Intelligence Surveillance and Reconnaissance (EW/ISR) Unmanned Underwater Vehicle (UUV) Payload
- Submarine Launch Decoy

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy	Date: May 2017
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 2096:
Payload Delivery Development is a non-acquisition program that supports innovative research and development efforts to enable integration of deployable and /or retrievable undersea vehicles, payload concepts, and offboard systems through design, manufacture, test/demonstration, evaluation, and validation for submarine platforms. In addition to technology development, the program will support engineering and integration of new and existing technologies to enable rapid prototyping and fielding of capabilities which will inform and provide solutions to urgent war-fighter needs. Experimentation and demonstration will be conducted with the Fleet (i.e., CSF, UUVRON, etc.) enabling an agile environment to demonstrate and provide high velocity learning through at-sea demonstrations, which will provide the Fleet and acquisition communities relevant employment data to inform CONOPs and fielding decisions. The program will furthermore support transition of high-interest systems and/or payloads from research and development to Programs of Record (PoRs), as appropriate.

The major developmental efforts include:
- Payload Handling System (PHS) is used to enable capabilities for the integration of large deployable and retrievable undersea vehicles, payloads, and offboard systems with submarines. RDT&EN funding will be used to design, manufacture, and field an integrated system utilized with submarine large ocean interfaces to enable launch and recovery of systems such as the Navy's Snakehead Large Diameter Unmanned Underwater Vehicle (LDUUV), the Shallow Water Combat Submersible (SWCS), and the LBS-AUV(S) from submarines, a capability which does not currently exist.
- The 3" Sub Launched Unmanned Aerial System (SL-UAS) project supports the future missions of the VIRGINIA Class Program and its payload module. The project will focus on the overall design, system engineering, prototyping, demonstrations, and qualification activities needed to execute the integration of a payload with Blackwing for rapid deployment with an integrated solution into existing shipboard systems. This system will be demonstrated on a US Submarine, at a land based facility, or on another host platform by the end of FY20. Capability will transition to the Submarine Combat Control System Program Office (PMS 425).

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	85.834	100.565	94.556	-	94.556
Current President's Budget	85.496	106.365	100.955	-	100.955
Total Adjustments	-0.338	5.800	6.399	-	6.399
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	2.015	0.000			
• SBIR/STTR Transfer	-2.352	0.000			
• Program Adjustments	0.000	5.800	6.700	-	6.700
• Rate/Misc Adjustments	-0.001	0.000	-0.301	-	-0.301

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: 9999: *Congressional Adds*		

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy	Date: May 2017
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 2016	FY 2017
Congressional Add: *Advanced submarine control*	9.655	0.000
Congressional Add Subtotals for Project: 9999	9.655	0.000
Congressional Add Totals for all Projects	9.655	0.000

Change Summary Explanation

Funding:
FY 2016: Decrease by $-2.352M for Small Business Innovative Research (SBIR) realignment, and increase by $+2.015M for Below Threshold Reprogramming (BTR) for Project 2033.

FY 2018: Net Increase by $+6.399M for development of a Kinetic Strike Payload for an Unmanned Aerial Vehicle ($+6.700M, Project 2096) and NWCF rate adjustments, and decreases Naval Innovative Science & Engineering (NISE)/Section 219.

Project 2033: In FY16, -$4.454M Congressional Reduction was applied for Stealth Programs.
In FY16, +$10M Congressional add was applied for Advanced Submarine Control. This add will develop, test and demonstrate numerous high risk advanced submarine control technologies associated with future submarine classes/design with advanced submarine payloads.
FY 2017 Program Adjustments support CNO Speed to Fleet Initiative for ISR/EW UUV and At-sea rapid prototyping, integration, and advanced submarine payloads demonstration. Additionally increase was programmed by CNO for design and procurement of materials for an advanced coatings demonstration as part of the Acoustic Superiority demonstrator (South Dakota Insertion Program - SSN 790). +$5.8M in the Request for Additional Appropriation to fund a Joint Emergent Operational Need Statement (JEONS) through the development and rapid prototyping of the Clandestine Delivered Mine (CDM).

Project 3391 (S3P):
- Project established in FY18. SSN/SSGN Survivability Program (S3P) previously funded under Project 2033 through FY17.

Project 2096:
- FY 2018 increase of $6.7M for the 3" Sub Launched Unmanned Aerial System (UAS).

Project 0223:
- FY 2016 to FY 2017 increase ($5.089M) is driven by the ramp-up of development of EW improvements within APB efforts and the development of a Sonar Tactical Decision Aid (STDA) common to submarine, surface and surveillance applications. EW is a top priority in the CNO's Design for Maintaining Maritime Superiority (Jan-16). Additionally, submarine, surface and surveillance programs each currently develop, field, and maintain similar, but unique, STDA products. The Common STDA development is intended to reduce future year development costs, by containing development efforts within one common system architecture and sharing of capability increases.
- FY 2017 to FY 2018 decrease ($1.468M) is due to a re-prioritization of requirements by the program sponsor.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
0223: *Sub Combat System Improvement (ADV)*	448.761	37.207	42.296	40.828	-	40.828	51.417	50.693	51.754	52.796	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Submarine Combat System Improvement (Advanced) (Non-ACAT) Project supports Navy Submarine Acoustic Superiority and Technology Insertion initiatives by the application of advanced development and testing of sensor processing and tactical control systems improvements. This 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, ONR, FNC, and 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. Light-Weight Low Cost Conformal Array (LWLCCA) has completed development and transitioned to fielding. The focus of sensor processing technology efforts through the APB program will address improvements in imaging, tactical control, Electronic Warfare (EW) and acoustics, including detection, localization, classification, ranging, tracking, situational awareness, tactical decision aides, command decision support tools and displays and other functions essential to mission success.

Technologies and/or capabilities developed here are shared to optimize re-use and cost effectiveness with surface and surveillance programs under the AxB program management methodology. ACB, ASB and APB may co-develop capabilities and modular architecture technologies to maximize commonality and cost effectiveness. Development efforts may be augmented by innovative concepts generated through the TANG Design Thinking process that includes Fleet operational end-users in capability design.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: Advanced Processing Build (APB)	31.932	36.371	35.053	0.000	35.053
Articles:	-	-	-	-	-
Description: APB is 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.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
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 CNO, N97. PEO SUB provides Milestone Decision Authority (MDA) oversight and approval. Beginning in FY17, Steps 1 and 2 will be 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-15) and allows for development of longer lead technologies. The content of a specific APB build (every two years on the odd year) will then be 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 will then be performed followed by Steps 3 and 4, as applicable, and transition to production. ***FY 2016 Accomplishments:*** Used the product of FY 2015 Return on Investment (ROI), Watch Section Task Analysis (WSTA) gaps and seams, and BAA evaluations along with direction from the Fleet/STRG/COMSUBFOR/N97 to establish content and continue the development of capabilities for APB-17. Initiated limited Electronic Warfare (EW) APB development program. Continued the development of capabilities for APB-17, completing Steps 1 and 2. Completed APB-15 Step 3 land-based and ROI testing, conducted Step 4 at-sea testing and transition to production. Conducted a TANG event at the Theater ASW (TASW) level to inform and generate innovative concepts for APB-19. ***FY 2017 Plans:*** - Continue the development of APB-17, integrate for testing, and initiate land-based laboratory string testing. Establish a Tactical Scenario Guide and conduct a WSTA gaps and seams test to inform system shortfalls in the context of the selected scenarios. - Conduct an Industry Day and BAA solicitation to drive competition for future APB innovative technologies. - Collaborate with the STRG and UWDC to prepare a multi-year capability development road map to inform the content of the APB Pipeline. Initiate planning and development efforts on Pipeline capabilities. - Initiate development of a STDA common to submarine, surface and surveillance application.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continue EW APB development program. In FY17 the EW APB program ramps-up the development of EW improvements within APB efforts and the development of a STDA common to submarine, surface and surveillance applications. EW develops ship vulnerability assessment tools to counter potential adversaries that are increasingly equipped with modern radars as well as non-Navy maritime traffic congesting littoral waters with high-end electronic signals. EW is a top priority in the CNO's Design for Maintaining Maritime Superiority (Jan-16). - Common STDA development is intended to reduce future year development costs, by containing development efforts within one common system architecture and sharing of capability increases. Life cycle STDA costs will also decrease as one baseline, rather than three, is documented, maintained and trained on. ***FY 2018 Base Plans:*** - Continue advanced concepts, data collection and analysis for EW APB. - Continue Common STDA development. - Conduct Step 3 land-based and Step 4 at-sea testing of APB-17. Hold MDA reviews and transition APB-17 to production. - Continue Step 1 and Step 2 development and testing of concepts, algorithms and technologies in response to Fleet requirements. - Conduct System Engineering review and Fleet-endorsed selection of technology candidates for APB-19. Begin integration of APB-19 capabilities. ***FY 2018 OCO Plans:*** N/A					
Title: Flank Array Demonstration	1.675	2.125	1.975	0.000	1.975
Articles:	-	-	-	-	-
FY 2016 Accomplishments: Commenced development of beamforming and signal processing improvements to maximize LFA capability as well as tactical/combat system updates making use of improved capabilities to perform target localization. Conducted at-sea testing and data analysis of the LVA-2 array on USS Maryland in support of Acoustic Superiority goals. ***FY 2017 Plans:*** - Continue development of beamforming and signal processing improvements to maximize LFA capability as well as tactical/combat system updates making use of improved capabilities to perform target localization.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Conduct critical at-sea testing events scheduled in FY 2017 for LVA-1 (installed on USS DALLAS), and FY 2017 and beyond for the newly fielded LVA-2 (installed/now operational on USS MARYLAND) and analyze FY 2016/FY 2017 at-sea test results. This testing/analysis is necessary to integrate enhanced signal processing capability for LFAs and collect data that will be used to improve LVA tactical performance. These processing upgrades are directly applicable to improving the forward and back-fit LVA production programs for Virginia Class Submarines, SSBN's, and Ohio Replacement Submarines. The planned increase supports critical at-sea testing events scheduled in FY 2017 for LVA-1, and FY 2017 and beyond for LVA-2 and the analysis of FY 2016/ FY 2017 at-sea test results. ***FY 2018 Base Plans:*** - Continue to conduct critical at-sea testing events for LVA2 and analyze FY 2017/FY 2018 at-sea test results. This testing/analysis is necessary to integrate enhanced signal processing capability for LFAs and collect data that will be used to improve LVA tactical performance. These processing upgrades are directly applicable to improving the forward and back-fit LVA production programs for Virginia Class Submarines, SSBN's, and Ohio Replacement Submarines. ***FY 2018 OCO Plans:*** N/A					
Title: Advanced Sensors	3.600	3.800	3.800	0.000	3.800
Articles:	-	-	-	-	-
FY 2016 Accomplishments: Continued towed array embedded sensor and open architecture telemetry development. Fabricated embedded sensor test module and conducted tow test to evaluate in-hose performance of embedded sensors. Continued development of towed array vector sensors. Initiated development of next generation towed array using open architecture and embedded sensor technology ***FY 2017 Plans:*** - Continue embedded sensor and open architecture telemetry development. - Complete open architecture component development and design and fabricate towed array modules to demonstrate high bandwidth operation and dual sample rate capability. - Incorporate lessons learned from FY 2016 Lake Pend Oreille (LPO) testing into FY 2017 array design. Update telemetry system layout, architecture, and component designs. Conduct array environmental, calibration, and LPO testing.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Initiation of the plan to develop a High Speed Signal Path (HSSP) in support of the Bow Conformal Array (BCA)(new effort in FY17). The BCA is intended to improve sonar performance while reducing future submarine construction costs. ***FY 2018 Base Plans:*** - Incorporate lessons learned from FY 2017 LPO testing into FY 2018 array design. Update telemetry system layout, architecture, and component designs. Conduct array environmental, calibration, and LPO testing. - Continue development of the HSSP. ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	37.207	42.296	40.828	0.000	40.828

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Use competitively awarded contracts from Broad BAA solicitations and SBIR initiatives. Integration to fielded systems performed under contracts awarded by the recipient production program within PEO SUB.

E. Performance Metrics

- APB: Deliver at-sea tested submarine capability improvements to PEO SUB as prescribed by the Fleet every two years. Conduct milestone reviews with the Milestone Decision Authority (MDA), PEO SUB prior to delivery.
- Deliver Next Generation TB-29(x) embedded sensor prototype evaluation report.
- Deliver Fat Line Vector Sensor Towed Array (VSTA) Lake Pend Oreille test reports.

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	C/CPFF	Adaptive Methods : VA	1.175	0.250	Mar 2016	0.250	Dec 2016	0.250	Dec 2017	-		0.250	0.000	1.925	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	1.765	0.020	May 2016	0.070	May 2017	0.070	Dec 2017	-		0.070	Continuing	Continuing	Continuing
Product Development	C/CPFF	General Dynamics : VA	20.097	1.934	Dec 2015	2.000	Dec 2016	2.500	Dec 2017	-		2.500	Continuing	Continuing	Continuing
Product Development	C/CPFF	GA Tech Research Institute : GA	3.016	0.060	Mar 2016	0.000		0.000		-		0.000	0.000	3.076	Continuing
Product Development	C/CPFF	In Depth Engineering : VA	4.700	0.665	Dec 2015	0.970	Nov 2016	0.500	Dec 2017	-		0.500	Continuing	Continuing	Continuing
Product Development	C/CPFF	JHU/APL : MD	86.155	7.200	Nov 2015	9.825	Nov 2016	9.400	Dec 2017	-		9.400	Continuing	Continuing	Continuing
Product Development	C/CPFF	Lockheed Martin : VA	55.358	8.120	Jan 2016	8.677	Nov 2016	8.535	Dec 2017	-		8.535	Continuing	Continuing	Continuing
Product Development	C/CPFF	Lockheed Martin : NY	9.564	0.000		0.000		0.000		-		0.000	0.000	9.564	Continuing
Product Development	C/CPFF	Metron : VA	5.373	1.880	Dec 2015	1.025	Nov 2016	1.000	Dec 2017	-		1.000	Continuing	Continuing	Continuing
Product Development	WR	NSWC/Carderock : MD	25.885	1.414	Nov 2015	2.395	Oct 2016	2.585	Nov 2017	-		2.585	Continuing	Continuing	Continuing
Product Development	WR	NUWC/Newport : RI	86.348	7.897	Nov 2015	6.434	Nov 2016	6.480	Nov 2017	-		6.480	Continuing	Continuing	Continuing
Product Development	C/CPAF	NSMA : VA	11.144	0.750	Mar 2016	0.550	Feb 2017	0.650	Jan 2018	-		0.650	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	7.219	0.520	Dec 2015	0.784	Nov 2016	0.650	Dec 2017	-		0.650	Continuing	Continuing	Continuing
Product Development	C/CPFF	PSU/ARL : PA	9.080	0.400	Dec 2015	0.650	Nov 2016	0.650	Dec 2017	-		0.650	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	10.764	1.500	Nov 2015	1.500	Feb 2017	1.650	Dec 2017	-		1.650	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: FY 2018 Navy			Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 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	15.409	1.880	Nov 2015	2.080	Dec 2016	2.150	Dec 2017	-		2.150	Continuing	Continuing	Continuing
Product Development	C/CPFF	UT/ARL : TX	27.872	0.937	Dec 2015	0.775	Nov 2016	0.700	Dec 2017	-		0.700	Continuing	Continuing	Continuing
Product Development	C/CPFF	VAR : VAR*	22.001	0.722	Dec 2015	3.253	Dec 2016	2.000	Dec 2017	-		2.000	Continuing	Continuing	Continuing
		Subtotal	431.126	36.149		41.238		39.770		-		39.770	-	-	-

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 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPAF	BAE Systems : MD	12.665	0.000		0.000		0.000		-		0.000	0.000	12.665	Continuing
Program Management Support	C/CPIF	CGI Federal : VA	0.000	1.000	Dec 2015	1.000	May 2017	1.000	Dec 2017	-		1.000	Continuing	Continuing	Continuing
Program Management Support	C/CPFF	EG&G (URS) : VA	4.291	0.000		0.000		0.000		-		0.000	0.000	4.291	Continuing
Travel	Allot	NAVSEA PEO IWS5 : DC	0.679	0.058	Oct 2015	0.058	Dec 2016	0.058	Oct 2017	-		0.058	Continuing	Continuing	Continuing
		Subtotal	17.635	1.058		1.058		1.058		-		1.058	-	-	-

	Prior Years	FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	448.761	37.207		42.296		40.828		-		40.828	-	-	-

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Navy			Date: May 2017
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)*	

	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Cost To Complete	Total Cost	Target Value of Contract

Remarks

Exhibit R-4, RDT&E Schedule Profile: FY 2018 Navy		Date: May 2017
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)*

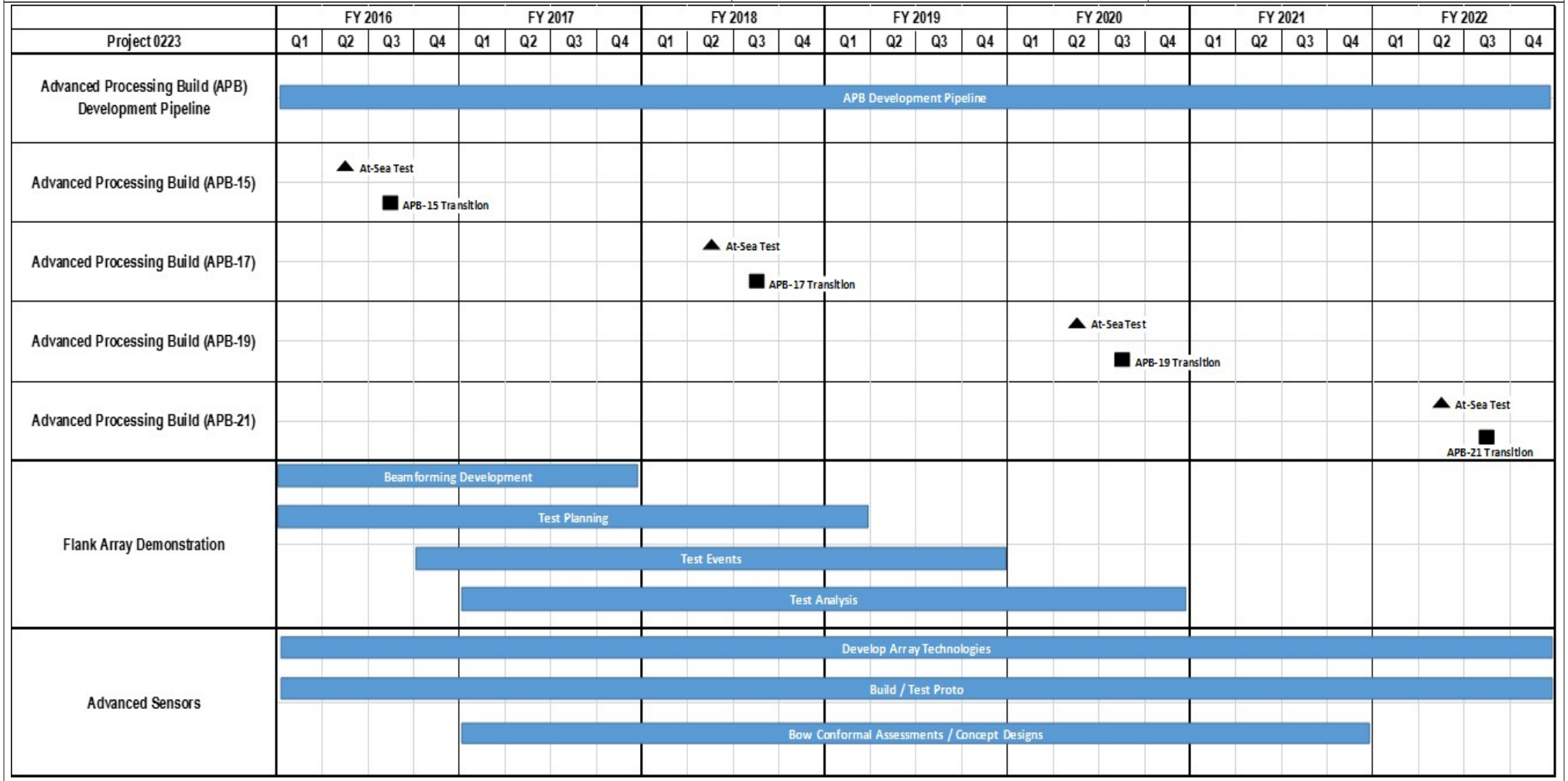


Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0223				
Advanced Processing Build (APB): APB Development (continued)	1	2016	4	2022
Advanced Processing Build (APB): APB-15: APB-15 At-Sea Test	2	2016	2	2016
Advanced Processing Build (APB): APB-15: Transition APB-15 to PEO SUB Production Programs	3	2016	3	2016
Advanced Processing Build (APB): APB-17: APB-17 At-Sea Test	2	2018	2	2018
Advanced Processing Build (APB): APB-17: Transition APB-17 to PEO SUB Production Programs	3	2018	3	2018
Advanced Processing Build (APB): APB-19: APB-19 At-Sea Test	2	2020	2	2020
Advanced Processing Build (APB): APB-19: Transition APB-19 to PEO SUB Production Programs	3	2020	3	2020
Advanced Processing Build (APB): APB-21: APB-21 At-Sea Test	2	2022	2	2022
Advanced Processing Build (APB): APB-21: Transition APB-21 to PEO SUB Production Programs	3	2022	3	2022
Flank Array: Beamforming Development	1	2016	4	2017
Flank Array: Flank Array Test Planning	1	2016	1	2019
Flank Array: Flank Array Test Conduct	4	2016	4	2019
Flank Array: Flank Array Test Analysis	1	2017	4	2020
Advanced Sensors: Develop Array Technologies (continued)	1	2016	4	2022
Advanced Sensors: Build & Test Prototype Arrays (continued)	1	2016	4	2022
Advanced Sensors: Bow Conformal Assessments / Concept Designs	1	2017	4	2021

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
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*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
2033: *Adv Submarine Systems Development*	444.547	38.634	55.677	35.795	-	35.795	34.828	35.419	36.164	36.880	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Advanced Submarine Systems Development (ASSD) Program is a non-acquisition program that develops and matures advanced technologies for successful integration into current and future submarine classes and in so doing lowers the technical risk and costs of integrating these new technologies prior to acquisition and speeds their delivery as capabilities into the fleet and into formal programs of record (PORs). ASSD transitions Hull, Mechanical, and Electrical (HM&E) technologies, payloads, and future naval concepts from the Science & Technology (S&T) and Research and Development (R&D) communities through the development, maturation, and technical integration of technology projects to operational submarine platforms for assessment, testing, and evaluation. Once the projects have proven their maturity and promise through at-sea testing they are formally transitioned into formal programs of record at lower risk and costs. Additionally, ASSD operates and maintains R&D infrastructure assets that are critical in the long-term design, assessment and construction of modern, stealthy submarine platforms. 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 transition technology for integration into current and future submarine classes to achieve new transformational capabilities while achieving total-ownership cost reductions. Experimentation and demonstration are conducted in a joint warfighting context with other services, (i.e. the U.S. Marines, U.S. Army, and the U.S. Air Force), to enable early assessment of the 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 Agreements (PA) with the United Kingdom, Canada, Australia and other international partners. The technology efforts in ASSD develop future technologies able to be integrated into the Virginia class, Columbia class and in-service submarine programs.

Several programmatic changes are notable in this year's budget exhibits. (1) SEA073 has established new programmatic pillars to better align the different projects within Project 2033. The specific project efforts within these new pillars have not changed other than new program starts and completions that are detailed below. (2) The SSN/SSGN Survivability Program (S3P) efforts previously funded under this project (through FY17) will move to Project 3391 in FY18. The S3P program addresses gaps in stealth and the survivability for the current and future SSN/SSGN force. (3) The increase in funding from FY 2016 to FY 2017 was programmed by CNO for design, procurement, and installation of an advanced submarine hull treatment demonstration as part of the Acoustic Superiority demonstrator, South Dakota (SSN 790) Insertion Program (SDIP). Additional increases to support a CNO Speed to Fleet initiative and investment to establish rapid prototyping development funding for advanced submarine payloads and time-critical technology efforts were also provided.

Project 2033 is comprised of three budget categories: Strategic Capability R&D Infrastructure, Long Range R&D Investment, Rapid Technology Prototyping. Strategic capability R&D infrastructure is investment to 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 maturation and readiness for incorporation into existing and future

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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*

submarine baselines at contract award. Rapid technology prototyping are technology projects focused on delivering a technology capability within a 18-30 month window from program start to submarine at-sea demonstration.

Major developmental efforts include:

- Large Scale Vehicle (LSV)
- Intermediate Scale Measurement System (ISMS)
- Advanced Submarine Control
- Advanced Material Propeller (AMP) Technology
- Innovation Technology Transition (SBIRs/STTRs transition)
- Next Generation Attack Submarine Technologies
- Next Generation (NG) Thrust (Future Propulsor/Shaft Technologies)
- Submarine Signature Management/Acoustic Superiority
- Advanced Hull Coatings
- Next Generation Towed Array Reliability
- Support of ONR Future Naval Capability (FNC) new starts transitioning to submarine platforms
- Hydraulic Elimination through Electrification
- Common Unmanned Aerial Vehicle (UAS) Communications
- Fleet Module Autonomous Underwater Vehicle (FMUAV)
- Li-Ion Battery FMAUV Submarine Integration
- Clandestine Delivered Mine (CDM)
- Advanced Weapons Enhanced by Submarine UAS against Mobile targets (AWESUM)/Submarine Unmanned Aerial System (UAS)
- Submarine Payload Integration
- EW/ISR Unmanned Underwater Vehicle (UUV) Payload
- Submarine Launched Decoy

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: Strategic Capability R&D Infrastructure	12.410	17.217	18.856	0.000	18.856
Articles:	-	-	-	-	-
Description: Description: Sustains Navy R&D capability for continued operations of the Large Scale Vehicle (LSV-2) and the Intermediate Scale Measurement System (ISMS) test facility in support of VIRGINIA and COLUMBIA Class Programs of Record (plus numerous other smaller programs) and future submarine technology development. Facilities support the conduct of large scale model experiments for submarines. Facilities focus on evaluating the stealth, control, affordability, and operational effectiveness of new technologies					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
that are prototyped on large-scale models. The technology validation provided by the models has provided significantly cost and schedule savings by allowing prototyping and development at just-under full scale vice with first-of-hull assets. ***FY 2016 Accomplishments:*** Conducted system upgrades on ISMS. Conducted LSV2 core ship systems maintenance, maintain crew qualifications, ensure compliance with all LSVSAFE and general regulations, maintain and operate acoustic data systems and all required shore support systems. Continued critical COLUMBIA propulsor trials and conducted propulsor testing. Initiated recapitalization of the LSV2 advance submarine control system. Completed plan for long-term recapitalization of LSV2, including electric drive system replacement conceptual down-selection. ***FY 2017 Plans:*** Continue ongoing system upgrades and replacements on ISMS. Conduct LSV2 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. Continue critical COLUMBIA propulsor trials. Support ship and system alterations to support COLUMBIA signature and propulsor trials, including replacement of LSV acoustic array and underwater tracking systems. Complete recapitalization of the LSV2 advanced submarine control system. Begin design for LSV2 drive system replacement. ***FY 2018 Base Plans:*** Conduct LSV2 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. Operate and maintain ISMS acoustic test range underwater and shore-based facilities. Continue ongoing system upgrades and replacement on ISMS. Test and validate new LSV range acoustic arrays and tracking systems, continue critical COLUMBIA propulsor trials, support advanced array hardware and systems maintenance. Complete replacement of LSV acoustic array and underwater tracking system. Support ship and system alterations to safely support COLUMBIA signature and propulsor trials. ***FY 2018 OCO Plans:*** N/A					
Title: Long Range R&D	18.412	27.592	13.522	0.000	13.522
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Description: Develop advanced technologies and tools to increase current and future submarine capabilities, lower acquisition and life-cycle costs, and enhance the survivability of submarines. Develop technologies and Tactics, Techniques, and Procedures (TTPs) that facilitates new and enhance existing warfighting concepts. The program currently supports development of advanced submarine hull coatings for improved acoustic performance, maintainability, and cost with the objective of near-term implementation on VIRGINIA and COLUMBIA class platforms as well as future submarine classes. The budget line continues to develop submarine alternative propulsion, propeller designs, and stern configurations with potential to significantly reduce submarine acquisition costs while increasing performance. 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, and self-defense that are providing near-term capability and cost reduction for in-service and future submarine classes.					
FY 2016 Accomplishments: Completed data collection of the Advanced CO2 Removal Unit (ACRU) shipboard test cube on aboard SSBN platform (technology baselined for COLUMBIA class insertion). Completed development of Ionic Current Monitoring System (ICMS) technology and started planning a TEMPALT demonstration on a VIRGINIA Class hull. Installed the Advanced Active Shaft Grounding System (AASGS) Electronic Grounding Unit (EGU) TEMPALT on a VIRGINIA Class hull for demonstration at-sea. Completed pierside test planning and EM trial planning for the EGU TEMPALT. Completed development of the AASGS Shaft Current Sensor (SCS) and the Contact Technology (CT) technologies and start planning TEMPALTs on a VIRGINIA Class hull. Initiated performance testing of Sprayable Acoustics Damping System (SADS) Improved Damping Tile System (IDTS) material. Completed the design and fabrication and performed in-water testing of the Advanced Submarine Control (ASC) pump jet technology for the VIRGINIA Class baseline. Completed the fabrication and certification testing of the Advanced Material Propeller (AMP) Generation 2 full scale metallic hub and shipped equipment for extended fatigue testing as part of US-AUS Project Arrangement. Continued to leverage products between Small Business and IR&D efforts. Commenced risk reduction efforts associated with demonstration of high TRL advanced coating system on a VIRGINIA class platform. Defined requirements and finalized program to transition ONR Future Naval Capability (FNC) advanced coating concepts to future undersea platforms. Conducted advanced coating laboratory performance tests for US and UK materials as part of international cooperative project. Initiated submarine advanced signature management programs designed to enhance submarine acoustic and non-acoustic stealth					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
(classified details). Completed at-sea demonstration of the Tension Belt Drogue (TBDD) prototype on 688-class submarine while continuing land-based testing on the Towed Array OA-9070B Dual Belted Diverter (DBD) and Tensioner. Continued developing the Towed Array design and operational loading and distribution predicting tool FNC and conducted land-based and in-water testing with a full-scale instrumented validation towed array to validate the tool. Transitioned towed modelling and handler efforts to the Submarine Acoustic Systems Program Office (PMS 401). ***FY 2017 Plans:*** Install the ICMS TEMPALT on a VIRGINIA Class hull for demonstration at-sea and complete pier-side test and EM trial planning for the TEMPALT. Perform at-sea testing of the AASGS EGU TEMPALT at-sea. Install the AASGS SCS and CT AASGS TEMPALTs on VIRGINIA class platform for demonstration at-sea. Develop CONOPs and performance specifications for the ASC pump jet technology. Continue developing and testing submarine aft and forward ASC pump jet technology and initiate shipboard integration design efforts for the VA Class baseline with PMS450. Manufacture Generation 3 full-scale AMP composite blades and metallic hub. Perform hub and blade assembly testing. Continue to leverage products between Small Business and Independent Research and Development (IR&D) efforts. Assess and study future technologies for future submarine classes and perform studies for cost and platform performance. Identify enabling technologies and submarine concept design integration characteristics. Initiate technology development efforts on critical, long-lead technologies. Define and evaluate new/alternative Next Generation Thrust (NGT) technologies, design concepts, alternative materials and evaluate system configuration arrangements. Perform laboratory stress magnetization and electric model experiments on joint US/UK models. Commence detailed planning associated with large-scale testing to perform underwater electric and magnetic signature testing utilizing UK asset(s) at US range facility. Continue development of submarine advanced signature management efforts (classified details). Conduct advanced coating laboratory performance tests for US and UK advanced hull materials. Initiate industrialization efforts for the ONR FNC advanced treatments. Commence fabrication and testing of treatments and development of an Operational Alternation (OPALT) package. Leverage lessons learns from Virginia class advanced hull treatment demonstration to initiate qualification testing associated with transition of ONR FNC treatment concepts for future platforms. Identify full-scale demonstration opportunities and initiate development of required OPALT data packages. ***FY 2018 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Perform at-sea testing for an EM trial of ICMS TEMPALT. Perform pier-side testing and EM trial of AASGS SCS and CT TEMPALTs. Deliver full-scale Generation 3 AMP composite blades and metallic hub assembly to the Royal Australian Navy (AUS) for demonstration at-sea on a Collins Class submarine. Continue to leverage products between Small Business and Independent Research and Development (IR&D) efforts. Continue NGT design studies and plan small and/or large scale testing of technologies. Develop a plan to integrate and assess impact of proposed NGT technology into future submarine design concepts. Further develop high TRL and low TRL treatment concepts with the UK and support technical exchanges. Continue industrialization and material assessment to transition advanced coatings technologies from ONR FNC effort. Continue development of submarine advanced signature management efforts (classified details). Conduct patch tests of advanced treatments to platforms. SSN/SSGN Survivability Program (S3P) efforts previously funded under this project have moved to Project 3391 under this Program Element. ***FY 2018 OCO Plans:*** N/A					
Title: Rapid Prototyping ***Articles:*** ***Description:*** Conducts Navy and joint demonstrations of advanced technologies and payloads in order to assess the operational value of the technologies and systems under consideration to speed transition of operational capabilities. Focus is to develop, demonstrate, and transition technology projects in an 18 -30 month period. Transition successful, high-interest systems to the acquisition community. ***FY 2016 Accomplishments:*** - Transitioned the AWESUM/Submarine UAS from the study/prototype system that was demonstrated in SEP 2015 in a Joint Concept Test Demonstration to a fully tactical system. Installed AWESUM/Submarine UAS tactical system on US submarine for a full deployment. Transitioned program to the Submarine Combat Control System Program Office (PMS 425). - Completed the Lithium Ion Battery S2F project with certification testing. Established a follow-on project for the rapid prototyping of the design for demonstration and testing on a US submarine in FY18. Main elements of the project included construction of a Lithium-safe SAFECAP design and TEMPALT package for integration into a submarine. - Commenced development of the next generation Electronic Warfare/Intelligence, Surveillance and Reconnaissance (EW/ISR) payload for the FMAUV/Littoral Battle Space (LBS) UUV and associated submarine	7.812 -	10.868 -	3.417 -	0.000 -	3.417 -

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
support and integration. Matured the Submarine Launched Decoy (SLD) to a relevant configuration for at sea testing. Developed a TEMPALT and manufactured test assets for testing in FY17 and transitioned to PMS435. - Initiated the Clandestined Delivered Mine (CDM) rapid prototyping project (FY16 BTR - of $2.0M). Initiated efforts for submarine integration of multiple advanced UAS payloads with a common communication architecture.					
FY 2017 Plans: - Continue development of the Lithium Ion SAFECAP design and prepare TEMPALT packages for full-scale mission demonstration. - Complete development of the submarine Launched Decoy and conduct at-sea testing and analysis. Transition project to the Submarine Sensors Program Office (PMS435). - Complete development of the next generation EW/ISR payload for the FMAUV/LBS vehicle and conduct at-sea test demonstration. Transition payload to the Battlespace Awareness and Information's Operations Program Office (PMW 120). - Initiate rapid prototyping project to develop a common, communication architecture for employment of UAS from submarines (Blackwing and Experimental Fuel (XFC) UAVs). Project will conduct a demonstration of this architecture in a submarine mast by the end of FY18. - Continue CDM rapid prototyping project. Tasks include vehicle design and development efforts to support a late FY17 procurement contract for the vehicle system and initiation of a full Weapons System Explosive Safety Review Board (WSESRB) process (transition office is TBD). To continue CDM efforts, FY18 expenditures will be funded FY17 carryover funding.					
FY 2018 Base Plans: - Conduct at-sea testing of the final submarine SAFECAP hardware and TEMPALT package. Transition the design into the LBS program of record in the Battlespace Awareness and Information's Operations Program Office (PMW 120). - Conduct testing of the common, communication architecture for UAS from a submarine or land-based test facility. Initiate transition to Combat Control System (PMS425), Submarine Imaging & Electronic Warfare (PMS435) and Communications (PMW770) program offices. Continue integration and testing of innovative payload concepts into off-hull platforms. Initiate development of an advanced long-range fiber deployable buoy for submarine safety and ISR. Initiate TEMPALT design and operational test plan development.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continue CDM rapid prototyping project and conduct initial at-sea assessments. Continue to conduct safety and certification analysis and reviews to ensure Weapons System Explosive Safety Review Board (WSESRB), Fuse and Initiation System Technical Review Panel (FISTRP), and the Software Safety Technical Review Panel (SSSTRP) certification. Conduct study TEMPALT shock certification, implosion certification, information assurance, hydrodynamic release analysis and other TEMPALT requirements. Initiate technical authority review and approval process for submarine TEMPALT. FY18 CDM efforts to include vehicle procurement, integration testing and initial in-water testing will be financed with FY 17 carryover. ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	38.634	55.677	35.795	0.000	35.795

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

F2033: 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. Sole source Concept Formulation (CONFORM) contracts with the only two submarine design/construction shipyards, General Dynamics Electric Boat (GDEB) and Huntington Ingalls Industries (HII) facilitate this process. Use of topic-specific Broad Area 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 technology Hull Mechanical & Electrical (HM&E) and payload systems.

E. Performance Metrics

To enable transition of a minimum of three technology challenge solutions supporting emergent warfighter needs.
- Sustain critical one of a kind national Research and Development (R&D) hydroacoustic infrastructure enabling the design and assessment of VIRGINIA Class, OHIO Replacement, and future submarine class designs.
- Deliver 2-3 Rapid Prototype projects annually to evaluating future submarine technology/payload concepts.
- Tactical deployment of AWESUM/Submarine UAS system on a US submarine.
- Assess as-built VIRGINIA and SSGN submarines for design drivers/design tools and model validation to define R&D needs for future submarine classes.
- Test innovative Towed Array Handler concept focused on improving system reliability and fleet operational availability.
- Develop future coatings to enable continued acoustic superiority of VA Class design.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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*

- Successfully construct and deliver full-scale advanced material propeller for at-sea testing.

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Navy			Date: May 2017
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 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	WR	NSWC PHILLY : Philly, PA	0.000	0.165	Dec 2015	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	MIPR	CNA : Alex, VA	1.060	0.430	Feb 2016	0.200	Feb 2017	0.204	Feb 2018	-		0.204	0.000	1.894	-
Product Development	SS/CPFF	Lockheed Martin : Manassas, VA	1.500	0.217	Dec 2015	0.000		0.000		-		0.000	0.000	1.717	-
Product Development	WR	NRL : Washington, DC	1.423	0.895	Feb 2016	0.000		0.000		-		0.000	0.000	2.318	-
Product Development	SS/CPFF	Rolls Royce, Marine North America : New Bedford, MA	2.580	0.500	Mar 2016	0.000		0.000		-		0.000	0.000	3.080	-
Product Development	SS/CPFF	SupShips : Groton, CT	2.434	0.524	Feb 2016	0.000		0.000		-		0.000	0.000	2.958	-
Product Development	WR	Applied Physical Sciences : Groton, CT	0.400	0.086	Dec 2015	0.000		0.000		-		0.000	0.000	0.486	-
Product Development	SS/CPFF	HII : Newport News, VA	8.580	0.000	Apr 2016	4.730	Apr 2017	4.750	Apr 2018	-		4.750	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Dahlgren, VA	5.271	0.060	Dec 2015	0.000		0.000		-		0.000	0.000	5.331	5.241
Product Development	SS/CPFF	EB : Groton, CT	58.126	3.525	Apr 2016	17.104	Apr 2017	2.901	Apr 2018	-		2.901	Continuing	Continuing	Continuing
Product Development	SS/CPFF	Raytheon : Portsmouth, RI	16.034	0.200	Nov 2015	0.000		0.000		-		0.000	0.000	16.234	16.340
Product Development	WR	NSWC : Carderock, MD	85.469	3.744	Apr 2016	5.705	Apr 2017	5.750	Apr 2018	-		5.750	Continuing	Continuing	Continuing
Product Development	SS/CPFF	ARL/PSU : State College, PA	7.758	0.670	Apr 2016	0.575	Apr 2017	0.580	Apr 2018	-		0.580	Continuing	Continuing	Continuing
Product Development	SS/CPFF	UT/ARL : Austin, TX	6.300	1.076	Dec 2015	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JHU/APL : Laurel, MD	18.922	3.075	May 2016	1.200	Apr 2017	1.224	Apr 2018	-		1.224	Continuing	Continuing	Continuing
Product Development	Various	Various : Various	35.921	0.000		0.289	Apr 2017	0.290	Apr 2018	-		0.290	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Newport, RI	71.219	4.914	Mar 2016	1.820	Mar 2017	1.825	Mar 2018	-		1.825	Continuing	Continuing	Continuing
Product Development	WR	ONR : Arlington, VA	8.641	1.583	Dec 2015	0.000		0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Navy		Date: May 2017
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 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	SS/CPFF	Progeny : Manassas VA	0.620	0.075	Dec 2015	0.000		0.000		-		0.000	0.000	0.695	-
		Subtotal	332.258	21.739		31.623		17.524		-		17.524	-	-	-

Remarks

Various/VAR is used to group multiple activities with small funding levels.
Activities will be incrementally funded. The award dates reflect the latest incremental portion funds will obligate.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	SS/CPFF	Various : Various	12.304	1.313	Jun 2016	1.339	Jun 2017	1.340	Jun 2018	-		1.340	Continuing	Continuing	Continuing
Government Engineering Support	WR	Various : Various	6.513	0.350	Mar 2016	0.350	Mar 2017	0.357	Mar 2018	-		0.357	Continuing	Continuing	Continuing
Travel	WR	NAVSEA HQ : Not Specified	0.859	0.144	Apr 2016	0.100	Mar 2017	0.102	Mar 2018	-		0.102	Continuing	Continuing	Continuing
Acquisition Workforce	Various	Not Specified : Not Specified	0.293	0.000		0.000		0.000		-		0.000	0.000	0.293	0.293
		Subtotal	19.969	1.807		1.789		1.799		-		1.799	-	-	-

Remarks

Various/VAR is used to group multiple activities with small funding levels.
Activities will be incrementally funded. The award dates reflect the latest incremental portion funds will obligate.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	SS/CPFF	EB : Groton, CT	11.998	1.700	Mar 2016	5.800	May 2017	5.810	May 2018	-		5.810	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Navy			Date: May 2017
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 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	SS/CPFF	Raytheon : Portsmouth, VA	9.104	0.000		0.000		0.000		-		0.000	0.000	9.104	9.104
Developmental Test & Evaluation	Various	Various : Various	7.387	0.000		0.670	Apr 2017	0.675	Apr 2018	-		0.675	0.000	8.732	6.372
Developmental Test & Evaluation	WR	NUWC : Newport, RI	20.883	2.000	Apr 2016	7.050	Apr 2017	1.255	Apr 2018	-		1.255	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NSWC : Carderock, MD	34.629	9.263	Apr 2016	6.745	Apr 2017	6.732	Apr 2018	-		6.732	Continuing	Continuing	Continuing
Developmental Test & Evaluation	SS/CPFF	HII : Newport News, VA	5.794	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Developmental Test & Evaluation	SS/CPFF	JHU/ARL : Laurel, MD	1.805	2.000	May 2016	2.000	Apr 2017	2.000	Apr 2018	-		2.000	0.000	7.805	0.305
Developmental Test & Evaluation	SS/CPFF	ARL/PSU : State College, PA	0.720	0.125	Dec 2015	0.000		0.000		-		0.000	0.000	0.845	0.720
		Subtotal	92.320	15.088		22.265		16.472		-		16.472	-	-	-

Remarks

Various/VAR is used to group multiple activities with small funding levels.
Activities will be incrementally funded. The award dates reflect the latest incremental portion funds will obligate.

	Prior Years	FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	444.547	38.634		55.677		35.795		-		35.795	-	-	-

Remarks

Exhibit R-4, RDT&E Schedule Profile: FY 2018 Navy		Date: May 2017
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*

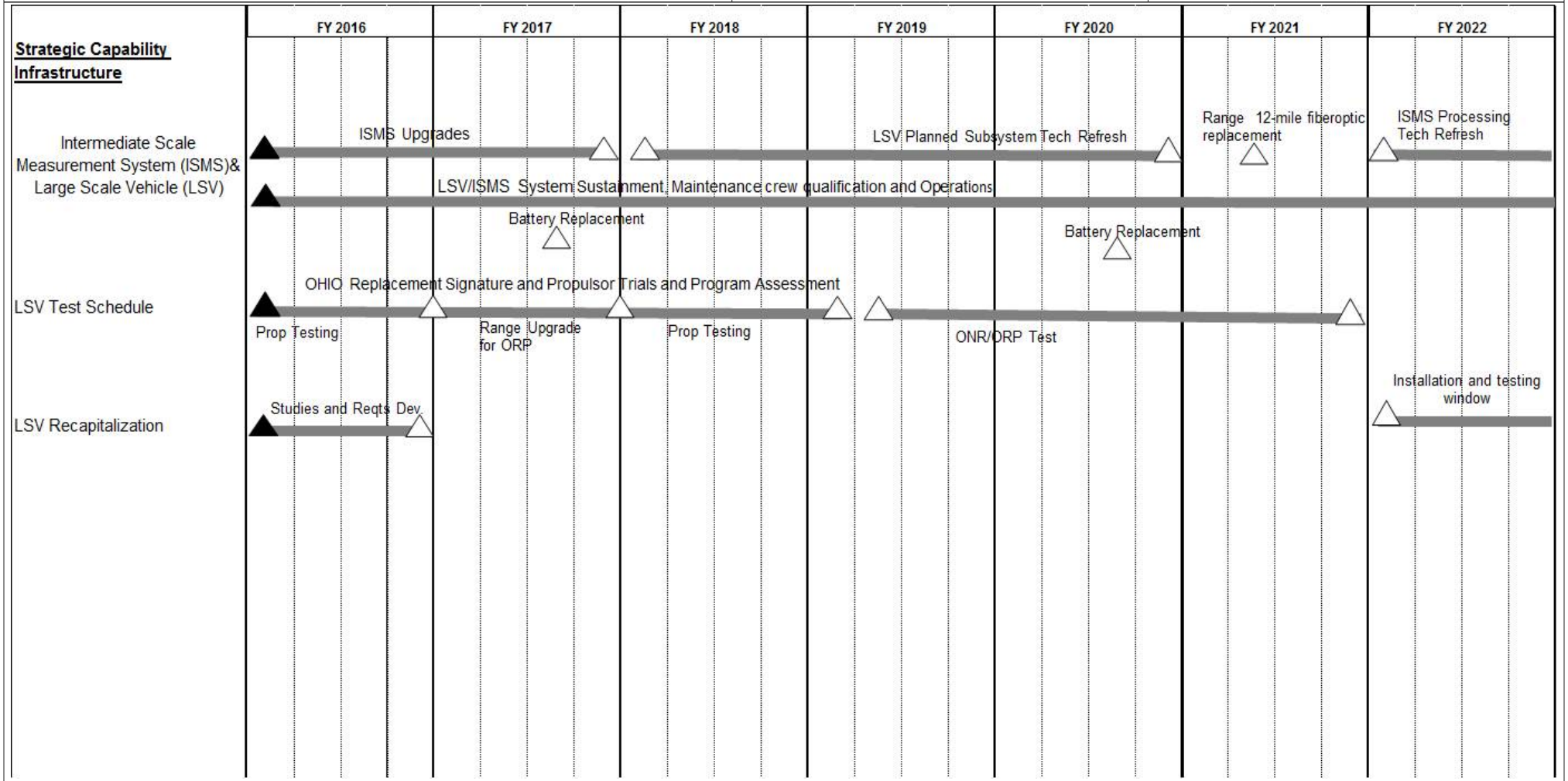


Exhibit R-4, RDT&E Schedule Profile: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

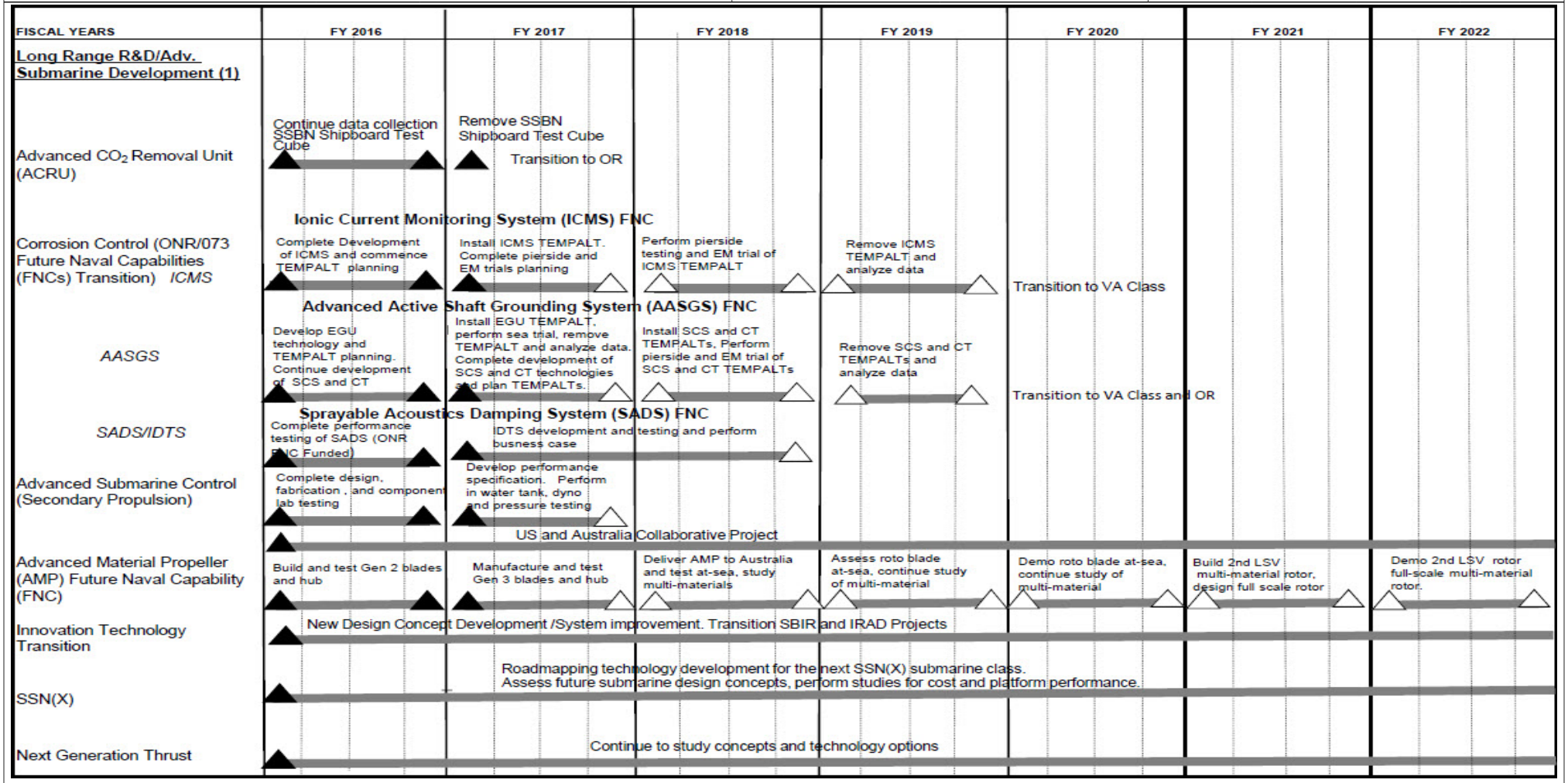


Exhibit R-4, RDT&E Schedule Profile: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

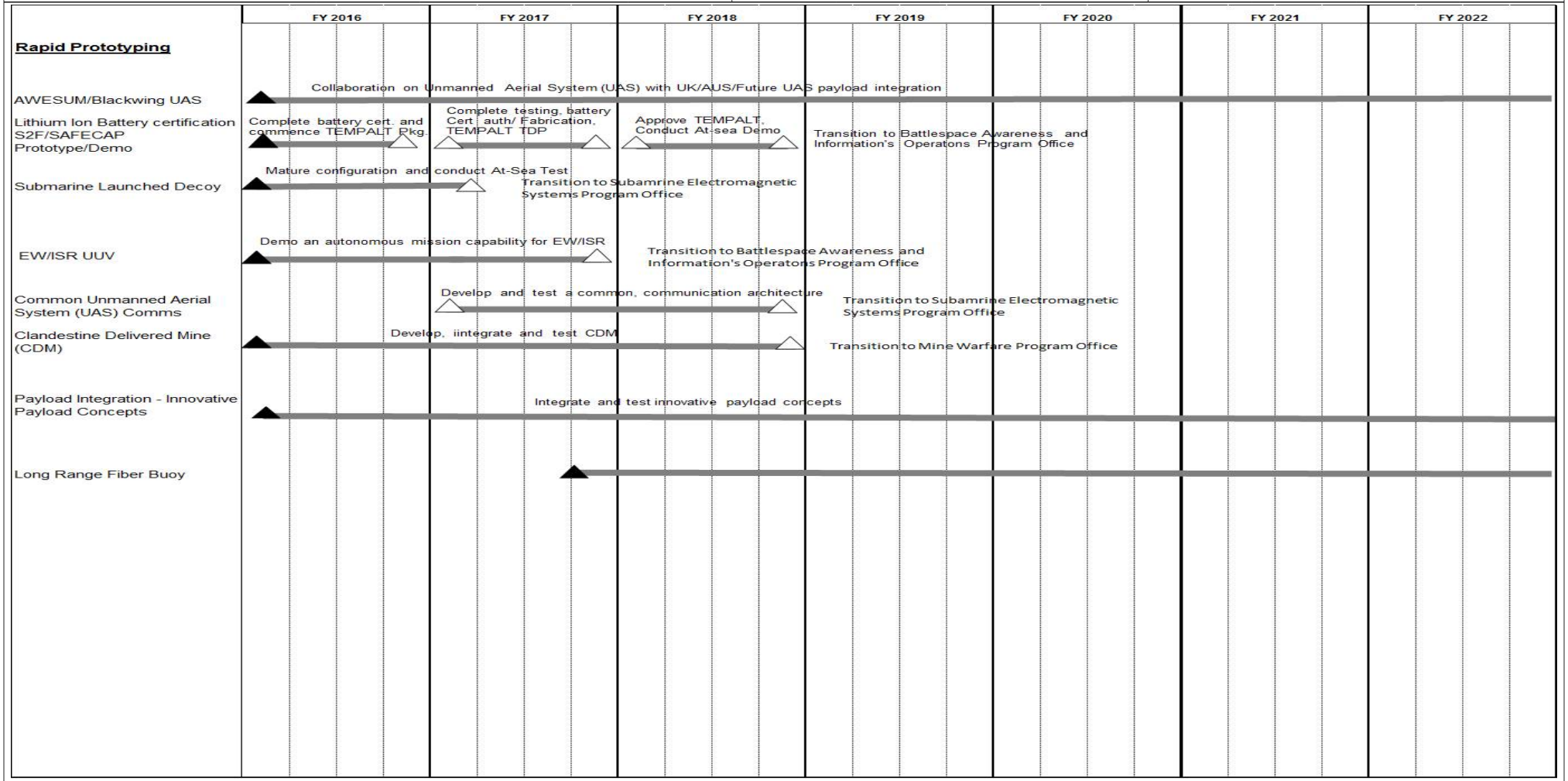


Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2033				
Strategic Capability Infrastructure: ISMS/LSV - ISMS Upgrades	1	2016	4	2017
Strategic Capability Infrastructure: ISMS/LSV - LSV Planned Subsystem Tech Refresh	1	2018	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	2022
Strategic Capability Infrastructure: ISMS /LSV - Sustainment, Maintenance,Crew Qualification and Operations	1	2016	4	2022
Strategic Capability Infrastructure: ISMS /LSV - Battery Replacement (BR)	3	2017	3	2017
Strategic Capability Infrastructure: ISMS /LSV - BR	3	2020	3	2020
Strategic Capability Infrastructure: LSV Test Schedule - Prop Testing	1	2016	4	2016
Strategic Capability Infrastructure: LSV Test Schedule - Range Upgrade for LSV	1	2017	4	2017
Strategic Capability Infrastructure: LSV Test Schedule - Propeller Testing	1	2018	1	2019
Strategic Capability Infrastructure: LSV Test Schedule - ONR/ORP Test	2	2019	4	2021
Strategic Capability Infrastructure: LSV Recapitalization - Studies and Requirements Dev.	1	2016	4	2016
Strategic Capability Infrastructure: LSV Recapitalization - Installation and Testing Window	1	2022	4	2022
Long Range R&D/Advanced Submarine Development: Advanced CO2 Removal Unit (ACRU) - Continue data collection SSBN Shipboard Test Cube	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Advanced CO2 Removal Unit (ACRU) - Remove SSBN Shipboard Test Cube	1	2017	1	2017
Long Range R&D/Advanced Submarine Development: Corrosion Control - ICMS - Complete Development of ICMS and commence TEMPALT Planning	1	2016	4	2016

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
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 Submarine Development: Corrosion Control - ICMS - Install ICMS TEMPALT. Complete Pierside and EM trials planning	1	2017	4	2017
Long Range R&D/Advanced Submarine Development: Corrosion Control - ICMS - Perform pierside testing and EM Trial TEMPALT	1	2018	4	2018
Long Range R&D/Advanced Submarine Development: Corrosion Control - AASGS - Install EGU TEMPALT and complete planning. Commence TEMALT planning for SCS and CT Technologies	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Corrosion Control - AASGS - Monitor EGU TEMPALT at-sea. Install SCS and CT TEMPALTs. Complete SCS and CT Pierside and EM trial TEMPALT planning	1	2017	4	2017
Long Range R&D/Advanced Submarine Development: Corrosion Control - AASGS - Remove EGU TEMPALT. Perform pierside and EM trial, SCS and CT TEMPALT testing	1	2018	4	2018
Long Range R&D/Advanced Submarine Development: Corrosion Control - AASGS - Remove TEMPALTS and analyze data	1	2019	4	2019
Long Range R&D/Advanced Submarine Development: Corrosion Control - SADS - Complete performance testing (ONR funded)	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Advanced Submarine Control (ASC) - Complete design, fabrication & certification testing	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Advanced Submarine Control - (ASC) - Develop CONOPS and performance specification and testing. Initiate Shipboard Integration	1	2017	4	2017
Long Range R&D/Advanced Submarine Development: Advanced Material Propeller - US and Australia Collaborative Project	1	2016	4	2022
Long Range R&D/Advanced Submarine Development: Advanced Material Propeller (AMP) - Build and test Gen 2 blades and hub	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Advanced Material Propeller - Manufacture and test Gen 3 blades and hub	1	2017	4	2017

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
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 Submarine Development: Advanced Material Propeller (AMP) - Deliver AMP to Australia and test at-sea, study multi-material	1	2018	4	2018
Long Range R&D/Advanced Submarine Development: Advanced Material Propeller (AMP) - Assess roto blade at-sea, continue study of multi-material	1	2019	4	2019
Long Range R&D/Advanced Submarine Development: Advanced Material Propeller (AMP) - Demo roto blade at-sea, continue study of multi-material	1	2020	4	2020
Long Range R&D/Advanced Submarine Development: Advanced Material Propeller (AMP) - Build 2nd LSV multi-material rotor, design full scale rotor	1	2021	4	2021
Long Range R&D/Advanced Submarine Development: Advanced Material Propeller (AMP) - Demo 2nd LSV rotor full-scale multi-material rotor	1	2022	4	2022
Long Range R&D/Advanced Submarine Development: Innovation Technolology Transition (SBIR transition) - New Design Concept Dev.,/Sys. improvement. Transition SBIR and IRAD projects	1	2016	4	2022
Long Range R&D/Advanced Submarine Development: SSN(X) - Roadmapping technology developnent for the next submarine class	1	2016	4	2022
Long Range R&D/Advanced Submarine Development: Next Generation Thrust (NGT)	1	2016	4	2022
Long Range R&D/Advanced Submarine Development: Electromagnetic Signatures Project Arrangement with UK & Advanced Signature Management FNC	1	2016	4	2022
Long Range R&D/Advanced Submarine Development: Advanced Hull Coatings - Joint US/UK Coatings Development and Modeling	1	2016	4	2017
Long Range R&D/Advanced Submarine Development: Advanced Hull Coatings - Transition ONR Future Naval Capability (FNC) Hull Coatings	1	2016	4	2022
Long Range R&D/Advanced Submarine Development: Advanced Hull Coatings - Develp OPALT Treatment pkg and begin Long Lead Procurement	2	2016	2	2017
Long Range R&D/Advanced Submarine Development: Advanced Hull Coatings - Finalize Requirements and Treatment Configuration	3	2017	2	2018
Long Range R&D/Advanced Submarine Development: Advanced Hull Coatings - Treatment Installation, conduct at-sea test on VA Class Submarine	3	2018	4	2019

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
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 Submarine Development: Advanced Hull Coatings - Data Analysis	1	2020	4	2022
Long Range R&D/Advanced Submarine Development: Next Generation Towed Array Handler (NGTAH) and In-Service Reliability - Complete at-sea demo	1	2016	1	2016
Long Range R&D/Advanced Submarine Development: Next Generation Towed Array Handler and In-Service Reliability - Perform Landbased test on the belt diverter and Tensioner. Transition to PMS401	2	2016	4	2016
Long Range R&D/Advanced Submarine Development: Towed Array Reliability Improvement FNC - Conduct landbased and in-water testing	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Towed Array Reliability Improvement FNC - Conduct at-sea testing and update software tools	1	2017	4	2017
Long Range R&D/Advanced Submarine Development: Towed Array Reliability Improvement FNC - Develop and validate software Tools for Predicting Array Operational Loading & Distribution (FNC)	1	2016	4	2017
Long Range R&D/Advanced Submarine Development: Advanced Signature Management FNC	1	2019	1	2022
Long Range R&D/Advanced Submarine Development: Longe Range FIber Buoy	1	2016	4	2019
Long Range R&D/Advanced Submarine Development: SSN/SSGN (S3P) - Address gaps in stealth and survivability for SSN and SSGNs	1	2016	4	2017
Long Range R&D/Advanced Submarine Development: Operational Survivability Assessment - Annual assessment of states of S3P with respect to adversary capability and available science	1	2016	4	2017
Long Range R&D/Advanced Submarine Development: Operational Survivability - Assessment of SSN/SSGN acoustic health as requested by the SOG	1	2016	4	2017
Long Range R&D/Advanced Submarine Development: Non-Acoustic Assessment - Assessment of SSN/SSGN non-acoustic health as requested by the SOG	1	2016	4	2017
Long Range R&D/Advanced Submarine Development: SAS Sea Testing - Sub vs. Sub Sea Testing	1	2016	4	2017

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
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 Submarine Development: Mast Sea Testing - RCS Measurement and Operational Tesing	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: NOMAD - Model, Test, and Analysis	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Communication - Model, Test and Analysis	1	2016	4	2017
Long Range R&D/Advanced Submarine Development: Fixed Arrays - Sea Test and Analysis	1	2017	4	2017
Long Range R&D/Advanced Submarine Development: Sea Test Validation Program - Sea Test and Analysis (1-2 per year)	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Sea Test Validation Program - Sea Test and Analysis	1	2017	4	2017
Long Range R&D/Advanced Submarine Development: PELAGOS - Sea Test Tactical TEMPALT	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: PELAGOS - Commence Project to Program of Record, Initiate VA Tactical version/configuration	1	2017	4	2017
Long Range R&D/Advanced Submarine Development: Submarine Acoustic Superiority (SAS) - Utility Analysis	1	2017	4	2017
Long Range R&D/Advanced Submarine Development: Countermeasure #1 Development - At-seaTest/Validate Models	1	2016	4	2016
Long Range R&D/Advanced Submarine Development: Countermeasure #1 Development - Update Algorithms	1	2017	4	2017
Rapid Prototyping: AWESUM JCTD - Collaboration on Unmanned Aerial System (UAS) with UK/AUS/Future payload integration	1	2016	4	2022
Rapid Prototyping: Lithium Ion Battery Certification - Complete battery certification and TEMPALT Technical Data Pkg (TDP)	1	2016	4	2016
Rapid Prototyping: Lithium Ion Battery Certification -Complete testing, certification approval, fabrication, TEMPALT TDP	1	2017	4	2017

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
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**
Rapid Prototyping: Lithium Ion Battery Certification - Approve TEMPALT, conduct at-sea demo. Transition to Battlespace Awareness and Information Operations Program Office	1	2018	4	2018
Rapid Prototyping: Submarine Launch Decoy - Mature configuration and conduct At-Sea Test	1	2016	4	2017
Rapid Prototyping: EW/ISR UUV - Demo an autonomous mission capability for EW/ISR	1	2016	4	2017
Rapid Prototyping: Common Unmanned Aerial System (UAS) Coms	1	2017	4	2018
Rapid Prototyping: Clanedestine Delivered Mine (CDM) - Develop, integrate and test CDM	1	2016	4	2018
Rapid Prototyping: Payload Integration - Innovative Payload Concepts	1	2016	4	2022

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / *Advanced Submarine System Development*	Project (Number/Name) 2096 / *Payload Delivery Development*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
2096: *Payload Delivery Development*	0.000	0.000	8.392	15.738	-	15.738	19.889	26.622	9.391	8.749	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Payload Delivery Development is a non-acquisition program that supports innovative research and development efforts to enable integration of deployable and /or retrievable undersea vehicles, payload concepts, and offboard systems through design, manufacture, test/demonstration, evaluation, and validation for submarine platforms. In addition to technology development, the program will support engineering and integration of new and existing technologies to enable rapid prototyping and fielding of capabilities which will inform and provide solutions to urgent war-fighter needs. Experimentation and demonstration will be conducted with the Fleet (i.e., CSF, UUVRON, etc.) enabling an agile environment to demonstrate and provide high velocity learning through at-sea demonstrations, which will provide the Fleet and acquisition communities relevant employment data to inform CONOPs and fielding decisions. The program will furthermore support transition of high-interest systems and/or payloads from research and development to Programs of Record (PoRs), as appropriate.

Payload Handling System (PHS)
PHS is used to enable capabilities for the integration of large deployable and retrievable undersea vehicles, payloads, and offboard systems with submarines. RDT&EN funding will be used to design, manufacture, and field an integrated system utilized with submarine large ocean interfaces to enable launch and recovery of systems such as the Navy's Snakehead Large Diameter Unmanned Underwater Vehicle (LDUUV), the Shallow Water Combat Submersible (SWCS), and the LBS-AUV(S) from submarines, a capability which does not currently exist. This capability will allow the Submarine Force the flexibility to launch and recover Snakehead, SWCS, LBS-AUV(S), and other advanced systems of various configurations in support of critical Undersea Warfare (USW) missions, providing battle space awareness and extending war-fighting reach. 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, Seabed Warfare, Counter - Autonomous Underwater Vehicle (AUV) Warfare, Electromagnetic Maneuver Warfare (EMMW), Deception, and Non-Lethal Sea Control. This capability is paramount to countering evolving threats from emerging world powers and maintaining dominance in the undersea domain.

Program growth from FY17 to FY18 is required in order to provide necessary design and engineering team support for the completion of preliminary design review (PDR) for the PHS and transition to critical design in FY18. The nominal level of preliminary design tasking planned for FY17 will be increased significantly in FY18 to support development of design products which will comprise the technical package for PDR and the basis for detailed design to support critical design review (CDR). Additional FY18 growth efforts will include development of interface control between PHS, submarine platforms, and hosted offboard systems, and collaborative engineering efforts required for integration into both current and future submarine designs. Funding below requested levels would result in delay of PHS delivery and risk to payload integration into current and future submarines, severely limiting Fleet capability to launch and recover undersea vehicles, payloads, and offboard systems in support of critical undersea warfare (USW) missions. Additionally, all far forward USW mission tasking will continue to be limited to only manned platforms and prevent the Submarine Force from exploiting the potential of offboard systems for conducting otherwise impossible tasks.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

3" Sub Launched Unmanned Aerial System (SL-UAS)
SL-UAS project supports the future missions of the VIRGINIA Class Program and its payload module. The project will focus on the overall design, system engineering, prototyping, demonstrations, and qualification activities needed to execute the integration of a payload with Blackwing for rapid deployment with an integrated solution into existing shipboard systems. This system will be demonstrated on a US Submarine, at a land based facility, or on another host platform by the end of FY20. Capability will transition to the Submarine Combat Control System Program Office (PMS 425).

The following key activities support a critical capability for Undersea Warfare (USW) missions by providing close-in defense for the Submarine Force against adversary systems:

1. Engineering and integration of existing/proven technology and payloads required to provide the capabilities to maintain dominance in the undersea domain.
2. Communication modifications for transition of new capability into both current and future submarine designs.
3. Testing and demonstrations necessary to prove out the capability and Concept of Operations (CONOP).
4. Development of a high density storage system to safely stow proposed equipment types onboard submarines.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: Payload Handling System (PHS)	0.000	8.392	9.038	0.000	9.038
Articles:	-	-	-	-	-
FY 2016 Accomplishments: N/A					
FY 2017 Plans: Conduct non-recurring engineering to support preliminary design of PHS for integration of government and industry payloads and offboard systems into the Submarine Force: Start development of the following for PDR: -System Arrangement -Structural Analysis -Hydrodynamic Load Case Modeling/Analysis -Shock Modeling/Analysis -Interface Control Documentation					
FY 2018 Base Plans: Continue non-recurring engineering to support completion of preliminary design review (PDR). Commence detailed/critical design of PHS to support integration of government and industry payloads and offboard systems into the Submarine Force: Start/Continue/Complete development of the following for PDR:					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
-System Arrangement -Structural Analysis -Hydrodynamic Load Case Modeling/Analysis -Shock Modeling and Analysis -Interface Control Documentation -System Schematic and Diagram -Payload Handling Element Material Friction Test -Payload Handling Element Design -Hydraulic System Design -Electrical and Control System Design -Complete PDR Start the following for CDR: -Payload Handling Element Detailed Design -Hydraulic System Detailed Design -Electrical and Control System Detailed Design -System Schematic and Diagram update based on detailed design -System Arrangement based on detailed design -Detailed Structural Analysis -Detailed Hydrodynamic Load Case Modeling/Analysis -Detailed Shock Modeling/Analysis -Interface Control Documentation -Long Lead Material Identification -Manufacturing Cost Estimate Development -Operating Procedure Development -Hazard Assessment Development -Failure Modes and Effects Analysis ***FY 2018 OCO Plans:*** N/A					
Title: 3" Sub Launched Unmanned Aerial System (SL-UAS)	0.000	0.000	6.700	0.000	6.700
Articles:	-	-	-	-	-
FY 2016 Accomplishments:					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
N/A ***FY 2017 Plans:*** N/A ***FY 2018 Base Plans:*** Initiate rapid prototyping and system engineering efforts required for integration of a payload with the Blackwing design (including review and modification of system requirements, communications, interface and drawings for payload equipment, and system and subsystem detailed design). Start/Complete the following efforts: - Define system requirements of UAV, cannister, and payload - UAV reliability/production effort - Further development of MCM/MMM and common data link - Initial payload determination and testing - Demonstration preparation (UAS test systems material procurement and builds; development of special test fixtures; and demo requirements) - Safe storage effort (capability/requirements development) ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	0.000	8.392	15.738	0.000	15.738

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Payload Delivery Development is a non-acquisition program that leverages government laboratories and field activities to enable research and development efforts in support of technology and system development, manufacture, testing, integration and fielding on submarine host platforms. Engage with industry and utilize various contracts (i.e., sole-source, competitive) from broad solicitations as necessary to facilitate development and production support and rapid integration of payloads and offboard systems.

E. Performance Metrics

Payload Handling System (PHS)

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

Completion of Preliminary Design Review (PDR). Commencement of Critical Design.

3" Sub Launched Unmanned Aerial System (SL-UAS)
Updated Master Schedule and design down-select. Development of design documentation and interface control requirements. Completion of Detailed Design Review.

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Navy			Date: May 2017
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603561N / *Advanced Submarine System Development*	Project (Number/Name) 2096 / *Payload Delivery Development*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	WR	NUWC NPT : Newport, RI	0.000	0.000		1.624	May 2017	3.047	Oct 2017	-		3.047	Continuing	Continuing	Continuing
Product Development	WR	NSWC PD : Philadelphia, PA	0.000	0.000		3.150	May 2017	3.488	Oct 2017	-		3.488	Continuing	Continuing	Continuing
Product Development	WR	NUWC KPT : Keyport, WA	0.000	0.000		1.650	May 2017	4.288	Oct 2017	-		4.288	Continuing	Continuing	Continuing
Product Development	WR	PSNS : Bremerton, WA	0.000	0.000		1.598	May 2017	0.628	Oct 2017	-		0.628	Continuing	Continuing	Continuing
Product Development	WR	NSWC CD : West Bethesda, MD	0.000	0.000		0.330	May 2017	1.546	Oct 2017	-		1.546	Continuing	Continuing	Continuing
Product Development	SS/CPFF	AeroVironment : Simi Valley, CA	0.000	0.000		0.000		2.250	Jan 2018	-		2.250	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		8.352		15.247		-		15.247	-	-	-

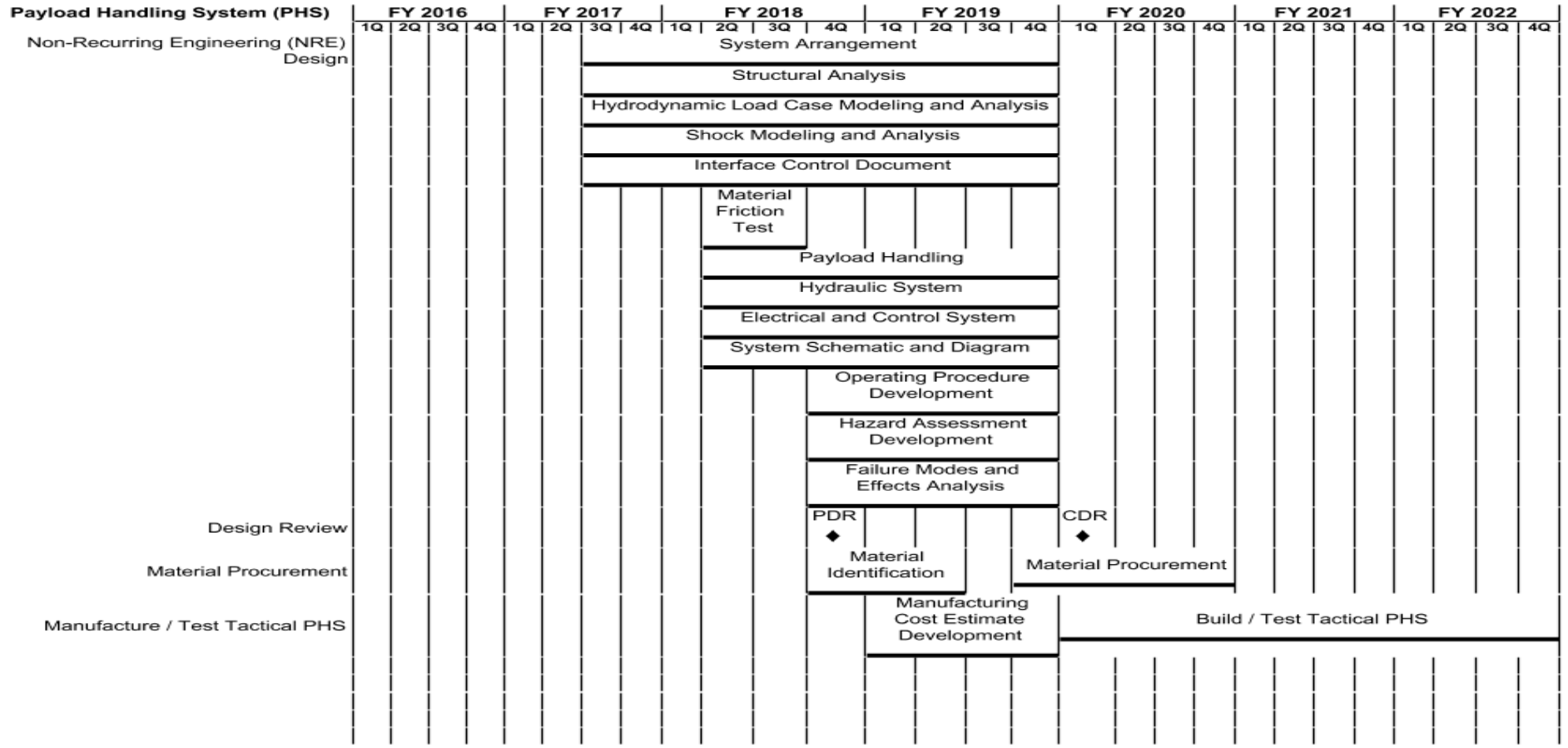
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Allot	NAVSEA HQ : Washington DC	0.000	0.000		0.040	May 2017	0.191	Oct 2017	-		0.191	Continuing	Continuing	Continuing
Contractor Management Services	C/CPAF	TBD : TBD	0.000	0.000		0.000		0.300	Oct 2017	-		0.300	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.040		0.491		-		0.491	-	-	-

	Prior Years	FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		8.392		15.738		-		15.738	-	-	-

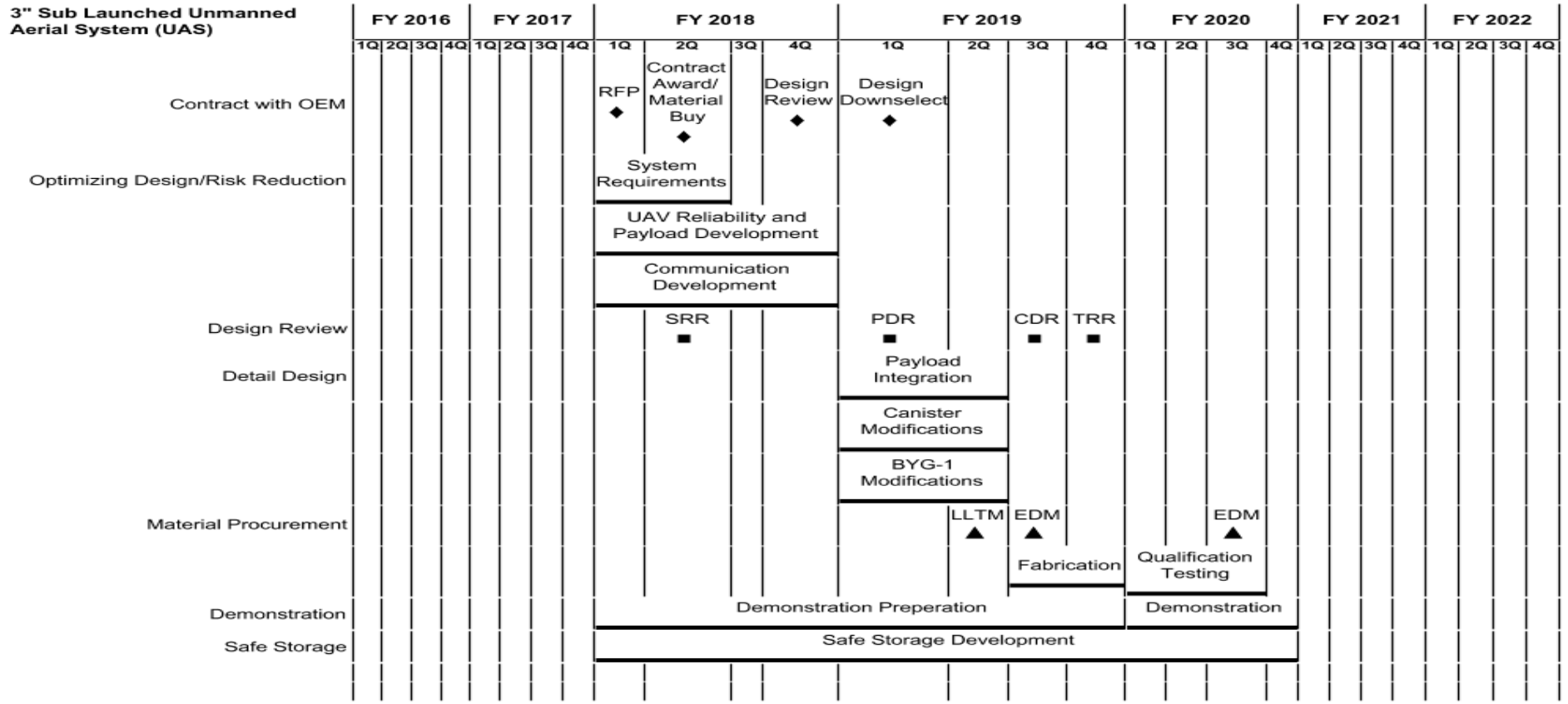
Remarks

Exhibit R-4, RDT&E Schedule Profile: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*



2018PB - 0603561N - 2096

Exhibit R-4, RDT&E Schedule Profile: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*



2018PB - 0603561N - 2096

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
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)				
Non-Recurring Engineering (NRE) Design: System Arrangement Development	3	2017	4	2019
Non-Recurring Engineering (NRE) Design: Structural Analysis	3	2017	4	2019
Non-Recurring Engineering (NRE) Design: Hydrodynamic Load Case Modeling and Analysis	3	2017	4	2019
Non-Recurring Engineering (NRE) Design: Shock Modeling and Analysis	3	2017	4	2019
Non-Recurring Engineering (NRE) Design: Interface Control Document	3	2017	4	2019
Non-Recurring Engineering (NRE) Design: Payload Handling Element Material Friction Test	2	2018	3	2018
Non-Recurring Engineering (NRE) Design: Payload Handling Element Design Development	2	2018	4	2019
Non-Recurring Engineering (NRE) Design: Hydraulic System Design Development	2	2018	4	2019
Non-Recurring Engineering (NRE) Design: Electrical and Control System Design Development	2	2018	4	2019
Non-Recurring Engineering (NRE) Design: System Schematic and Diagram Development	2	2018	4	2019
Non-Recurring Engineering (NRE) Design: Operating Procedure Development	4	2018	4	2019
Non-Recurring Engineering (NRE) Design: Hazard Assessment Development	4	2018	4	2019
Non-Recurring Engineering (NRE) Design: Failure Modes and Effects Analysis	4	2018	4	2019
Design Review: Preliminary Design Review	4	2018	4	2018
Design Review: Critical Design Review	1	2020	1	2020
Material Procurement: Material Identification	4	2018	2	2019
Material Procurement: Material Procurement	4	2019	4	2020

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Manufacture / Test Tactical PHS: Manufacturing Cost Estimate Development	1	2019	4	2019
Manufacture / Test Tactical PHS: Manufacture / Test Tactical PHS	1	2020	4	2022
3" Sub Launched Unmanned Aerial System (UAS)				
Contract with OEM: Request for Proposal	1	2018	1	2018
Contract with OEM: Contract Award/ All-up Round Material Purchase	2	2018	2	2018
Contract with OEM: Design Review	4	2018	4	2018
Contract with OEM: Design Downselect	1	2019	1	2019
Optimizing Design/Risk Reduction: System Requirements	1	2018	2	2018
Optimizing Design/Risk Reduction: UAV Reliability and Payload Development	1	2018	4	2018
Optimizing Design/Risk Reduction: Communication Development	1	2018	4	2018
Design Review: System Requirements Review	2	2018	2	2018
Design Review: Preliminary Design Review	1	2019	1	2019
Design Review: Critical Design Review	3	2019	3	2019
Design Review: Test Readiness Review	4	2019	4	2019
Detail Design: Payload Integration	1	2019	2	2019
Detail Design: Canister Modifications	1	2019	2	2019
Detail Design: BYG-1 Modifications	1	2019	2	2019
Material Procurement: Long Lead Time Material	2	2019	2	2019
Material Procurement: Communication Upgrade EDM (a)	3	2019	3	2019
Material Procurement: Communication Upgrade EDM (b)	3	2020	3	2020
Material Procurement: Fabrication	3	2019	4	2019
Material Procurement: Qualification Testing	1	2020	3	2020
Demonstration: Demonstration Preperation	1	2018	4	2019
Demonstration: Demonstration	1	2020	4	2020
Safe Storage: Safe Storage Development	1	2018	4	2020

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
3391: *SSN/SSGN Survivability Program*	0.000	0.000	0.000	8.594	-	8.594	8.454	8.743	8.889	9.063	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 3391 SSN/SSGN Survivability Program (S3P): Project realigned in FY18. S3P previously funded under Project 2033 through FY17. The S3P is chartered by OPNAV N97 to assure SSN/SSGN survivability and the ability of submarines to complete their missions even if covert mobility is compromised.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: SSN/SSGN Survivability Program	0.000	0.000	8.594	0.000	8.594
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 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 also evolving 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 penetrating contested waters and operating in the littorals. S3P supports fleet development of Tactics, Techniques, and Procedures (TTPs) that facilitate new or enhance existing warfighting concepts.

FY 2016 Accomplishments:
FY 2016 activity funded under Project 2033.

S3P completed two assessments for advanced future requirements for VIRGINIA Class which assisted N97 and Navy Acquisition Program offices enhance stealth in VA Block VI and beyond. S3P completed one major multi-national sea test in support of Acoustic Superiority. This exercise advanced the Navy's understanding of acoustics in tactically relevant environments. S3P also completed the operational deployment of an

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
experimental environmental sensor suite to inform submarine non-acoustic vulnerabilities for fleet operators. Five data collection events were completed which informed improvements to the sensor suite and requirements for future fleet systems. Additionally, S3P completed sea testing on acoustic arrays, a Radio-Frequency (RF) and communications vulnerability assessment, and assessment of four real-world concerns from the Fleet. Finally, S3P completed its annual SSN/SSGN Operational Survivability Assessment (OSA) for the Flag-level Operations Review Group (ORG). While informing Fleet leadership on vulnerability issues, the OSA also establishes S3P technical work priorities for future years. Full details of S3P FY16 work and the findings of the OSA can be provided in a classified setting. ***FY 2017 Plans:*** FY 2017 activity funded under Project 2033. S3P is addressing gaps in stealth and survivability for current and future SSN/SSGN force to include responding to fleet questions on current tactical vulnerabilities and completion of the annual Operational Survivability Assessment. S3P technical work includes an assessment of VIRGINIA Block V acoustic superiority requirements, analysis of deployment data from the environmental sensor suite deployed in FY16, evaluation of mast and antenna stealth requirements and countermeasure concepts, and continued radio-frequency/ communications and acoustic array vulnerability assessments. The technical work plan includes seven sea-test events and one pier-side data collection event. Additionally, S3P will complete a final report to document and summarize the findings of two years of acoustic vulnerability work (FY15-FY16). All work is designed to inform immediate fleet concerns as well as future stealth and survivability requirements. Detailed information about the nature and impact of FY17 technical work can be provided in a classified setting. ***FY 2018 Base Plans:*** In FY 2018 funding for S3P activity shifts from Project 2033 to Project 3391. S3P will continue to address gaps in stealth and survivability for the current and future SSN/SSGN force to include responding to fleet questions on current tactical vulnerabilities and completion of an annual Operational Survivability Assessment. S3P will conduct acoustic and non-acoustic vulnerability assessment projects, and					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
will conduct sea tests to better characterize vulnerability and evaluate two developmental Tactical Decision Aids. Details can be provided in a classified setting. ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	0.000	0.000	8.594	0.000	8.594

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

S3P is a non-acquisition activity which 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 will ensure alignment between OPNAV, NAVSEA, ONI, and the Fleet on survivability issues. S3P will develop recommendations for stealth requirements to OPNAV N97 and provide technical basis for Tactics, Techniques, and Procedures developed by the Undersea Warfighting Development Command (UWDC). S3P will operate under OPNAV N97 and Fleet Flag panel (Operations Review Group) oversight. Products and metrics will be evaluated by the Submarine Operations Group and Operations Review Group. S3P will recommend technical requirements on all matters of submarine survivability to OPNAV N97.

E. Performance Metrics

Conduct in-depth assessment of SSN/SSGN Survivability for peacetime and wartime operations in anti-access area denial environment. Respond to emergent fleet tasking to assess real-world vulnerability concerns. Complete annual SSN/SSGN Operational Survivability Assessment report for ORG. Conduct 3-4 vulnerability assessments per fiscal year (each assessment is a 2-12 month level of effort). Conduct 1-3 countermeasure development efforts per fiscal year (each project is a 2-3 year level of effort). Specific technical topics each year are selected based on Fleet needs (as validated by the ORG), evolving threats, and mission requirements.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	9.655	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.655
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Develop, test and demonstrate numerous high risk advanced submarine control technologies that will improve and/or provide new tactical operational capability at a reduced cost.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017
Congressional Add: Advanced submarine control	9.655	0.000
FY 2016 Accomplishments: Designed, developed and tested advanced submarine control related technologies that improved submarine control, operational profile, stealth, enhanced ship control and maneuverability and mitigated risks. Performed hydrodynamic and hydroacoustics analysis on advanced submarine control systems to insure performance requirements were met. Performed required land-based and in-water qualification testing (e.g., shock, pressure, Electromagnetic Interference (EMI), and tested and evaluated control system technologies used in external applications using innovative designs and materials to alleviate corrosion and signature issues.		
FY 2017 Plans: Conduct non-recurring engineering and analysis on advanced submarine control related technologies, conduct stealth technology assessments and down select technologies for testing, commence manufacturing and/or procure advanced submarine control and stealth technologies, and perform at-sea operational testing and demonstrations.		
Congressional Adds Subtotals	9.655	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

E. Performance Metrics

Commence design of stealth and controller component technologies. Perform technical analysis, land-based and in-water qualification testing including shock, pressure and Electromagnetic Interference (EMI).