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 0603595N *I (U)Ohio Replacement*							
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	796.804	947.783	700.811	776.158	-	776.158	514.520	447.447	326.007	208.311	Continuing	Continuing
3220: *SBSD Advanced Submarine System Development*	796.804	947.783	700.811	776.158	-	776.158	514.520	447.447	326.007	208.311	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): P444

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 Unit 3220:

The objective of the Sea Based Strategic Deterrent (SBSD) Advanced Submarine System Development project is to design and prepare for construction of the replacement of the OHIO Class SSBN.

PB 18 funding levels align with Milestone B Cost Component Position (CCP)

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	971.393	700.811	757.737	-	757.737
Current President's Budget	947.783	700.811	776.158	-	776.158
Total Adjustments	-23.610	0.000	18.421	-	18.421
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-23.610	0.000			
• Program Adjustments	0.000	0.000	9.630	-	9.630
• Rate/Misc Adjustments	0.000	0.000	8.791	-	8.791

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 0603595N *I (U)Ohio Replacement*

Change Summary Explanation

Funding: Added additional FY 18 funding to fund program to the Milestone B cost position.

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 0603595N / *(U)Ohio Replacement*	Project (Number/Name) 3220 / *SBSD 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
3220: *SBSD Advanced Submarine System Development*	796.804	947.783	700.811	776.158	-	776.158	514.520	447.447	326.007	208.311	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: P444

A. Mission Description and Budget Item Justification

The Sea Based Strategic Deterrent (SBSD) Advanced Submarine System Development project supports the COLUMBIA SSBN program. The funding applies to the design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for Common Missile Compartment (CMC) design, whole ship design, and component technologies development for the next generation U.S. ballistic missile submarine (SSBN). This RDT&E program supports cooperation with the United Kingdom (UK) to maintain strategic deterrence, based on a single effort to develop a CMC as agreed by the UK Secretary of State for Defense and the U.S. Secretary of Defense in 2009.

The COLUMBIA program strategy is to maximize the re-use of existing OHIO systems and new designs from the SEAWOLF and VIRGINIA Classes (as applicable), focus on Life Cycle Total Ownership Cost (TOC) affordability, and meet the military requirements established for this SSBN to achieve mission success in a challenging environment. The requested funding levels provide for the Technology Development, Design, and Engineering Integration efforts necessary to support the Columbia Class SSBN lead ship construction start in FY 2021.

The following key activities support a ship acquisition program to replace the OHIO Class SSBNs:

1. Design and development of a missile compartment, launch system, and strategic weapons support systems to meet U.S. strategic requirements while cooperating with the UK on modernizing its strategic deterrent in accordance with Presidential direction (December 2006).
2. Concept, System Definition, and Detailed Design for remaining portions of the ship will be accomplished through a Design/Build/Sustain approach modeled after the approach used by the VIRGINIA Class program.
3. Engineering and integration of existing technologies and development of new technologies required to provide the capabilities necessary to ensure platform operational effectiveness and minimize life cycle cost.

COLUMBIA SSBN program's Concept Definition, System Definition Prototyping, and Technology Development Efforts supports design, systems engineering, prototyping and vendor qualification activities needed to develop the CMC design, the COLUMBIA whole ship design, and component development. The COLUMBIA design timelines are based on a design approach proven on the VIRGINIA Class Program, adjusted for the additional complexity of a missile compartment and Strategic Weapons Systems (SWS). Planned technical studies and prototyping are necessary to reduce risks associated with updating SSBN system designs for current technical standards and demonstrating design feasibility of developmental technology to meet the ship design and construction schedule.

The Navy continues investing in program funded affordability initiatives similar to those employed successfully for VIRGINIA Class, but tailored to the unique SSBN mission and operational tempo of COLUMBIA Class to drive down overall program costs. Efforts will focus on reducing ship construction costs through implementing more effective design features and production methods to produce a more affordable/producible submarine. As part of this effort, alternative contracting strategies are also being examined to include multi-class multiyear procurement (MYP) and Economic Order Quantity (EOQ).

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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System Development*

Activities for FY 2016 were executed to ensure the first article quad pack prototype of the CMC remains on schedule to support the UK DREADNOUGHT Program. These activities included the start of construction for the first article quad pack in August 2016 with a planned completion in the fall of 2018. The CMC program will mature required technologies and re-host the TRIDENT II D5 SWS (Launcher, Fire Control and Navigation) while ensuring no degradation to D5 security, safety and performance. In addition, whole ship design efforts are focused on technologies requiring significant engineering, integration and development time as well as those technologies that are required to support ship design and construction schedules such as the propulsor and maneuvering/ship control. These technologies are critical for stealth capability for a ship class that will be in service until the 2080s. Ship detailed design efforts include important pre-construction activities such as finalizing ship requirements, risk characterization and mitigation, improvement and validation of performance prediction tools and improvement of design tools. Technology development will address engineering and integration of existing technologies as well as maturation of developmental technologies. PB 18 funding levels align with Milestone B Cost Component Position (CCP). On 14 December 2016, the Secretary of the Navy announced the lead ship of the OHIO Replacement Program will be USS COLUMBIA (SSBN 826) which officially designates this program the COLUMBIA Class Submarine Program.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: Common Missile Compartment Design and Prototyping	517.316	335.809	268.920	0.000	268.920
Articles:	-	-	-	-	-
FY 2016 Accomplishments: The combination of Common Missile Compartment (CMC) Design and Prototyping and Ship Study and Design represents the required Lead Design Yard (LDY) Shipbuilder effort for the COLUMBIA Class SSBN Program. CMC: This funding was applied to the design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for CMC design and component / technology development for the COLUMBIA submarine. A number of efforts were accomplished to include completing CMC Pressure Hull Confirmation model testing, initiating construction of the Forward Confirmation Model, and commenced efforts supporting prototyping of the Missile Tubes (MTs). First Article Quad Pack (FAQP) Design Disclosures, Missile Tube Design Disclosures and CMC System Descriptions were all completed in support of those prototyping efforts. Support of the development of Strategic Weapons Support Systems (SWSS) for the land based test facility in Cape Canaveral, Florida continued. The COLUMBIA Program continued both construction preparation and support activities that enabled start of FAQP construction in August 2016 and continued manufacturing efforts of FAQP missile tubes. These efforts continued to validate MT's to Missile Tube Quad Pack (MTQP) production techniques development, testing, and integration of missile tubes and keel robotic welding techniques that support process certification and generated digital manufacturing data for the prototype FAQP. Specific design efforts included were the continued work on the design and development of the MTs, MTM's and the entire CMC which includes: System Diagrams (100 percent complete), Arrangement Disclosures (93 percent complete and totaled approximately 949 arrangements), and Design Disclosures (27 percent complete with FAQP specific Design Disclosures 100					

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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
percent complete and totaled approximately 269 design disclosures). All CMC Preliminary Hazard Analyses and Safety Requirements Hazard Analyses are complete. Ship Study and Design: This funding was applied to the design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for whole ship design, shipbuilder component / technology development for the COLUMBIA submarine. Efforts completed in FY2016 include: finalizing ship control surface geometry, completion the of final phase of Concept of Operations Exercise (COOPEX) to evaluate crew manning and control system/operator interface architecture to evaluate system functionality, arrangements and operator roles and design of the forward and aft ends of COLUMBIA including Rest of Ship (RoS) system integration including the completion of all but one System Description. The COOPEX enabled assessment of the COLUMBIA designs ability to meet the Strategic Weapons System Support (SWSS) Key Performance Parameter (KPP). Additionally, this effort included the completion of approximately 88 percent of engineered component procurement specifications, 96 percent of Systems Diagrams, 35 percent of Arrangements (859 arrangement disclosures). This effort also completed the RoS Design Disclosures (46 design disclosures not including CMC design disclosures) and completed approximately 70 percent of Preliminary Hazard Analyses. Advanced CO2 Removal Unit (ACRU) prototype demonstration performance in a relevant environment to achieve a Technology Readiness Level 6 prior to Milestone. Maintained configuration control for all CMC interfaces with RoS; began ship integration of the Generation 1 Propulsor designs and progressed a Non-Shipboard Prototype to validate the next generation design tool at the shipbuilder; conducted full scale evaluation of Towed Communications Buoy (TCB); tested the Pike and Dolly Varden models at the Acoustic Research Detachment, Naval Surface Warfare Center in Bayview, Idaho; completed material property characterization for the composite material to be used in the Navigation Sonar system window; supported preliminary design of an Out of Autoclave Bow Dome including shock qualification planning and critical design feature testing; tested candidate propulsor bearing materials at the full scale bearing test rig.					
FY 2017 Plans: The combination of CMC Design and Prototyping and Ship Study and Design represents the required LDY Shipbuilder effort for the COLUMBIA Program. CMC: This funding applies to the design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for CMC design and component / technology development for the COLUMBIA class submarine. Included in this effort is continued development of CMC design products, FAQP Manufacturing Engineering Documents and Work Instructions that support continued construction of the FAQP. Specifically, this effort includes completing 100 percent of CMC Arrangements (approximately 1037 products) and 67 percent					

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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
of CMC Design Disclosures (approximately 650 products) by the end of the FY. Specific planned efforts for 2017 also include continued prototyping of the MTs, continued construction of the prototype FAQP (for ultimate use in the Missile Tube Module) and validation of the Integrated Tube and Hull manufacturing techniques and modular construction techniques for application to the entire MTM installation and test of FAQP manufacturing fixtures; continued manufacturing for the FAQP pressure hull; and support of development of (SWSS) for the land based test facility. Ship Study and Design: LDY efforts increase by approximately 20 percent in FY 2017, driven by a 50 percent increase in labor hours and time related material associated with design disclosure and arrangement development as well as the accompanying engineering analysis. The increase in funding requirements from FY 2016 to FY 2017 supports the 83 percent design completion goal for an FY 2021 Lead Ship construction start and the aggressive 84 month build schedule necessary to support the first strategic deterrent patrol in FY 2031. This funding applies to the shipbuilder design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for whole ship design, component / technology development for the COLUMBIA class SSBN submarine. Specific efforts in FY 2017 include supportability analysis, the completion of 100 percent of engineered component procurement specifications, 70 percent of total Arrangements (approximately 1700 arrangement disclosures not including CMC arrangements), 19 percent of total Design Disclosures (870 design disclosures including CMC design disclosures), and completed development of a Non-Shipboard Prototype to validate the next generation design tool at the shipbuilder. Efforts will also continue towards Safety Requirements Hazard Analyses and maintaining configuration control for all CMC interfaces with RoS and progressing ship integration of the Propulsor design. ***FY 2018 Base Plans:*** The combination of CMC Design and Prototyping and Ship Study and Design represents the required LDY Shipbuilder effort for the COLUMBIA Program. CMC: This funding applies to the design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for CMC design and component / technology development for the COLUMBIA submarine. Included in this effort is continued development of CMC design products. Specific planned efforts in FY 2018 include the completion of approximately 89 percent of CMC Design Disclosures (890 design disclosures) in support of the MTM build. Specific planned efforts for 2018 also include: continued fabrication of MTs; completion of manufacturing of the FAQP and continued support of development of (SWSS) for the land based test facility, SWS Ashore.					

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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Ship Study and Design: This funding applies to the shipbuilder design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for whole ship design, component / technology development for the COLUMBIA submarine. Specific efforts in FY 2018 include the completion of 90 percent of total Arrangements (approximately 3800 arrangement disclosures including CMC arrangements), and 58 percent of total Design Disclosures (approximately 2629 design disclosures including CMC design disclosures) supportability assessments. Efforts will also continue towards maintaining configuration control for all CMC interfaces with RoS and progressing ship integration of the Propulsor design. ***FY 2018 OCO Plans:*** N/A					
Title: NAVSEA R&D and Prototyping	166.963	142.608	283.488	0.000	283.488
Articles:	-	-	-	-	-
FY 2016 Accomplishments: This funding applied to the Government combat systems, component, and technology development for the COLUMBIA submarine which is essential to achieving required signatures, maneuverability, combat, and communications capabilities. Accomplishments in FY2016 included: initiating construction of Forward Confirmation Model (FCM), completing CMC Pressure Hull Confirmation model testing to collapse pressure, and commencing efforts supporting prototyping of the MTs, QPs and ultimately the MTM. Efforts completed in FY2016 included finalizing: ship control surface geometry, final phase of COOPEX to evaluate crew manning and control system/operator interface architecture to evaluate system functionality, arrangements and operator roles, and design of the forward and aft ends of COLUMBIA class SSBN including RoS system integration which included the completion of all but one System Description. Another big accomplishment was the prototype demonstrated performance in a relevant environment to achieve a Technology Readiness Level 6 prior to Milestone B. In 2016 the COLUMBIA Program also maintained configuration control for all CMC interfaces with RoS, completed testing of Generation 1 Propulsor designs. Finally, additional accomplishments included: conducting full scale evaluation of (TCB), and testing on the Pike and Dolly Varden models, completed material property characterization for the composite material to be used in the Navigation Sonar system window, supported preliminary design of an Out of Autoclave Bow Dome including shock qualification planning and critical design feature testing. Tested candidate propulsor bearing materials at the full scale bearing test rig. ***FY 2017 Plans:*** This funding applies to the Government combat systems, component and technology development for the COLUMBIA submarine which is essential to achieving required signatures, maneuverability, combat, 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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
communications capabilities. Efforts in FY 2017 will include continued work on the Generation 2 Propulsor design (including small and intermediate scale testing) as well as completion of both the fabrication of forward confirmation model and data analysis for CMC Confirmation Model, the Project Arrangement for composite material applications in COLUMBIA SSBNs, and lifecycle testing of Composite Navigation Sonar System and Bow dome shock qualification and detailed design completion. In addition, the COLUMBIA program will provide experiments and simulations to refine platform characterization, maneuvering performance, develop Submerged Operating Envelope (SOE), installation and testing of the High Gain Measurement System and continue Pike testing, commence fabrication and testing of ACRU qualification unit. Specific efforts will also include: continued development, refinement, and delivery of GFI for Non-Propulsion Electronics Systems (NPES), continued assessment of AN/BRR-6 Towed Buoy Antenna (TBA) reliability based updates (including delivery of updated GFI), continued initial systems architecture assessment and development in conjunction with existing submarine classes to deliver increased GFI fidelity, and completion of testing and analysis to support the finalization of control surface design. Finally this effort will continue Government support and oversight of development of approximately 50 engineered components and CMC will continue construction of the prototype FAQP and validation of the Integrated Tube and Hull manufacturing technique as well as applying modular construction techniques to be further applied to the entire MTM. This effort includes the delivery of reliability centered maintenance products and approximately 100 provisioning packages required for ship support and maintenance. Additionally, this effort includes the manufacture of the remaining lead ship COLUMBIA missile tubes that will be incorporated into the prototype MTM.					
FY 2018 Base Plans: This funding applies to the Government combat systems, component and technology development for the COLUMBIA submarine essential to achieving required signatures, maneuverability, combat and communications capabilities. Efforts in FY 2018 will include: Generation 2 propulsor design, intermediate scale testing, and hardware manufacturing for LSV testing. The COLUMBIA Program will also begin testing of an array upgrade to support Generation 2 propulsor large scale vehicle testing, and will continue to test the COLUMBIA prototype bearing on the full scale bearing test rig. In addition, preliminary hydrodynamic characterization and submerged operating envelope development will begin development of drawings and procurement specifications for the COLUMBIA sonar bow dome and continued efforts for: development, refinement, delivery of GFI for NPES, assessment of AN/BRR-6 reliability based updates (including delivery of updated GFI), and initial systems architecture assessment and development in conjunction with existing submarine classes to deliver increased GFI fidelity will ensue. Finally this effort will continue Government support and oversight of development of approximately 50 engineered components and CMC will continue preparations for construction of prototype					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
missile tube module leveraging lessons from FAQP prototype. FY2017 to FY2018 increases more than inflation due to requirements for lead ship design related to testing component development, prototyping and propulsor manufacturing preparation. ***FY 2018 OCO Plans:*** N/A					
Title: Systems Engineering/Program Management	71.896	11.226	38.520	0.000	38.520
Articles:	-	-	-	-	-
FY 2016 Accomplishments: This funding applies to the Government oversight, including Program Office management and technical support from government laboratories, for review, analysis and approval of lead design yard and various government performers' design deliverables. Specific efforts in FY 2016 included: continued review and approval of Arrangements, System Descriptions/ Diagrams, and Design Disclosures in accordance with the Integrated Master Schedule (IMS) via technical oversight, review and Government approval of all LDY developed design products, as well as continuing maintenance planning and design for sustainment activities to ensure Sea Based Strategic Deterrent (SBSD) availability requirements can be met. In addition the COLUMBIA Program also continued to identify and assess platform, shore facilities, and infrastructure characteristics to identify opportunities to reduce program costs and program affordability initiatives in order reduce overall out-year program costs. Specific initiatives included Integrated Product Development Environment (IPDE) process development and validation through prototyping efforts, and identification of candidates for material reuse. Continued program affordability efforts were targeted to achieving potential savings associated with multi-year and/or Economic Order Quantity (EOQ) procurements across submarine classes, investigating the government vs. contractor furnished equipment mix for potential efficiencies, and identifying potential savings associated with continuous missile tube and/or launch tube production runs. The Test and Evaluation Master Plan (TEMP) and the Live Fire Test and Evaluation (LFT&E) Management Plan were drafted and staffed, and other preparations for Acquisition Milestone B, were completed. Finally, the COLUMBIA Class SSBN program completed a progressive Preliminary Design Review in support of Milestone B to demonstrate that the technology development, technical baseline development, and design efforts have sufficiently matured and contain acceptable and manageable risks to allow the program to complete the COLUMBIA design consistent with the approved Capabilities Development Document (CDD) requirements. ***FY 2017 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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
This funding applies to the Government oversight, including Program Office management and technical support from government laboratories, for review, analysis and approval of lead design yard and various government performers' design deliverables. Specific efforts in FY 2017 will include: continued review and approval of Arrangements, System Descriptions/ Diagrams, and Design Disclosures in accordance with the Integrated Master Schedule (IMS) via technical oversight, and a review and Government approval of all Lead Design Yard (LDY) developed design products. The TEMP approval is expected in the first quarter. Approval of the alternate Live Fire Test and Evaluation (LFT&E) strategy is also expected in the first quarter and OSD(AT&L) approval of the waiver for COLUMBIA Full Up System Level (FUSL) testing shortly thereafter. The Acquisition Milestone B review is planned for the first quarter. In addition the COLUMBIA program and Commander Operational Test and Evaluation Force will conduct an Early Operational Assessment (OT-B1) which will assess Critical Operational Issues identified in the COLUMBIA TEMP. EOA's identify risks to the successful completion of initial test and evaluation early in the acquisition process so as to support timely corrective action when required. OT-B1 will include review of COLUMBIA design documents and developmental test results but emphasis will be placed on characterizing COLUMBIA's tactical performance against the threat of record via modeling and simulation. OT-B1 will also assess COLUMBIA's cybersecurity. Tabletop platform cyber risk assessments, including deep dives into mission essential systems will continue. Additional cyber controls based on the NAVSEA Cyber Functional Requirement Document (FRD) and will be developed and provided to the shipbuilder and GFE providers. Continued program affordability efforts will target quantifying potential savings associated with multi-year and/or EOQ procurements across submarine classes, investigating the government vs. contractor furnished equipment mix for potential efficiencies, identifying and quantifying manufacturing/producibility improvements and potential savings associated with continuous MT and/or launch tube production runs. The Conventional Launcher Trial Certification Plan for COLUMBIA torpedo and countermeasure launching capabilities will be completed. A common Failure Reporting and Corrective Action System (FRACAS) for use by the COLUMBIA and VIRGINIA class (VACL) programs will be initiated. The FRACAS will maximize the utility of failure data that is of mutual interest, maintain alignment on system evaluation and potential design changes, and minimize the costs to both programs. Ultimately this effort will support investigation of VACL systems with higher than expected failure rates and facilitate improvements and operations and support (O&S) cost reduction, as well as and prevent the recurrence on COLUMBIA Class. Reliability modeling efforts will continue. Reliability Growth plans will be developed for the ARCU and the Thin Line Towed Array Handling System (TLTAHS). ***FY 2018 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
This funding applies to the Government oversight, including Program Office management and technical support from government laboratories, for review, analysis and approval of lead design yard and various government performers' design deliverables. Specific efforts in FY 2018 will include logistics life cycle development; identification and assessment of platform, shore facilities and infrastructure requirements; development of maintenance and repair standards; and higher fidelity functional mapping of CDD requirements to key subordinate design documents such as the NPES Functional Requirements Document (FRD) and Ship Building Specifications in support of both the planned System Engineering Technical Review (SETR) events and platform arrangements reviews and staffing of other design deliverables from the LDY and Participating Resource Managers. Tabletop platform cyber risk assessments, including deep dives into mission essential systems, will continue. Cyber Developmental and Operational Test (DT/OT) events will be planned and conducted. FY2017 to FY2018 increases more than inflation due to realigned phasing in the Milestone B cost estimate. OT-B1 will conclude with delivery of Commander Operational Test and Evaluation Force's report in the third quarter. The maturation of the OT-B1 COLUMBIA Survivability M&S will continue, taking leverage from relevant at sea data collected by other programs and the Fleet so as to reduce the need for COLUMBIA first of class sea testing. ***FY 2018 OCO Plans:*** N/A					
Title: Strategic Weapons Systems Integration	191.608	211.168	185.230	0.000	185.230
Articles:	-	-	-	-	-
FY 2016 Accomplishments: Continued system engineering efforts required for the re-hosting and integration of the TRIDENT II (D5) SWS on the COLUMBIA submarine including review and modification of SWS Coordination, Interface and Arrangement Drawings for SWS equipment within the CMC and Missile Control Center Module (MCCM), as the SWS system and its subsystems transitioned into detailed-design. The COLUMBIA program continued SWS Test Systems material procurement and builds, test berth/facility modifications, and development of special test vehicles. Furthermore, the COLUMBIA Program continued SWS Ashore test capability development, SWS training capability/requirements development, and final design efforts for the Launch Test Facility (LTF). The program conducted a launcher evaluation test readiness review as well as an integration and test of multiple components at the LTF; continued preliminary Fire Control hardware and software subsystem integration testing, design and development efforts for shipboard SWS Navigation, and systems engineering design efforts related to the COLUMBIA Class SSBN guidance handling carts; conducted mechanical and electrical surface support					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
equipment, critical design reviews, and completed build and test of phase 1 of the Inertial Navigation Simulator involving the simulation of subsystem interfaces; and commenced Reentry Body Simulator development. ***FY 2017 Plans:*** The program will continue system engineering efforts required for the re-hosting and integration of the TRIDENT II (D5) SWS on the COLUMBIA submarine including review and modification of SWS Coordination, Interface and Arrangement Drawings for SWS equipment within the CMC and Missile Control Center Module (MCCM) and SWS system and subsystem detailed design. The COLUMBIA program plans to continue land-based test berth / facility modifications. The COLUMBIA program is continuing SWS Test Systems material procurement and builds and development of special test vehicles; SWS Ashore test capability development; and SWS training capability/requirements development; design and development efforts for shipboard SWS Launcher, Fire Control and Navigation subsystems in preparation for the Critical Design Reviews; systems engineering design efforts related to the COLUMBIA Class SSBN guidance handling carts and procurement of a prototype guidance handling cart along with a plan to initiate the launcher evaluation at the (LTF) and complete Reentry Body Simulator development. ***FY 2018 Base Plans:*** Continuing system engineering efforts required for the re-hosting and integration of the TRIDENT II (D5) SWS on the COLUMBIA submarine including review and modification of SWS Coordination, Interface and Arrangement Drawings for SWS equipment within the CMC and MCCM, and SWS system and subsystem detailed design. The COLUMBIA program will also complete launcher evaluation testing at the LTF as well as land-based test berth / facility modifications. The COLUMBIA program will continue: SWS Test Systems material procurement and builds; development of special test vehicles; SWS Ashore test capability development; SWS training capability/requirements development; systems engineering design related to the COLUMBIA guidance handling carts and procurement of a prototype guidance handling cart. The COLUMBIA program will conduct SWS Launcher, Fire Control and Navigation subsystems Critical Design Reviews. Reentry Body Simulator production will commence. ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	947.783	700.811	776.158	0.000	776.158

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 0603595N / *(U)Ohio Replacement*	Project (Number/Name) 3220 / *SBSD Advanced Submarine System Development*	

C. Other Program Funding Summary ($ in Millions)

Line Item	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
• RDTEN/0603570N/3219: *SBSD Nuclear Technology Development*	419.273	390.326	265.462	-	265.462	190.107	114.010	80.088	60.144	Continuing	Continuing
• RDTEN/0101221N/0951: *Joint Warhead Fuze Sustainment Program*	93.440	111.857	109.730	-	109.730	64.610	32.348	21.473	0.000	0.000	732.275
• OPN/5358: *Strategic Missile Systems Equip*	240.677	215.138	246.221	-	246.221	275.485	278.260	245.166	258.037	Continuing	Continuing
• WPN/1250: *TRIDENT II Mods*	1,089.064	1,103.086	1,143.595	-	1,143.595	1,110.469	1,210.406	1,253.015	1,247.250	Continuing	Continuing
• OMN/1D2D: *Fleet Ballistic Missile*	1,048.056	1,072.385	1,111.862	-	1,111.862	1,186.510	1,213.641	1,226.476	1,257.831	Continuing	Continuing
• SCN/1045: *COLUMBIA Class Submarine*	0.000	773.138	842.853	-	842.853	3,024.236	1,473.898	4,237.852	4,260.920	95,064.200	109,677.097
• MCN/32414106: *Submarine Propulsor Manufacturing Support Facility*	0.000	0.000	0.000	-	0.000	71.930	0.000	0.000	0.000	0.000	71.930

Remarks

D. Acquisition Strategy

The Common Missile Compartment (CMC)will be designed and developed to support the U.S. and UK in development of the COLUMBIA and DREADNOUGHT SSBN programs enabling a common U.S.-UK CMC and maximizing the benefit of the ongoing U.S.-UK partnership in strategic deterrence. The COLUMBIA Class Program R&D efforts will incentivize cost reduction initiatives in the design, construction and operations & support portions of the program. R&D efforts will be performed by Navy laboratories, shipyards, private industry, and University Affiliated Research Centers.

E. Performance Metrics

Updated Integrated Master Schedule and CMC build strategy down-select. Development of signature management efforts to address knowledge gap, concepts for propulsor and shafting, and design guidance and interface control requirements.

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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System 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	Ship Design Contractor-EB : Groton, CT	425.044	517.316	Oct 2015	335.809	Oct 2016	268.920	Oct 2017	-		268.920	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Carderock, MD	145.437	153.110	Oct 2015	121.628	Oct 2016	106.337	Oct 2017	-		106.337	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Philadelphia, PA	0.000	0.000		0.000		28.091	Oct 2017	-		28.091	0.000	28.091	-
Product Development	WR	NUWC : Newport, RI	14.808	21.045	Oct 2015	10.045	Oct 2016	26.795	Oct 2017	-		26.795	Continuing	Continuing	Continuing
Product Development	Various	NAVSEA : Various	23.921	23.297	Oct 2015	10.935	Oct 2016	122.265	Oct 2017	-		122.265	Continuing	Continuing	Continuing
Product Development	SS/CPFF	ARL Penn State University : State College, PA	0.492	0.492	Oct 2015	0.377	Oct 2016	0.900	Oct 2017	-		0.900	Continuing	Continuing	Continuing
Product Development	SS/CPFF	NGMS : Sunnyvale, CA	35.904	51.420	Oct 2015	46.912	Oct 2016	36.051	Oct 2017	-		36.051	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JHU/APL : Laurel, MD	4.896	3.500	Oct 2015	6.102	Oct 2016	6.394	Jan 2018	-		6.394	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Keyport, WA	0.000	0.000		0.652	Oct 2016	0.648	Oct 2017	-		0.648	Continuing	Continuing	Continuing
Product Development	SS/CPFF	CSDL : Cambridge, MA	3.330	3.266	Oct 2015	2.485	Oct 2016	0.772	Oct 2017	-		0.772	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Corona, CA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Product Development	SS/CPFF	LMRMS : Mitchel Field, NY	7.935	19.719	Oct 2015	22.153	Oct 2016	26.526	Oct 2017	-		26.526	Continuing	Continuing	Continuing
Product Development	C/CPFF	EMCUBE : Alexandria, VA	0.951	0.715	Oct 2015	0.693	Oct 2016	0.528	Oct 2017	-		0.528	Continuing	Continuing	Continuing
Product Development	SS/CPFF	LMMSC : Sunnyvale, CA	26.472	25.816	Oct 2015	22.962	Apr 2017	21.030	Oct 2017	-		21.030	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JRC : Washington, DC	0.867	0.796	Oct 2015	1.333	Oct 2016	1.027	Oct 2017	-		1.027	Continuing	Continuing	Continuing
Product Development	C/CPFF	GDMS : Pittsfield, MA	25.291	29.561	Nov 2015	39.481	Oct 2016	27.859	Nov 2017	-		27.859	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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System 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	CNSW : China Lake, CA	9.401	15.194	Nov 2015	25.134	Oct 2016	20.380	Nov 2017	-		20.380	Continuing	Continuing	Continuing
Product Development	SS/CPFF	IEC : Anaheim, CA	1.136	1.023	Oct 2015	0.710	Oct 2016	0.525	Oct 2017	-		0.525	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Dahlgren, VA	3.432	3.722	Oct 2015	5.981	Oct 2016	8.459	Oct 2017	-		8.459	Continuing	Continuing	Continuing
Product Development	SS/CPFF	BAE : Rockville, MD	7.624	10.100	Oct 2015	10.091	Oct 2016	8.341	Oct 2017	-		8.341	Continuing	Continuing	Continuing
Product Development	SS/CPFF	BNA : Huntington Beach, CA	0.894	0.874	Oct 2015	1.449	Oct 2016	1.985	Oct 2017	-		1.985	Continuing	Continuing	Continuing
Product Development	WR	NSWC Crane : Crane, IN	12.205	18.152	Nov 2015	13.715	Oct 2016	13.646	Nov 2017	-		13.646	Continuing	Continuing	Continuing
Product Development	SS/CPFF	SPA : Alexandria, VA	2.711	2.944	Oct 2015	2.477	Oct 2016	2.063	Oct 2017	-		2.063	Continuing	Continuing	Continuing
Product Development	Various	SSP : Various	5.222	4.314	Oct 2015	8.461	Oct 2016	8.096	Oct 2017	-		8.096	Continuing	Continuing	Continuing
		Subtotal	757.973	906.376		689.585		737.638		-		737.638	-	-	-

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
Contractor Management Support	C/CPFF	Various : Multiple Awards	19.938	21.925	Oct 2015	0.000	Oct 2016	27.047	Nov 2017	-		27.047	Continuing	Continuing	Continuing
Government Management Support	WR	Various: NSWC : Carderock, MD	18.477	19.032	Oct 2015	10.786	Oct 2016	8.272	Oct 2017	-		8.272	Continuing	Continuing	Continuing
Government Management Support	WR	Various: NSWC : Philadelphia, PA	0.000	0.000		0.000		1.471	Oct 2017	-		1.471	0.000	1.471	-
Government Management Support	WR	Various: NUWC : Newport, RI	0.000	0.000		0.000		1.103	Oct 2017	-		1.103	0.000	1.103	-
Travel	WR	NAVSEA HQ : Washington, D.C.	0.416	0.450	Nov 2015	0.440	Nov 2016	0.627	Nov 2017	-		0.627	Continuing	Continuing	Continuing
		Subtotal	38.831	41.407		11.226		38.520		-		38.520	-	-	-

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Navy			Date: May 2017
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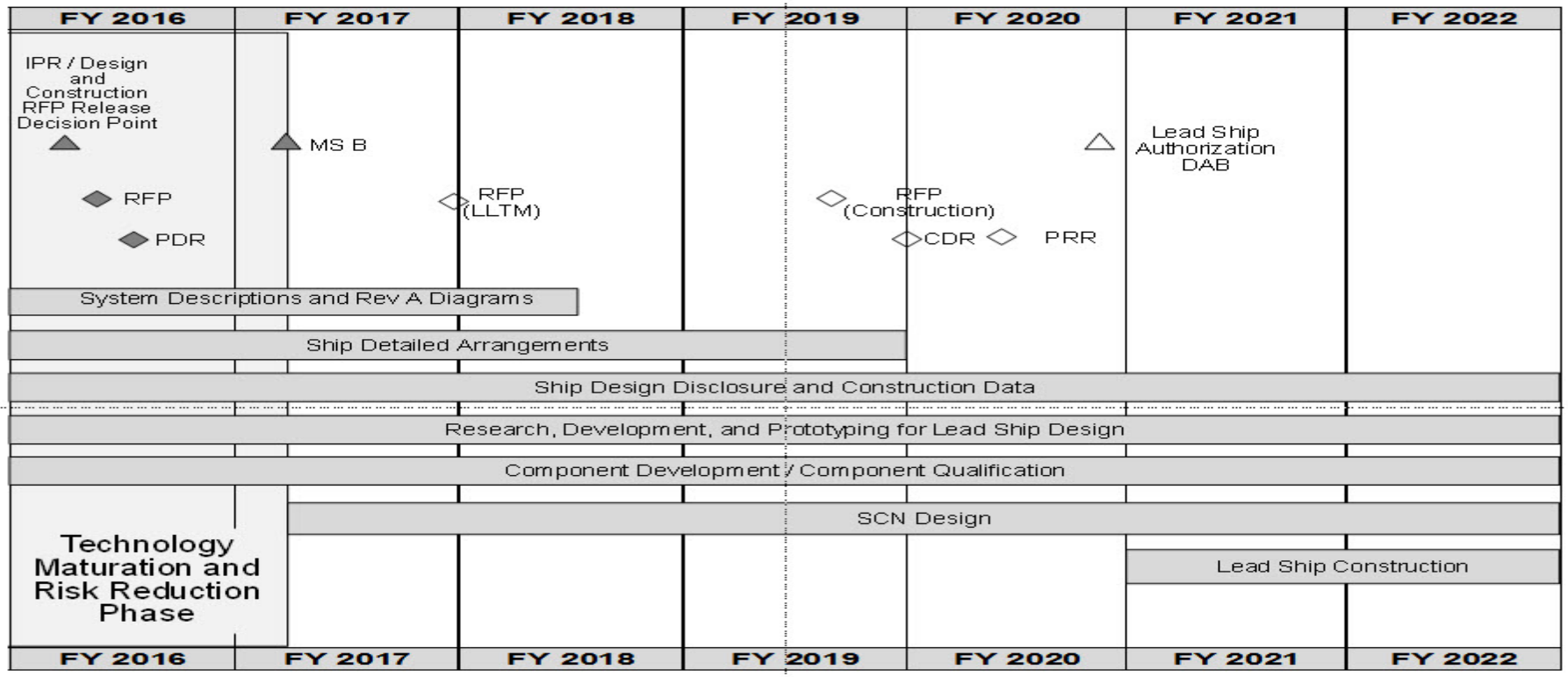
	Prior Years	FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	796.804	947.783		700.811		776.158		-		776.158	-	-	-

Remarks

The listed Award Dates represent the date on which initial obligations occur for the effort.

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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System Development*



CDR - Critical Design Review
DAB - Defense Acquisition Board
IPR - In Progress Review
LLTM - Long Lead Time Material
MS - Milestone
PDR - Preliminary Design Review
PRR – Production Readiness Review
RDT&E - Research, Development, Test, & Evaluation
RFP - Request for Proposal
SCN - Shipbuilding and Conversion, Navy

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 0603595N / *(U)Ohio Replacement*	**Project (Number/Name)** 3220 / *SBSD Advanced Submarine System Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Notes: * Effort began prior to 1st Quarter FY 2016. ** Effort continues past 4th Quarter FY 2022				
System Descriptions and Rev A Diagrams*	1	2016	2	2018
Ship Detailed Arrangements*	1	2016	4	2019
Ship Design Disclosure and Construction Data*, **	1	2016	4	2022
Research, Development, and Prototyping for Lead Ship*, **	1	2016	4	2022
Component Development/Component Qualification* , **	1	2016	4	2022
SCN Design**	1	2017	4	2022
Lead Ship Construction**	1	2021	4	2022