RCS: DD-A&T(Q&A)823-444

# SSBN 826 COLUMBIA Class Submarine (SSBN 826)

As of FY 2021 President's Budget

Defense Acquisition Management
Information Retrieval
(DAMIR)

## Table of Contents

## Common Acronyms and Abbreviations for MDAP Programs

Acq O&M - Acquisition-Related Operations and Maintenance
ACAT - Acquisition Category
ADM - Acquisition Decision Memorandum
APB - Acquisition Program Baseline
APPN - Appropriation
APUC - Average Procurement Unit Cost
$B - Billions of Dollars
BA - Budget Authority/Budget Activity
Blk - Block
BY - Base Year
CAPE - Cost Assessment and Program Evaluation
CARD - Cost Analysis Requirements Description
CDD - Capability Development Document
CLIN - Contract Line Item Number
CPD - Capability Production Document
CY - Calendar Year
DAB - Defense Acquisition Board
DAE - Defense Acquisition Executive
DAMIR - Defense Acquisition Management Information Retrieval
DoD - Department of Defense
DSN - Defense Switched Network
EMD - Engineering and Manufacturing Development
EVM - Earned Value Management
FOC - Full Operational Capability
FMS - Foreign Military Sales
FRP - Full Rate Production
FY - Fiscal Year
FYDP - Future Years Defense Program
ICE - Independent Cost Estimate
IOC - Initial Operational Capability
Inc - Increment
JROC - Joint Requirements Oversight Council
$K - Thousands of Dollars
KPP - Key Performance Parameter
LRIP - Low Rate Initial Production
$M - Millions of Dollars
MDA - Milestone Decision Authority
MDAP - Major Defense Acquisition Program
MILCON - Military Construction
N/A - Not Applicable
O&M - Operations and Maintenance
ORD - Operational Requirements Document
OSD - Office of the Secretary of Defense
O&S - Operating and Support
PAUC - Program Acquisition Unit Cost

PB - President's Budget
PE - Program Element
PEO - Program Executive Officer
PM - Program Manager
POE - Program Office Estimate
RDT&E - Research, Development, Test, and Evaluation
SAR - Selected Acquisition Report
SCP - Service Cost Position
TBD - To Be Determined
TY - Then Year
UCR - Unit Cost Reporting
U.S. - United States
USD(AT&L) - Under Secretary of Defense (Acquisition, Technology and Logistics)
USD(A&S) - Under Secretary of Defense (Acquisition and Sustainment)

## Program Information

| Program Name |
| --- |
| SSBN 826 COLUMBIA Class Submarine (SSBN 826) |

| DoD Component |
| --- |
| Navy |

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## References

**SAR Baseline (Development Estimate)**

Under Secretary of Defense (Acquisition, Technology & Logistics) Approved Acquisition Program Baseline (APB) dated January 04, 2017

**Approved APB**

Defense Acquisition Executive (DAE) Approved Acquisition Program Baseline (APB) dated February 25, 2019

## Mission and Description

The COLUMBIA Class Submarine Program (SSBN 826) will design and construct a replacement for the OHIO Class Fleet Ballistic Missile Submarines (SSBN) which begin retiring in 2027 at a rate of one per year. The program goals are to provide an affordable platform capable of executing the strategic mission while remaining survivable through 2080. The mission of the COLUMBIA Class Submarine is strategic deterrence which will be enabled through the integration and deployment of the TRIDENT II D5 Life Extended Strategic Weapon System (SWS) on a new submarine class that satisfies the Sea Based Strategic Deterrent Initial Capabilities Document and Chief of Naval Operations approved Capabilities Development Document attributes.

# Executive Summary

## Program Highlights Since Last Report

Since the previous submission, the COLUMBIA Class Program has been executing detail design, component development, and construction readiness efforts to support construction start in October 2020. COLUMBIA Class is executing several Lines of Effort (LOE) to implement Integrated Enterprise Plan (IEP) Initiatives to reduce COLUMBIA Class schedule risk through Design, Construction, Material & Supplier Base, Government Furnished Equipment, Acquisition, and Cost Reduction across the submarine enterprise. While risk areas remain with the Industrial Base, Government activities (Naval Foundry and Propeller Center, etc.) and ongoing Missile Tube welding issues, the Program is proactively managing these risks and is confident it will achieve planned COLUMBIA Class Lead Ship design, construction, and delivery schedules.

The Lead Ship schedule remains on track to start construction in October 2020, with design and planning efforts ongoing. Design progress is slightly behind schedule with improving trends, and the Program executes vigilant oversight to continue progress towards 83% design maturity at construction start. The Program's focus is on driving disclosure completions to maintain the required rate with high quality, as well as managing design change efforts. To date, General Dynamics Electric Boat (GDEB) has completed 99% of Arrangements (99% planned) with the Ship Arrangements complete, 61% of Design Disclosures (67% planned), and 22% of Work Instructions (22% planned). The Navy and GDEB continue to work towards validating the Integrated Product Development Environment (IPDE) and business process functionality to support design and construction progress. The Technical Authority (TA) portion of the IPDE tool received additional software upgrades and fixes in December 2019, with the final set of upgrades/fixes to this functionality scheduled to be completed in 2020. The Next Generation Planning tool went into use in August 2019 with additional functionalities for this tool scheduled to be delivered in 2020. Development efforts to enable delivery of IPDE based design and construction information between GDEB and Newport News Shipbuilding (NNS) are progressing with all baseline phases to support Huntington Ingalls Industries Newport News (HII-NNS) efforts scheduled to be completed by December 2020.

Construction readiness efforts are ongoing with Advance Construction beginning back in FY 2018 (now in progress on all 6 Super Modules) and procurements for critical Long Lead Time Material (LLTM) that began in FY 2019. The IEP initiatives execute industrial base risk mitigation, procurement and production efficiencies across the Submarine Enterprise, and manpower and facilities planning efforts. COLUMBIA Class currently implements Missile Tube Continuous Production, Advance Construction, Multi-Program Material Procurement (including Production Backup Units), and material ordering to support Shipyard Manufactured Items Continuous Production to realize construction efficiencies and cost savings consistent with authorities provided by 10 USC 2218a: National Sea-Based Deterrence Fund. COLUMBIA continues to conduct Critical Supplier Assessments in FY 2020 to analyze attributes such as capacity limitations, workload efficiencies, first-tier and sub-tier cross dependencies, strategic sourcing, and supplier quality. In early 2019, GDEB and HII-NNS completed a comprehensive assessment of the critical submarine industrial base suppliers as an update to the 2018 assessment, and designated a total of 324 suppliers as critical. The shipbuilders are currently on track for completing the next annual iteration of the comprehensive supplier assessment package by early 2020. In FY 2020, the Navy is continuing to invest in supplier improvement and facilitization to de-risk COLUMBIA construction schedules by improving the sub-vendor industrial base health. However, the industrial base remains the top program risk. Other construction readiness efforts include prototype construction/advance construction and component development of the Missile Tube Module (MTM), Reactor Compartment Bulkhead (RCB), Propulsor, and Advanced Carbon Dioxide Removal Unit (ACRU). GDEB and HII-NNS are investing in facilities to support the COLUMBIA construction schedule and VIRGINIA Class production requirements.

Following development and concurrence with an initial comprehensive repair plan to recover from the welding and Non-Destructive Testing (NDT) issues identified in July 2018, U.S. First Article Quad Pack (FAQP) work completed in October 2019 utilizing Missile Tubes with known welding non-conformances to de-risk the joint U.S./U.K. program via full scale testing of the Integrated Tube in Hull (ITH) construction fixtures. The shipbuilder has determined that repair and re-use of the constituent Missile Tubes is possible, but not in a quad pack configuration; efforts are in progress to cut the Missile Tubes out of the quad pack while GDEB evaluates final repair plans. A disposition recommendation for the 4 Missile Tubes is expected in April 2020. Identification of additional required re-inspections on Missile Tubes from a second vendor created delays to both vendor and Quonset Point construction schedules. This new issue is expected to impact the missile compartment schedule margin, but not impact lead ship schedule. As of December 2019, seven months of schedule

margin remains in Super Module 3 (the Common Missile Compartment) and no delay to COLUMBIA lead ship delivery is anticipated. However, additional margin consumption is expected.

The Program awarded the Integrated Product and Process Development (IPPD) contract in November 2017 to execute COLUMBIA Class Design Completion, Component Development, and Prototype Manufacturing of the Missile Tube Module (MTM) and Reactor Compartment Bulkhead (RCB). This contract spans through the completion of the lead ship COLUMBIA Class submarine design and is incentivized to complete 83% of design disclosures by October 2020 which will enhance the design maturity and construction readiness. Subsequent contract modifications in FY 2018 and FY 2019 support Advance Construction, LLTM procurements, and Missile Tube Continuous Production. Over the last year, COLUMBIA executed a new contracting approach coordinated with GDEB and NNS to shorten the traditional proposal/negotiation timeline to award the Build I construction contract prior to October 2020, which is required to meet the planned delivery schedule. The COLUMBIA Build I Request For Proposal (SSBN 826 and SSBN 827) was released on October 4, 2019. In late December 2019, the Program Office and GDEB reached a priced settlement for the COLUMBIA Build 1 contract, including the construction of the first two ships and associated design, engineering, material, and support efforts. The Program is working efforts to award the contract in FY 2020, ahead of schedule. The program is funded in FY 2020 and FY 2021 with plans to ensure proper FY 2022 and out year funding is budgeted to support contract requirements. COLUMBIA continues to aggressively pursue cost reduction efforts through IPPD contract incentives and the Cost Control Management Board (CCMB). The MILCON breach identified in this report is primarily due to a revised cost estimate for Kings Bay facility modifications. The revised estimate is driven by an updated NAVFAC DD-1391 Cost Estimate for MILCON Project P676 and incorporates revised DoD guidance for unit costs, updated infrastructure planning factors for mechanical and electrical services, refined site planning & preparation assumptions, and updated operational security requirements for both TTF Kings Bay and TTF Bangor. A Program Deviation Report (PDR) is currently being drafted.

**SSBN826 Program Highlights Since Last Report**

Government Efforts

- Completed prototype manufacturing and commenced qualification testing of the Low Pressure Blower, Missile Gas Supply Valve, Trim & Drain Pump, and Diesel Seawater Eductor (Jan 2019)
- Commenced shipset production of the Missile Heating and Cooling Pump (Jan 2019)
- Naval Surface Warfare Center Carderock Division (NSWCCD) released RFP for propulsor Bearing Support Structure (Feb 2019) and awarded first production contract (Sep 2019)
- Completed third deployment of reconfigured PIKE model at NSWCCD Acoustic Research Detachment (Feb 2019)
- Held Propulsor Production Readiness Reviews #8-9 in Philadelphia, PA (Mar and Aug 2019)
- NSWCCD submitted propulsor fixed assembly down-selection recommendation (Mar 2019) and the program approved it (Apr 2019)
- Completed external electrical power upgrade at the Naval Foundry and Propeller Center (Mar 2019)
- Commenced procurement and manufacture of the lead ship production motor (Apr 2019)
- Poured propulsor Forward Outer Structure casting at Naval Foundry and Propeller Center (May 2019)
- Naval Facilities Engineering Command (NAVFAC) awarded MILCON P-106, Submarine Propulsor Manufacturing Support Facility, at the Naval Foundry and Propeller Center (Jun 2019)
- Validated full scale Electric Drive System performance with the alternate motor (Jun 2019)
- Completed COLUBMIA (CLB) testing using the PIKE scale model at the NSWCCD Acoustic Research Detachment (Sep 2019)
- NAVFAC completed re-award of MILCON P-106, Submarine Propulsor Manufacturing Support Facility after two protests (Sep 2019)
- Completed CLB forward area testing on DOLLY VARDEN at the NSWCCD Acoustic Research Detachment (Dec 2019)
- Naval Foundry and Propeller Center (NFPC) poured full scale COLUMBIA first article rotor which will be used in destructive testing. This was the largest NiAlBr casting ever poured in U.S (Dec 2019)
- Delivered (Sep 2019) and installed the full size prototype main propulsion motor at the test facility in Philadelphia (Dec 2019)

Design Efforts

- Commenced detail design of the Gas Service Relief Valve (Jan 2019)

- Completed prototype manufacturing and commenced qualification testing of the Missile Heating & Cooling Heat Exchanger 3-Way Mixing Valve and 4-Way Manifold (Mar 2019)
- Commenced prototype manufacturing of the Shaft Seal Water Simplex Filter (Feb 2019)
- Commenced prototype manufacturing of the Hovering Pump (Mar 2019)
- Completed Hull, Mechanical & Electrical (HM&E) and Common Missile Compartment (CMC) Engineered Component Development Review (Apr 2019)
- Commenced prototype manufacturing of the Shaft Seal Water Pump, Hydraulic Oil Cooler, Reverse Osmosis Unit and Diesel Fuel Oil Filter Separator (Apr 2019)
- Completed prototype manufacturing and commenced qualification testing of the Ship Service Hydraulic Power Plant Pump (Apr 2019)
- Commenced prototype manufacturing of the Secondary Propulsion System (May 2019)
- Commenced qualification testing of the Hovering Pressurization and Vent Valve (May 2019)
- Commenced shipset production of the Hovering Pump (May 2019)
- Commenced initial qualification testing of the Air Conditioning Unit and Advanced Carbon Dioxide Removal Unit (Jun 2019)
- Completed qualification and commenced shipset production of the Missile Dehumidification and Drying Machine (Jun 2019)- Completed Preliminary Design and commenced Detail Design of the Arc Fault Detection System, Reverse Osmosis Pressure Reducing Valve, and Advanced Propulsor Bearing (Jul 2019)
- Completed Qualification Testing and commenced Ship Set Production of the High Pressure Air Compressor (Jul 2019)
- Completed Prototype Manufacture and commenced Qualification Testing of the Diesel Generator Set (Jul 2019)
- Completed Qualification Testing and commenced Final Design Update of the General and Detailed Light-emitting Diode Lighting Fixtures (Jul 2019)
- Completed Qualification Testing and commenced Final Design Update of the Emergency Main Ballast Tank Blow Actuation Valve (Aug 2019)
- Prototype Main Propulsion Motor Delivered to CTF (Sep 2019)
- Completed HM&E and CMC Engineered Component Design Review (Oct 2019)
- Commenced Concept Design for new Washing Machine (Oct 2019)
- Completed Detail Design and commenced Prototype Manufacturing of the Bulkhead Ventilation Isolation Butterfly Valve; Hydraulic Actuators for Forward and Aft Ship Service Hydraulic Distribution System; Hydraulic Actuators for Torpedo Tube Hydraulic System; Thin Line Towed Array Handling System; and 8-Inch Ball Valve (Oct 2019)
- Completed Qualification Testing and commenced Ship Set Production of the Missile Gas In-Line Check Valve; Hydraulic Motors for Weapons Stowage and Handling System (Hoist, Rammer, and Athwartship Drive); and Hydraulic Control Valves for Hydraulic Missile Launch System (Oct 2019)
- Completed Final Design Update and commenced Shipset Production of the General and Detailed Light Emitting Diode Lighting Fixtures (Nov 2019)

Program and Construction Efforts

-Updated Missile tube repair plan submitted to Naval Sea Systems Command (NAVSEA) and concurrence provided (Jan 2019). US provided repair plan details to UK in Feb 2019
- Conducted two deep dives on South Yard Assembly Building (SYAB) with Program Executive Office (PEO) COLUMBIA, Naval Reactors (NR), and GDEB senior leaders at Groton, CT (Jan, Mar 2019)
- Interim Supplier Assessments completed as part of the GDEB and NNS revised Supplier Quality and Oversight programs for Hunt Valve, Johnson Controls Navy Systems (JCNS), and Honeywell International (Jan, Feb and Mar 2019 respectively)
- Conducted various Manufacturing Assembly Plan (MAP) meetings with both shipbuilders. During these reviews GDEB & HII-NNS presented updates to the build plan, construction network, watch items design disclosures, fixtures, facilities plan, material and strategic sourcing plan.
- Conducted the first COLUMBIA Class Quarterly Production Progress Conference (QPPC) at Groton, CT with participation from Supervisor of Shipbuilding Groton (SOSG), Supervisor of Shipbuilding Newport News (SOSNN), NR, Strategic Systems Program (SSP), GDEB and NNS. (Feb 2019)
- Conducted a Program Design and Management Review (PDMR) at Groton, CT with participation from UK Ministry of Defence (MoD), SSP, SOSG, GDEB and BAE to discuss status of Missile Tube (MT) recovery effort, FAQP construction, off-tube kits and SWSA (Feb 2019)
- Conducted COLUMBIA Material Readiness Review with both shipbuilders at Newport News, VA to assess HII-NNS's material readiness to being Advance construction (AC) in June 2019 (Mar 2019)

- Conducted the second COLUMBIA Class Quarterly Production Progress Conference (QPPC) at Groton, CT with participation from SOSG, SOSNN, NR, SSP, GDEB and NNS (May 2019)
- Commenced Advance Construction at HII-NNS with stabilizer manufacturing supporting Super Module 6 (May 2019)
- Conducted deep dives on South Yard Assembly Building (SYAB) with PEO COLUMBIA, NR, and GDEB senior leaders at Groton, CT (May 2019)
- Interim Supplier Assessments completed as part of the GDEB and NNS revised Supplier Quality and Oversight programs for Portland Valve, Scot Forge, DRS Power and Control, Federal Equipment, JAL Industries and Northrup Grumman Marine Systems (Apr, May and Jun 2019 respectively)
- Conducted a Program Design and Management Review (PDMR) at Groton, CT with participation from UK MoD, SSP, SOSG, GDEB and BAE to discuss status of MT recovery effort, FAQP construction, off-tube kits and SWSA (May 2019)
- Conducted a material and supplier base (LOE 3) checkpoint review with both shipbuilders in Groton to review strategic sourcing (May 2019)
- US FAQP completed work in the E-Fixture, and the four pack was moved into the F-Fixture for integration with the hull cylinder (Apr 2019)
- Completed major assembly of the Prototype Main Propulsion Motor at the Motor Assembly Facility
- Awarded Supplier Development contract ($225M) to GDEB for submarine industrial base development and expansion to ensure second- and third-tier contractors are able to meet increased production requirements. This funding was Congressional add (May 2019)
- Conducted a Facility Master Plan (LOE 2) checkpoint review with both shipbuilders in Groton, CT (Jul 2019)
- Issued CLB Integrated Master Schedule, Revision F (Jul 2019)
- Conducted a Construction Readiness Review (CRR) for Advance Construction scheduled for 1st and 2nd Quarter of Calendar Year 2020 in Quonset Point, RI (Aug 2019)
- Commenced Lead Ship Advance Construction at Quonset Point with Section 2 Cylinder fabrication supporting Super Module 2 (Aug 2019)
- Conducted government independent assessment of South Yard Assembly Building (SYAB) with representatives from PMS 397, SOSG, NAVFAC, and GDEB at Groton, CT (Aug 2019)
- Conducted the third COLUMBIA Class Quarterly Production Progress Conference (QPPC) at Groton, CT with participation from PMS397, SOSG, SOSNN, NR, SSP, EB and NNS (Sep 2019)
- Broke ground on Groton SYAB (Sep 2019)
- Conducted a Program Design and Management Review (PDMR) at Groton, CT with participation from PMS397, UK MoD, SSP, SOSG, GDEB and BAE to discuss status of MT recovery effort, FAQP construction, off-tube kits and SWSA (Sep 2019)
- F Fixture Robotic Missile Tube-to-Keel welding completed (Sep 2019)
- Completed U.S. Common Missile Compartment [CMC] First Article Quad Pack [FAQP] (Oct 2019, TA-80 Milestone)
- Conducted Quarterly Vendor Visit at Precision Custom Components (PCC) in York, PA, with participation from PCC, PMS397, PMS450, and GDEB (Oct 2019)
- Conducted vendor visit to W International with representatives from PMS397, GDEB and HII-NNS (Oct 2019)
- Conducted a Resource Plan (LOE 2) checkpoint review with GDEB and HII-NNS (Nov 2019)
- Conducted a CMC Flag Review at Groton, CT, with participation from PMS397, UK MoD, SSP, SOSG, GDEB, and BAE to discuss status of MT recovery efforts, FAQP construction, off tube kits, and SWSA (Nov 2019)
- Conducted Quarterly MT Vendor Visit at BWX Technologies (BWXT) in Mt Vernon, IN, with participation from BWXT, PMS397, PMS450, SOSG, and EB (Nov 2019)
- Conducted PEO visit of UK suppliers and UK shipbuilder. Vendors include Babcock Marine, Goodwin, and Sheffield Forgemasters. Visits included conducting facility tours and discuss program status, delivery schedules, and quality assurance (Dec 2019)
- Conducted Superstructure Outsourcing Readiness Review with GDEB and HII-NNS (Nov 2019)
- Conducted Construction Readiness Review (CRR) for Advance Construction work scheduled for 1st through 3rd Quarter of Calendar Year 2020 in Newport News, VA (Dec 2019)
- Conducted Strategic Outsourcing (LOE 3) checkpoint review with GDEB and HII-NNS (Dec 2019)
- Completed oversight of 9 In-Depth Supplier Assessments (ISAs) with both shipbuilders (Oct – Dec 2019)
- Coordinated the release of an Industrial Base Analysis and Sustainment (IBAS) solicitation for the Level 1 Large Diameter Seamless Fittings marketspace (Oct – Dec 2019)

Strategic Weapons Support Systems (SWSS) / Strategic Weapon System (SWS) Efforts

- Completed installation of the SWSS skid (Missile Gas) at the SWS Ashore facility in Cape Canaveral, FL. (Jan 2019)
- Completed Surface Launch Test Qualification Launches #4-8 at China Lake (Jan - Mar 2019)
- Conducted Strategic Weapon System (SWS) Test Instrumentation Subsystem Underwater Communications System (UCS) Test Readiness Review (Feb 2019)
- Conducted incremental Strategic Weapon System (SWS) Fire Control Subsystem Hardware Production Readiness Reviews (Feb and Jul 2019)
- Completed Surface Launch Test Qualification Launches #9-16 of 16 at China Lake (Apr - Oct 2019)
- Conducted Strategic Weapon System (SWS) Missile Subsystem Surface Support Equipment (SSE) Monorail and Monorail Support Critical Design Review (Apr 2019)
- Completed installation of Strategic Weapon Support System (SWSS) skids (Missile Heating and Cooling, Missile Drying and Dehumidification) at the Strategic Weapon System Ashore facility in Cape Canaveral, FL (May - Jun 2019)
- Conducted Strategic Weapons Training System (SWTS) Navigation Subsystem Critical Design Review (Jun 2019) and Production Readiness Review (Oct 2019)
- Conducted Strategic Weapons Training System (SWTS) Preliminary Design Review (Jun 2019)
- Completed Locking Ring and Muzzle Hatch installation at SWS-A (Jun 2019)
- Conducted Strategic Weapon System (SWS) Missile Subsystem Critical Verification Review (Jul 2019)
- Delivered a COLUMBIA Launch Tube to Strategic Weapon System Ashore Facility (Aug 2019)
- Conducted Strategic Weapon System (SWS) Navigation Subsystem Hardware Production Readiness Review (Oct 2019)
- Completed Strategic Weapon Support System (SWSS) Validation and Verification (V&V) Preliminary Capability and Proficiency Effort (CAPE) evaluation for COLUMBIA Test Bay 2 at the Strategic Weapon System (SWS) Ashore Facility (Nov 2019)
- Completed installation of the COLUMBIA Test Bay 2 Launch Tube at the Strategic Weapon System (SWS) Ashore Facility (Nov 2019)
- Conducted Strategic Weapons Training System (SWTS) Critical Design Review (Nov 2019)
- Conducted Strategic Weapon System Ashore (SWSA) Test Readiness Review (Nov 2019)

Testing Efforts

- Director, Operational Test and Evaluation (DOT&E) completed an independent assessment of OT-B1 on March 20, 2019. The DOT&E assessment is aligned with results and conclusions from Commander Operational Test and Evaluation Force (COMOPTEVFOR) COLUMBIA Class OT-B1 Early Operational Assessment test report dated October 24, 2018
- Completed COLUMBIA Class Test and Evaluation Working-level Integrated Product Team (T&E WIPT) #28. Meeting highlights include briefing from PMS397 PM on Program Status, Metrics, and Risks and an award presentation from DON T&E Executive to PEO COLUMBIA for winning the 2018 Navy T&E WIPT (Jun 2019)
- 2019 Cybersecurity Early Developmental Test (EDT) events included a tabletop assessment of the SWFTS Information Assurance (IA) Toolkit (IATK) in May and a NAVSEA Cybersecurity Red Team (SEA-RT) test of the VA Class Block IV Ship Control System (SCS) in June. The SEA-RT conducted 21 test cases and provided recommendations to mitigate any identified SCS cybersecurity vulnerabilities (Aug 2019)
- The program office signed out a letter notifying CLB T&E WIPT signatories and stakeholders that the CLB Test and Evaluation Master Plan (TEMP) and Live-Fire Test and Evaluation (LFT&E) Master Plan (MP) will be updated in FY 2023 vice the Milestone B TEMP and LFT&E MP plan of FY 2019 (Aug 2019)
- Completed AN/BYG-1 (Combat Control) hardware shock LFT&E testing on the Deck Simulated Shock Machine (DSSM) at Naval Surface Warfare Center, Philadelphia (Nov 2019)
- Completed the COLUMBIA (SSBN 826) SWS First of Class (FOC) Demonstration and Shakedown Operation (DASO) planning meeting #1 at the Naval Ordnance Test Unit in Port Canaveral, FL (Nov 2019)
- Commenced the 2020 SSBN Security and Technology Program (SSTP) COLUMBIA Vulnerability Study (Nov 2019)
- Completed the Imaging (TI18/APB19) Cybersecurity Table Top (CTT) vulnerability assessment. Report planned March 2020 (Dec 2019)

Sustainment Efforts

- Completed TRIDENT REFIT FACILITY Gap Analysis and Industrial Use Study (GAIUS). The final report makes recommendations for what MILCON projects are needed to support COLUMBIA when it arrives in Kings Bay, GA and its output has been used to update the program's MILCON requirement (Oct 2019)

There are no significant software-related issues with this program at this time.

## History of Significant Developments Since Program Initiation

| History of Significant Developments Since Program Initiation | |
|---|---|
| **Date** | **Significant Development Description** |
| July 2008 | USD AT&L issues ADM directing entry into the Concept Refinement Phase and conduct of an Analysis of Alternatives. |
| October 2008 | Secretary of Defense sends letter to United Kingdom (UK) Secretary of State for Defense to affirm the U.S.-UK Mutual Defense Agreement and cost sharing for the Common Missile Compartment. |
| September 2010 | SCP approved with new design SSBN based on 12 ships with 16 - 87" missile tubes. |
| January 2011 | Milestone A ADM issued which authorized entry into Technology Maturation and Risk Reduction (TMRR) phase to complete a new design SSBN based on 12 ships with 16 - 87" missile tubes. |
| February 2012 | PB 2013 shifts lead ship construction from FY 2019 to FY 2021; the two year recapitalization delay removed all margin during the OHIO-OHIO Replacement (OR) transition period (FY 2027-FY2042), any delay in OR delivery or unexpected aging impact to OHIO will have significant impacts on SSBN Ao. |
| December 2012 | RDT&E Design Contract issued to General Dynamics – Electric Boat. |
| December 2014 | National Sea-Based Deterrence Fund established by Public Law 113-291. |
| November 2015 | Incremental funding authority and authority to enter in contracts for Advance Construction and economic order quantity provided by Public Law 114-92. |
| January 2017 | Milestone B APB approved (Program Initiation). |
| September 2017 | Award of the Integrated Product and Process Development (IPPD) contract. The Navy has transitioned all design efforts from the OHIO Replacement Research & Development (R&D) Design contract to the IPPD contract. |
| September 2018 | Award of the Two Year Advance Procurement Funding modification to the IPPD contract. |
| February 2019 | APB updated to reflect actual award of IPPD contract (September 2017) and align affordability targets with approved CDD. |
| October 2019 | Ongoing Advance Construction efforts now in progress for all 6 super modules |

## Threshold Breaches

| APB Breaches | | |
|---|---|---|
| **Schedule** | | ☐ |
| **Performance** | | ☐ |
| **Cost** | RDT&E | ☐ |
| | Procurement | ☐ |
| | MILCON | ☑ |
| | Acq O&M | ☐ |
| **O&S Cost** | | ☐ |
| **Unit Cost** | PAUC | ☐ |
| | APUC | ☐ |

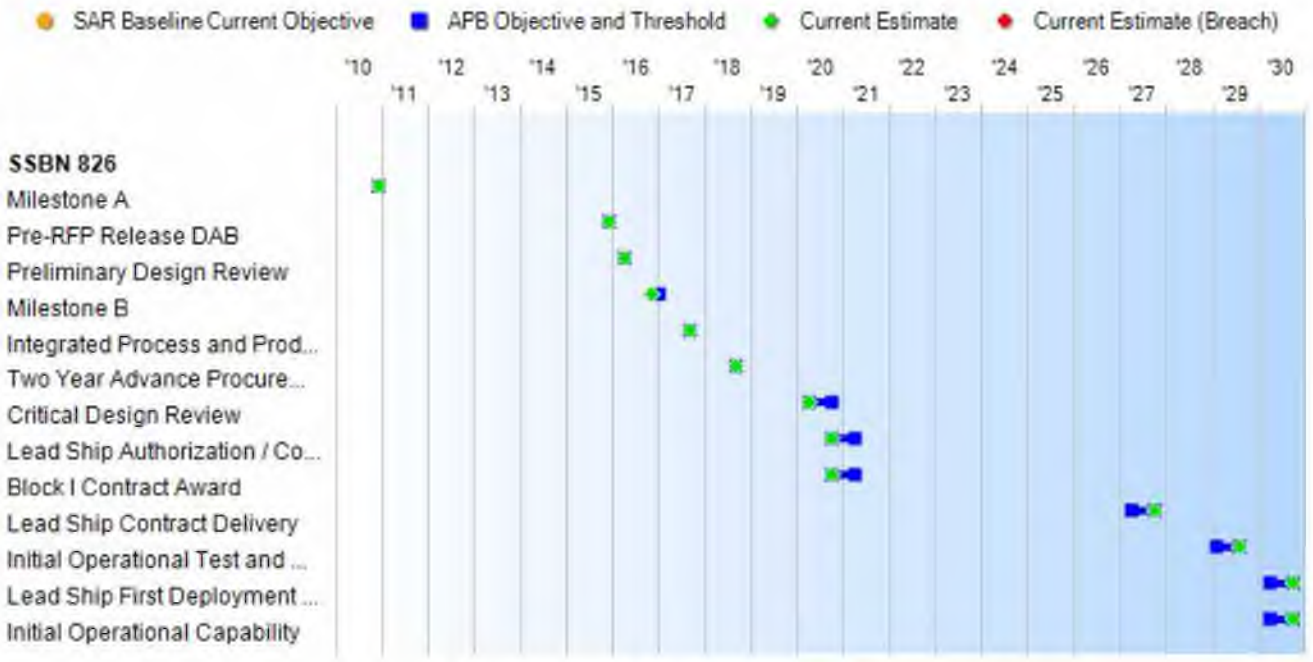
| Nunn-McCurdy Breaches | | |
|---|---|---|
| **Current UCR Baseline** | | |
| | PAUC | None |
| | APUC | None |
| **Original UCR Baseline** | | |
| | PAUC | None |
| | APUC | None |

**Explanation of Breach**

The MILCON breach in cost is primarily due to a revised cost estimate for TRIDENT Training Facility (TTF) modifications. The revised estimate is driven by an updated Naval Facilities Engineering Command (NAVFAC) DD-1391 Cost Estimate for MILCON Project P676 and incorporates revised DoD guidance for unit costs, updated infrastructure planning factors for mechanical and electrical services, refined site planning & preparation assumptions, and updated operational security requirements for both TTF Kings Bay and TTF Bangor.

A Program Deviation Report (PDR) is currently being drafted.

## Schedule




| Schedule Events | | | | |
|---|---|---|---|---|
| **Events** | **SAR Baseline Development Estimate** | **Current APB Development Objective/Threshold** | | **Current Estimate** |
| Milestone A | Dec 2010 | Dec 2010 | Dec 2010 | Dec 2010 |
| Pre-RFP Release DAB | Dec 2015 | Dec 2015 | Dec 2015 | Dec 2015 |
| Preliminary Design Review | Apr 2016 | Apr 2016 | Apr 2016 | Apr 2016 |
| Milestone B | Nov 2016 | Jan 2017 | Jan 2017 | Nov 2016 |
| Integrated Process and Product Development Contract Award | Jan 2017 | Sep 2017 | Sep 2017 | Sep 2017 |
| Two Year Advance Procurement Funding Modification | Oct 2018 | Sep 2018 | Sep 2018 | Sep 2018 |
| Critical Design Review | Apr 2020 | Apr 2020 | Oct 2020 | Apr 2020 |
| Lead Ship Authorization / Construction Start | Oct 2020 | Oct 2020 | Apr 2021 | Oct 2020 |
| Block I Contract Award | Oct 2020 | Oct 2020 | Apr 2021 | Oct 2020 |
| Lead Ship Contract Delivery | Apr 2027 | Apr 2027 | Oct 2027 | Oct 2027 |
| Initial Operational Test and Evaluation Complete | Feb 2029 | Feb 2029 | Aug 2029 | Aug 2029 |
| Lead Ship First Deployment Start | Apr 2030 | Apr 2030 | Oct 2030 | Oct 2030 |
| Initial Operational Capability | Apr 2030 | Apr 2030 | Oct 2030 | Oct 2030 |

## Change Explanations

None

## Notes

Milestone "Block I Contract Award" should now be referred to as "Build 1 Construction Contract Award" as the procurement strategy will not be a block buy based on legal review.

SSBN Hull Delivery / Obligation Work Limiting Date (OWLD) Dates

826 2027-10 / 2029-10
827 2030-10 / 2032-04
828 2032-07 / 2033-12
829 2033-06 / 2034-10
830 2034-05 / 2035-07
831 2035-04 / 2036-09
832 2036-03 / 2037-05
833 2037-02 / 2038-04
834 2038-01 / 2039-02
835 2039-01 / 2040-02
836 2039-12 / 2041-01
837 2040-12 / 2042-01

## Performance

| Performance Characteristics | | | | | |
|---|---|---|---|---|---|
| **SAR Baseline Development Estimate** | **Current APB Development Objective/Threshold** | | **Demonstrated Performance** | **Current Estimate** | |
| **Operations and Support (O&S) Cost KSA** | | | | | |
| Average annual O&S cost per unit of $96M (CY 2010$) | Average annual O&S cost per unit of $119M (CY 2017$) | Average annual O&S cost per unit of $131M (CY 2017$) | TBD | $123.99M (CY 2017 $) | (Ch-1) |
| **Net-Ready KPP** | | | | | |
| Meet the requirements defined within the OR SSBN PIIT of the Common Submarine Information Support Plan | Meet the requirements defined within the OR SSBN PIIT of the Common Submarine Information Support Plan | (T=O) Meet the requirements defined within the OR SSBN PIIT of the Common Submarine Information Support Plan | TBD | Meet the requirements defined within the OR SSBN PIIT of the Common Submarine Information Support Plan | |
| **Training KPP** | | | | | |
| OR SSBN crews are capable of being certified proficient for strategic patrol operations by the Group Commander upon completion of the normal PDTP in accordance with Fleet instructions | OR SSBN crews are capable of being certified proficient for strategic patrol operations by the Group Commander upon completion of the normal PDTP in accordance with Fleet instructions | (T=O) OR SSBN crews are capable of being certified proficient for strategic patrol operations by the Group Commander upon completion of the normal PDTP in accordance with Fleet instructions | TBD | OR SSBN crews are capable of being certified proficient for strategic patrol operations by the Group Commander upon completion of the normal PDTP in accordance with Fleet instructions | |
| **Space, Weight, Power, and Cooling (SWAP-C) KSA** | | | | | |
| Future Growth Margin: 3% of Condition A-1 weight Cooling Capacity: 10% cooling capacity over the chill water design heat load Power – 10% electrical power future growth margin for ship's electrical loads at full power while underway at delivery | Future Growth Margin: 3% of Condition A-1 weight Cooling Capacity: 10% cooling capacity over the chill water design heat load Power – 10% electrical power future growth margin for ship's electrical loads at full power while underway at delivery | (T=O) Future Growth Margin: 3% of Condition A-1 weight Cooling Capacity: 10% cooling capacity over the chill water design heat load Power – 10% electrical power future growth margin for ship's electrical loads at full power while underway at delivery | TBD | Future Growth Margin: 3% of Condition A-1 weight Cooling Capacity: 10% cooling capacity over the chill water design heat load Power – 10% electrical power future growth margin for ship's electrical loads at full power while underway at delivery | |
| **Procurement Cost KCP** | | | | | |
| Lead Ship End Cost | APUC of $7.3B (CY | APUC of $8.0B (CY | TBD | $7.18B (CY 2017$) | |

| | | | | |
|---|---|---|---|---|
| Less Plans of $6.3B (2010$) using Navy Inflation / Deflation Indices Average Follow Ship Hulls 2-12 End Cost of $4.9B (2010$) using Navy Inflation / Deflation Indices | 2017$) | 2017$) | | |
| **Lead Ship First Deployment Key Schedule Parameter** | | | | |
| Third quarter of FY2030 | Third quarter of FY 2030 | First quarter of FY 2031 | TBD | First quarter of FY 2031 |

Classified Performance information is provided in the classified annex to this submission.

## Requirements Reference

CDD Revision one for the COLUMBIA Class Submarine dated January 22, 2018

## Change Explanations

(Ch-1) The current estimate for Operations and Support (O&S) Cost KSA changed from $120.2M to $123.99M predominantly
driven by updated COLUMBIA Class Technical Foundation Paper (TFP) Revision B, updated lifecycle T&E costs, and revised manpower profile

## Acronyms and Abbreviations

KCP - Key Cost Parameter
O - Objective
PDTP - Pre-Deployment Training Plan
PIIT - Platform Information Integration Table
T - Threshold

## Track to Budget

### RDT&E

| Appn | | BA | PE | | |
|---|---|---|---|---|---|
| Navy | 1319 | 04 | 0603561N | | |
| | **Project** | | **Name** | | |
| | 3220 | | Advanced Submarine System Development | | (Sunk) |
| Navy | 1319 | 04 | 0603570N | | |
| | **Project** | | **Name** | | |
| | 3219 | | SBSD Nuclear Technology Development | | |
| Navy | 1319 | 04 | 0603595N | | |
| | **Project** | | **Name** | | |
| | 3220 | | COLUMBIA Class Submarine Development | | |
| | 3237 | | Launch Test Facility | | (Sunk) |

### Procurement

| Appn | | BA | PE | | |
|---|---|---|---|---|---|
| Navy | 1611 | 01 | 0101221N | | |
| | **Line Item** | | **Name** | | |
| | 1045 | | COLUMBIA Class Submarine | | |
| Navy | 1810 | 04 | 0101221N | | |
| | **Line Item** | | **Name** | | |
| | 5358 | | Strategic Missile Systems Equipment | (Shared) | |

### MILCON

| Appn | | BA | PE | | |
|---|---|---|---|---|---|
| Navy | 1205 | 01 | 0703676N | | |
| | **Project** | | **Name** | | |
| | 32414106 | | Submarine Propulsor Manufacturing Support Facility | (Shared) | (Sunk) |
| Navy | 1205 | 01 | 0712876N | | |
| | **Project** | | **Name** | | |
| | 42237684 | | Trident Refit Facility | (Shared) | |
| Navy | 1205 | 01 | 0805376N | | |
| | **Project** | | **Name** | | |
| | 32414547 | | Ohio Replacement Power and Propulsion Facility | | (Sunk) |
| Navy | 1205 | 01 | 0805976N | | |
| | **Project** | | **Name** | | |

| | | | | |
|---|---|---|---|---|
| | 42237676 | | Trident Training Facility Phase I | (Shared) |
| Navy | 1205 | 03 | 0901211N | |

| Project | Name | |
|---|---|---|
| 64482044 | MCON Design Funds | (Shared) |

## Cost and Funding

## Cost Summary

| Total Acquisition Cost | | | | | | | |
|---|---|---|---|---|---|---|---|
| Appropriation | BY 2017 $M | | | BY 2017 $M | TY $M | | |
| | SAR Baseline Development Estimate | Current APB Development Objective/Threshold | | Current Estimate | SAR Baseline Development Estimate | Current APB Development Objective | Current Estimate |
| RDT&E | 12648.1 | 12648.1 | 13912.9 | 12625.4 | 13020.3 | 13020.3 | 13028.9 |
| Procurement | 87426.5 | 87426.5 | 96169.2 | 86684.0 | 115044.3 | 115044.3 | 114367.1 |
| Flyaway | -- | -- | -- | 84831.1 | -- | -- | 111894.5 |
| Recurring | -- | -- | -- | 79510.5 | -- | -- | 105886.7 |
| Non Recurring | -- | -- | -- | 5320.6 | -- | -- | 6007.8 |
| Support | -- | -- | -- | 1852.9 | -- | -- | 2472.6 |
| Other Support | -- | -- | -- | 1852.9 | -- | -- | 2472.6 |
| Initial Spares | -- | -- | -- | 0.0 | -- | -- | 0.0 |
| MILCON | 147.3 | 147.3 | 162.0 | 174.3[1] | 173.4 | 173.4 | 207.9 |
| Acq O&M | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100221.9 | 100221.9 | N/A | 99483.7 | 128238.0 | 128238.0 | 127603.9 |

[1] *APB Breach*

**Current APB Cost Estimate Reference**

SCP dated September 26, 2016

**Cost Notes**

No cost estimate has been completed in the past year.

| Total Quantity | | | |
|---|---|---|---|
| Quantity | SAR Baseline Development Estimate | Current APB Development | Current Estimate |
| RDT&E | 0 | 0 | 0 |
| Procurement | 12 | 12 | 12 |
| Total | 12 | 12 | 12 |

## Cost and Funding

## Funding Summary

| Appropriation Summary<br>FY 2021 President's Budget / December 2019 SAR (TY$ M) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Appropriation | Prior | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | To Complete | Total |
| RDT&E | 9702.4 | 604.5 | 416.4 | 256.0 | 227.7 | 240.4 | 232.3 | 1349.2 | 13028.9 |
| Procurement | 4808.4 | 1820.9 | 4014.7 | 4004.7 | 4161.6 | 5212.4 | 6116.3 | 84228.1 | 114367.1 |
| MILCON | 58.3 | 0.0 | 2.1 | 2.1 | 54.2 | 2.4 | 27.6 | 61.2 | 207.9 |
| Acq O&M | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PB 2021 Total | 14569.1 | 2425.4 | 4433.2 | 4262.8 | 4443.5 | 5455.2 | 6376.2 | 85638.5 | 127603.9 |
| PB 2020 Total | 14582.9 | 2295.4 | 4335.3 | 4461.7 | 4139.7 | 5040.8 | 6506.4 | 85427.2 | 126789.4 |
| Delta | -13.8 | 130.0 | 97.9 | -198.9 | 303.8 | 414.4 | -130.2 | 211.3 | 814.5 |

| Quantity Summary<br>FY 2021 President's Budget / December 2019 SAR (TY$ M) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Quantity | Undistributed | Prior | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | To Complete | Total |
| Development | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Production | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 10 | 12 |
| PB 2021 Total | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 10 | 12 |
| PB 2020 Total | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 10 | 12 |
| Delta | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Cost and Funding

## Annual Funding By Appropriation

| Annual Funding<br>1319 \| RDT&E \| Research, Development, Test, and Evaluation, Navy | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal Year | Quantity | TY $M | | | | | |
| | | End Item Recurring Flyaway | Non End Item Recurring Flyaway | Non Recurring Flyaway | Total Flyaway | Total Support | Total Program |
| 2008 | -- | -- | -- | -- | -- | -- | 62.7 |
| 2009 | -- | -- | -- | -- | -- | -- | 140.3 |
| 2010 | -- | -- | -- | -- | -- | -- | 463.5 |
| 2011 | -- | -- | -- | -- | -- | -- | 627.3 |
| 2012 | -- | -- | -- | -- | -- | -- | 957.2 |
| 2013 | -- | -- | -- | -- | -- | -- | 727.4 |
| 2014 | -- | -- | -- | -- | -- | -- | 1125.2 |
| 2015 | -- | -- | -- | -- | -- | -- | 1256.6 |
| 2016 | -- | -- | -- | -- | -- | -- | 1367.0 |
| 2017 | -- | -- | -- | -- | -- | -- | 1071.5 |
| 2018 | -- | -- | -- | -- | -- | -- | 1041.1 |
| 2019 | -- | -- | -- | -- | -- | -- | 718.2 |
| 2020 | -- | -- | -- | -- | -- | -- | 541.1 |
| 2021 | -- | -- | -- | -- | -- | -- | 397.3 |
| 2022 | -- | -- | -- | -- | -- | -- | 256.0 |
| 2023 | -- | -- | -- | -- | -- | -- | 227.7 |
| 2024 | -- | -- | -- | -- | -- | -- | 240.4 |
| 2025 | -- | -- | -- | -- | -- | -- | 232.3 |
| 2026 | -- | -- | -- | -- | -- | -- | 254.9 |
| 2027 | -- | -- | -- | -- | -- | -- | 244.8 |
| 2028 | -- | -- | -- | -- | -- | -- | 245.5 |
| 2029 | -- | -- | -- | -- | -- | -- | 103.1 |
| 2030 | -- | -- | -- | -- | -- | -- | 94.7 |
| 2031 | -- | -- | -- | -- | -- | -- | 76.0 |
| 2032 | -- | -- | -- | -- | -- | -- | 80.1 |
| 2033 | -- | -- | -- | -- | -- | -- | 81.7 |
| 2034 | -- | -- | -- | -- | -- | -- | 83.4 |
| 2035 | -- | -- | -- | -- | -- | -- | 85.0 |
| Subtotal | -- | -- | -- | -- | -- | -- | 12802.0 |

| Annual Funding<br>1319 \| RDT&E \| Research, Development, Test, and Evaluation, Navy | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal Year | Quantity | BY 2017 $M | | | | | |
| | | End Item Recurring Flyaway | Non End Item Recurring Flyaway | Non Recurring Flyaway | Total Flyaway | Total Support | Total Program |
| 2008 | -- | -- | -- | -- | -- | -- | 70.7 |
| 2009 | -- | -- | -- | -- | -- | -- | 156.1 |
| 2010 | -- | -- | -- | -- | -- | -- | 508.1 |
| 2011 | -- | -- | -- | -- | -- | -- | 671.6 |
| 2012 | -- | -- | -- | -- | -- | -- | 1008.1 |
| 2013 | -- | -- | -- | -- | -- | -- | 758.1 |
| 2014 | -- | -- | -- | -- | -- | -- | 1156.1 |
| 2015 | -- | -- | -- | -- | -- | -- | 1275.3 |
| 2016 | -- | -- | -- | -- | -- | -- | 1363.0 |
| 2017 | -- | -- | -- | -- | -- | -- | 1049.3 |
| 2018 | -- | -- | -- | -- | -- | -- | 995.7 |
| 2019 | -- | -- | -- | -- | -- | -- | 673.6 |
| 2020 | -- | -- | -- | -- | -- | -- | 497.5 |
| 2021 | -- | -- | -- | -- | -- | -- | 358.1 |
| 2022 | -- | -- | -- | -- | -- | -- | 226.2 |
| 2023 | -- | -- | -- | -- | -- | -- | 197.3 |
| 2024 | -- | -- | -- | -- | -- | -- | 204.2 |
| 2025 | -- | -- | -- | -- | -- | -- | 193.5 |
| 2026 | -- | -- | -- | -- | -- | -- | 208.1 |
| 2027 | -- | -- | -- | -- | -- | -- | 195.9 |
| 2028 | -- | -- | -- | -- | -- | -- | 192.7 |
| 2029 | -- | -- | -- | -- | -- | -- | 79.3 |
| 2030 | -- | -- | -- | -- | -- | -- | 71.4 |
| 2031 | -- | -- | -- | -- | -- | -- | 56.2 |
| 2032 | -- | -- | -- | -- | -- | -- | 58.1 |
| 2033 | -- | -- | -- | -- | -- | -- | 58.1 |
| 2034 | -- | -- | -- | -- | -- | -- | 58.1 |
| 2035 | -- | -- | -- | -- | -- | -- | 58.1 |
| Subtotal | -- | -- | -- | -- | -- | -- | 12398.5 |

| Annual Funding<br>9999 \| RDT&E \| Non Treasury Funds | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal Year | Quantity | TY $M | | | | | |
| | | End Item Recurring Flyaway | Non End Item Recurring Flyaway | Non Recurring Flyaway | Total Flyaway | Total Support | Total Program |
| 2017 | -- | -- | -- | -- | -- | -- | 44.8 |
| 2018 | -- | -- | -- | -- | -- | -- | 49.6 |
| 2019 | -- | -- | -- | -- | -- | -- | 50.0 |
| 2020 | -- | -- | -- | -- | -- | -- | 63.4 |
| 2021 | -- | -- | -- | -- | -- | -- | 19.1 |
| Subtotal | -- | -- | -- | -- | -- | -- | 226.9 |

| Annual Funding<br>9999 \| RDT&E \| Non Treasury Funds | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal Year | Quantity | BY 2017 $M | | | | | |
| | | End Item Recurring Flyaway | Non End Item Recurring Flyaway | Non Recurring Flyaway | Total Flyaway | Total Support | Total Program |
| 2017 | -- | -- | -- | -- | -- | -- | 44.8 |
| 2018 | -- | -- | -- | -- | -- | -- | 49.6 |
| 2019 | -- | -- | -- | -- | -- | -- | 50.0 |
| 2020 | -- | -- | -- | -- | -- | -- | 63.4 |
| 2021 | -- | -- | -- | -- | -- | -- | 19.1 |
| Subtotal | -- | -- | -- | -- | -- | -- | 226.9 |

| Annual Funding<br>1611 \| Procurement \| Shipbuilding and Conversion, Navy | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal Year | Quantity | TY $M | | | | | |
| | | End Item Recurring Flyaway | Non End Item Recurring Flyaway | Non Recurring Flyaway | Total Flyaway | Total Support | Total Program |
| 2017 | -- | 13.6 | -- | 759.5 | 773.1 | -- | 773.1 |
| 2018 | -- | 120.5 | -- | 741.4 | 861.9 | -- | 861.9 |
| 2019 | -- | 2417.4 | -- | 756.0 | 3173.4 | -- | 3173.4 |
| 2020 | -- | 948.2 | -- | 872.7 | 1820.9 | -- | 1820.9 |
| 2021 | 1 | 3061.8 | -- | 952.9 | 4014.7 | -- | 4014.7 |
| 2022 | -- | 3004.0 | -- | 992.7 | 3996.7 | -- | 3996.7 |
| 2023 | -- | 3217.6 | -- | 932.6 | 4150.2 | -- | 4150.2 |
| 2024 | 1 | 5204.1 | -- | -- | 5204.1 | -- | 5204.1 |
| 2025 | -- | 6107.9 | -- | -- | 6107.9 | -- | 6107.9 |
| 2026 | 1 | 8675.6 | -- | -- | 8675.6 | 40.6 | 8716.2 |
| 2027 | 1 | 8332.4 | -- | -- | 8332.4 | 46.0 | 8378.4 |
| 2028 | 1 | 8312.0 | -- | -- | 8312.0 | 10.0 | 8322.0 |
| 2029 | 1 | 8484.4 | -- | -- | 8484.4 | 45.4 | 8529.8 |
| 2030 | 1 | 8701.0 | -- | -- | 8701.0 | 33.1 | 8734.1 |
| 2031 | 1 | 8700.3 | -- | -- | 8700.3 | 51.9 | 8752.2 |
| 2032 | 1 | 8841.5 | -- | -- | 8841.5 | 49.7 | 8891.2 |
| 2033 | 1 | 7559.3 | -- | -- | 7559.3 | 51.9 | 7611.2 |
| 2034 | 1 | 6710.4 | -- | -- | 6710.4 | 52.0 | 6762.4 |
| 2035 | 1 | 6303.7 | -- | -- | 6303.7 | 52.2 | 6355.9 |
| 2036 | -- | 181.2 | -- | -- | 181.2 | 52.7 | 233.9 |
| 2037 | -- | 190.2 | -- | -- | 190.2 | 53.3 | 243.5 |
| 2038 | -- | 209.3 | -- | -- | 209.3 | 53.6 | 262.9 |
| 2039 | -- | 237.9 | -- | -- | 237.9 | 29.2 | 267.1 |
| 2040 | -- | 100.5 | -- | -- | 100.5 | 20.8 | 121.3 |
| 2041 | -- | 78.0 | -- | -- | 78.0 | 2.9 | 80.9 |
| 2042 | -- | 173.9 | -- | -- | 173.9 | 2.3 | 176.2 |
| Subtotal | 12 | 105886.7 | -- | 6007.8 | 111894.5 | 647.6 | 112542.1 |

| Annual Funding<br>1611 \| Procurement \| Shipbuilding and Conversion, Navy | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal Year | Quantity | BY 2017 $M | | | | | |
| | | End Item Recurring Flyaway | Non End Item Recurring Flyaway | Non Recurring Flyaway | Total Flyaway | Total Support | Total Program |
| 2017 | -- | 12.8 | -- | 716.5 | 729.3 | -- | 729.3 |
| 2018 | -- | 111.4 | -- | 685.2 | 796.6 | -- | 796.6 |
| 2019 | -- | 2190.7 | -- | 685.1 | 2875.8 | -- | 2875.8 |
| 2020 | -- | 842.4 | -- | 775.4 | 1617.8 | -- | 1617.8 |
| 2021 | 1 | 2666.9 | -- | 830.0 | 3496.9 | -- | 3496.9 |
| 2022 | -- | 2565.2 | -- | 847.7 | 3412.9 | -- | 3412.9 |
| 2023 | -- | 2693.8 | -- | 780.7 | 3474.5 | -- | 3474.5 |
| 2024 | 1 | 4271.4 | -- | -- | 4271.4 | -- | 4271.4 |
| 2025 | -- | 4914.9 | -- | -- | 4914.9 | -- | 4914.9 |
| 2026 | 1 | 6844.2 | -- | -- | 6844.2 | 32.1 | 6876.3 |
| 2027 | 1 | 6444.6 | -- | -- | 6444.6 | 35.6 | 6480.2 |
| 2028 | 1 | 6302.8 | -- | -- | 6302.8 | 7.5 | 6310.3 |
| 2029 | 1 | 6307.3 | -- | -- | 6307.3 | 33.8 | 6341.1 |
| 2030 | 1 | 6341.5 | -- | -- | 6341.5 | 24.2 | 6365.7 |
| 2031 | 1 | 6216.7 | -- | -- | 6216.7 | 37.1 | 6253.8 |
| 2032 | 1 | 6193.7 | -- | -- | 6193.7 | 34.8 | 6228.5 |
| 2033 | 1 | 5191.7 | -- | -- | 5191.7 | 35.6 | 5227.3 |
| 2034 | 1 | 4518.3 | -- | -- | 4518.3 | 35.0 | 4553.3 |
| 2035 | 1 | 4161.2 | -- | -- | 4161.2 | 34.5 | 4195.7 |
| 2036 | -- | 117.3 | -- | -- | 117.3 | 34.1 | 151.4 |
| 2037 | -- | 120.7 | -- | -- | 120.7 | 33.8 | 154.5 |
| 2038 | -- | 130.2 | -- | -- | 130.2 | 33.3 | 163.5 |
| 2039 | -- | 145.1 | -- | -- | 145.1 | 17.8 | 162.9 |
| 2040 | -- | 60.1 | -- | -- | 60.1 | 12.4 | 72.5 |
| 2041 | -- | 45.7 | -- | -- | 45.7 | 1.7 | 47.4 |
| 2042 | -- | 99.9 | -- | -- | 99.9 | 1.4 | 101.3 |
| Subtotal | 12 | 79510.5 | -- | 5320.6 | 84831.1 | 444.7 | 85275.8 |

FY 2021 represents initial incremental funding of the COLUMBIA Class Submarine Lead Ship and assumes incremental funding of the first hull over FY 2021, FY 2022, FY 2023. Total end cost for the Lead ship is $14.393B TY including plans.

| Cost Quantity Information<br>1611 \| Procurement \| Shipbuilding and Conversion, Navy | | |
|---|---|---|
| **Fiscal Year** | **Quantity** | **End Item Recurring Flyaway (Aligned With Quantity) BY 2017 $M** |
| 2017 | -- | -- |
| 2018 | -- | -- |
| 2019 | -- | -- |
| 2020 | -- | -- |
| 2021 | 1 | 7510.9 |
| 2022 | -- | -- |
| 2023 | -- | -- |
| 2024 | 1 | 7879.8 |
| 2025 | -- | -- |
| 2026 | 1 | 6879.7 |
| 2027 | 1 | 6643.4 |
| 2028 | 1 | 6456.2 |
| 2029 | 1 | 6405.9 |
| 2030 | 1 | 6346.5 |
| 2031 | 1 | 6289.6 |
| 2032 | 1 | 6245.5 |
| 2033 | 1 | 6236.2 |
| 2034 | 1 | 6274.3 |
| 2035 | 1 | 6342.5 |
| 2036 | -- | -- |
| 2037 | -- | -- |
| 2038 | -- | -- |
| 2039 | -- | -- |
| 2040 | -- | -- |
| 2041 | -- | -- |
| 2042 | -- | -- |
| Subtotal | 12 | 79510.5 |

| Annual Funding<br>1810 \| Procurement \| Other Procurement, Navy | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal Year | Quantity | TY $M | | | | | |
| | | End Item Recurring Flyaway | Non End Item Recurring Flyaway | Non Recurring Flyaway | Total Flyaway | Total Support | Total Program |
| 2022 | -- | -- | -- | -- | -- | 8.0 | 8.0 |
| 2023 | -- | -- | -- | -- | -- | 11.4 | 11.4 |
| 2024 | -- | -- | -- | -- | -- | 8.3 | 8.3 |
| 2025 | -- | -- | -- | -- | -- | 8.4 | 8.4 |
| 2026 | -- | -- | -- | -- | -- | 579.9 | 579.9 |
| 2027 | -- | -- | -- | -- | -- | 27.6 | 27.6 |
| 2028 | -- | -- | -- | -- | -- | 280.3 | 280.3 |
| 2029 | -- | -- | -- | -- | -- | 489.9 | 489.9 |
| 2030 | -- | -- | -- | -- | -- | 84.2 | 84.2 |
| 2031 | -- | -- | -- | -- | -- | -- | -- |
| 2032 | -- | -- | -- | -- | -- | -- | -- |
| 2033 | -- | -- | -- | -- | -- | 162.1 | 162.1 |
| 2034 | -- | -- | -- | -- | -- | 164.9 | 164.9 |
| Subtotal | -- | -- | -- | -- | -- | 1825.0 | 1825.0 |

| Annual Funding<br>1810 \| Procurement \| Other Procurement, Navy | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal Year | Quantity | BY 2017 $M | | | | | |
| | | End Item Recurring Flyaway | Non End Item Recurring Flyaway | Non Recurring Flyaway | Total Flyaway | Total Support | Total Program |
| 2022 | -- | -- | -- | -- | -- | 7.0 | 7.0 |
| 2023 | -- | -- | -- | -- | -- | 9.8 | 9.8 |
| 2024 | -- | -- | -- | -- | -- | 7.0 | 7.0 |
| 2025 | -- | -- | -- | -- | -- | 7.0 | 7.0 |
| 2026 | -- | -- | -- | -- | -- | 470.5 | 470.5 |
| 2027 | -- | -- | -- | -- | -- | 22.0 | 22.0 |
| 2028 | -- | -- | -- | -- | -- | 218.6 | 218.6 |
| 2029 | -- | -- | -- | -- | -- | 374.5 | 374.5 |
| 2030 | -- | -- | -- | -- | -- | 63.1 | 63.1 |
| 2031 | -- | -- | -- | -- | -- | -- | -- |
| 2032 | -- | -- | -- | -- | -- | -- | -- |
| 2033 | -- | -- | -- | -- | -- | 114.5 | 114.5 |
| 2034 | -- | -- | -- | -- | -- | 114.2 | 114.2 |
| Subtotal | -- | -- | -- | -- | -- | 1408.2 | 1408.2 |

| Annual Funding<br>1205 \| MILCON \| Military Construction, Navy and Marine Corps | |
|---|---|
| **Fiscal Year** | **TY $M** |
| | **Total Program** |
| 2015 | 24.3 |
| 2016 | -- |
| 2017 | 1.4 |
| 2018 | 2.4 |
| 2019 | 30.2 |
| 2020 | -- |
| 2021 | 2.1 |
| 2022 | 2.1 |
| 2023 | 54.2 |
| 2024 | 2.4 |
| 2025 | 27.6 |
| 2026 | 34.3 |
| 2027 | 1.4 |
| 2028 | 25.5 |
| Subtotal | 207.9 |

| Annual Funding<br>1205 \| MILCON \| Military Construction, Navy and Marine Corps | |
|---|---|
| **Fiscal Year** | **BY 2017 $M**<br>**Total Program** |
| 2015 | 23.8 |
| 2016 | -- |
| 2017 | 1.3 |
| 2018 | 2.2 |
| 2019 | 27.2 |
| 2020 | -- |
| 2021 | 1.8 |
| 2022 | 1.8 |
| 2023 | 45.0 |
| 2024 | 2.0 |
| 2025 | 22.0 |
| 2026 | 26.9 |
| 2027 | 1.1 |
| 2028 | 19.2 |
| Subtotal | 174.3 |

Funding profile represents COLUMBIA Class Milestone B APB with the updates from PB 2021 controls,including Kings Bay facility modifications.

# Risks

## Significant Schedule and Technical Risks

| Significant Schedule and Technical Risks | |
|---|---|
| **Milestone A (December 2010)** | |
| 1. | Risk: Cost, Schedule, Performance. Driver: Integrating Rest of Ship design with Common Missile Compartment (CMC) and Propulsion Plant. |
| 2. | Risk: Cost, Schedule, Performance. Driver: Achieving appropriate level of design products at Construction start. |
| 3. | Risk: Cost. Driver: Achieving the follow-on boats, 2-12, cost objective of $4.9B. |
| **Milestone B (January 2017)** | |
| 1. | Risk: Cost, Performance. Driver: Ability to meet SSBN Operating Cycle and operate ships within OSD Affordability Caps (CY17$). Conduct maintenance on time, reliability to stay on patrol, and Average O&S Cost/Hull/Year $131M. |
| 2. | Risk: Performance. Driver: Ability to host and conduct timely launch of the TRIDENT II missile. Ship design impacts ability to host the SWS. Capable of achieving timely and successful launch. |
| 3. | Risk: Cost, Schedule. Driver: Ability to enable Integrated Tube & Hull (ITH) Construction. ITH fixturing and Robotic welding. |
| 4. | Risk: Cost, Schedule. Driver: Ability to construct lead ship in 84 months within cost and schedule and ability to reduce from an 84-month production span for the lead ship to a 70-month span for the eleventh ship. Factors include design maturity at construction start, shipbuilder facilitization and build plan. Facilities support and material availability. |
| **Current Estimate (December 2019)** | |
| 1. | Risk: Cost, Performance. Driver: Ability to meet SSBN Operating Cycle and operate ships within OSD Affordability Caps (CY17$). Conduct maintenance on time, reliability to stay on patrol, and Average O&S Cost/Hull/Year $131M. |
| 2. | Risk: Performance. Driver: Ability to host and conduct timely launch of the TRIDENT II missile. Ship design impacts ability to host the SWS. Capable of achieving timely and successful launch. |
| 3. | Risk: Cost, Schedule. Driver: Ability to construct lead ship in 84 months within cost and schedule and ability to reduce from an 84-month production span for the lead ship to a 70-month span for the eleventh and twelveth ships. Factors include design maturity at construction start, shipbuilder facilitization and build plan. Facilities support and material availability also are needed. |

## Risks

## Risk and Sensitivity Analysis

| Risks and Sensitivity Analysis | |
|---|---|
| **Current Baseline Estimate (February 2019)** | |
| 1. | The current baseline remains the same as the original baseline but with the additional driver: Funding. The program is funded in FY 2020 and FY 2021 with plans to ensure proper FY 2022 and out year funding is budgeted to support contract requirements. |
| **Original Baseline Estimate (January 2017)** | |
| 1. | The Navy's Cost position was approved at MSB and the President's Budget for 2018 fully funded the COLUMBIA Class Submarine in accordance with the Milestone B Cost Estimate. Risk: The program office identified two main cost drivers: maintenance and reliability of ships in order to operate within O&S Cost/Hull/Year $131M, and risks associated with planned construction efforts such as: design maturity, Shipbuilder facilitization and build plan, facilities support, material availability, and Integrated Tube & Hull (ITH) fixturing/welding efforts. |
| **Revised Original Estimate (N/A)** | |
| None | |
| **Current Procurement Cost (December 2019)** | |
| 1. | PAUC / APUC changes since the December 2018 SAR submission were driven by a combination of acquisition initiatives, design and prototype testing requirements, and an updated program cost estimate. |

## Low Rate Initial Production

| Item | Initial LRIP Decision | Current Total LRIP |
|---|---|---|
| **Approval Date** | 1/4/2017 | 1/4/2017 |
| **Approved Quantity** | 12 | 12 |
| **Reference** | Milestone B ADM | Milestone B ADM |
| **Start Year** | 2021 | 2021 |
| **End Year** | 2035 | 2035 |

The Current Total LRIP Quantity is more than 10% of the total production quantity in accordance with the Milestone B ADM approved January 4, 2017, which approved a LRIP quantity of 12, which is the total buy necessary due to the earliest date at which Operational Test and Evaluation could be conducted on the lead ship.

## Foreign Military Sales

None

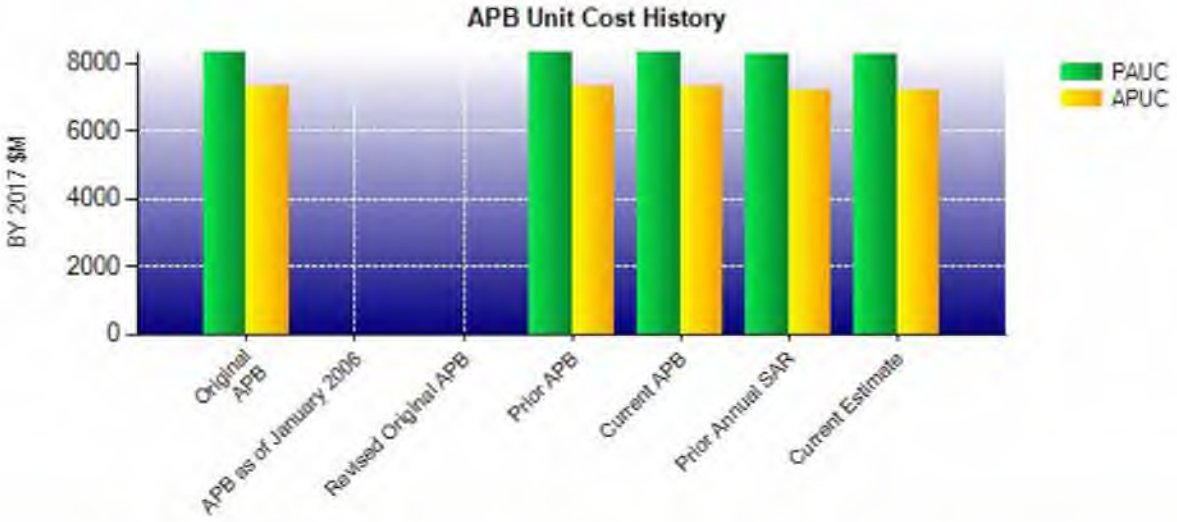
## Nuclear Costs

$18,785.9 TY$M. These costs are for reactor propulsion plant equipment. These costs are included in the Shipbuilding and Conversion, Navy costs in this report. Department of Energy costs are excluded from this report.

## Unit Cost

| Current UCR Baseline and Current Estimate (Base-Year Dollars) | | | |
|---|---|---|---|
| Item | BY 2017 $M<br>Current UCR Baseline (Feb 2019 APB) | BY 2017 $M<br>Current Estimate (Dec 2019 SAR) | % Change |
| Program Acquisition Unit Cost | | | |
| Cost | 100221.9 | 99483.7 | |
| Quantity | 12 | 12 | |
| Unit Cost | 8351.825 | 8290.308 | -0.74 |
| Average Procurement Unit Cost | | | |
| Cost | 87426.5 | 86684.0 | |
| Quantity | 12 | 12 | |
| Unit Cost | 7285.542 | 7223.667 | -0.85 |

| Original UCR Baseline and Current Estimate (Base-Year Dollars) | | | |
|---|---|---|---|
| Item | BY 2017 $M<br>Original UCR Baseline (Jan 2017 APB) | BY 2017 $M<br>Current Estimate (Dec 2019 SAR) | % Change |
| Program Acquisition Unit Cost | | | |
| Cost | 100221.9 | 99483.7 | |
| Quantity | 12 | 12 | |
| Unit Cost | 8351.825 | 8290.308 | -0.74 |
| Average Procurement Unit Cost | | | |
| Cost | 87426.5 | 86684.0 | |
| Quantity | 12 | 12 | |
| Unit Cost | 7285.542 | 7223.667 | -0.85 |




| APB Unit Cost History | | | | | |
|---|---|---|---|---|---|
| Item | Date | BY 2017 $M | | TY $M | |
| | | PAUC | APUC | PAUC | APUC |
| Original APB | Jan 2017 | 8351.825 | 7285.542 | 10686.500 | 9587.025 |
| APB as of January 2006 | N/A | N/A | N/A | N/A | N/A |
| Revised Original APB | N/A | N/A | N/A | N/A | N/A |
| Prior APB | Jan 2017 | 8351.825 | 7285.542 | 10686.500 | 9587.025 |
| Current APB | Feb 2019 | 8351.825 | 7285.542 | 10686.500 | 9587.025 |
| Prior Annual SAR | Dec 2018 | 8243.308 | 7176.417 | 10565.783 | 9463.650 |
| Current Estimate | Dec 2019 | 8290.308 | 7223.667 | 10633.658 | 9530.592 |

## SAR Unit Cost History

| Current SAR Baseline to Current Estimate (TY $M) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PAUC Development Estimate | Changes | | | | | | | | PAUC Current Estimate |
| | Econ | Qty | Sch | Eng | Est | Oth | Spt | Total | |
| 10686.500 | 74.875 | 0.000 | 0.000 | 0.000 | -128.517 | 0.000 | 0.800 | -52.842 | 10633.658 |

| Current SAR Baseline to Current Estimate (TY $M) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Initial APUC Development Estimate | Changes | | | | | | | | APUC Current Estimate |
| | Econ | Qty | Sch | Eng | Est | Oth | Spt | Total | |
| 9587.025 | 70.858 | 0.000 | 0.000 | 0.000 | -128.092 | 0.000 | 0.800 | -56.434 | 9530.592 |

| SAR Baseline History | | | | |
|---|---|---|---|---|
| Item | SAR Planning Estimate | SAR Development Estimate | SAR Production Estimate | Current Estimate |
| Milestone A | N/A | Dec 2010 | N/A | Dec 2010 |
| Milestone B | N/A | Nov 2016 | N/A | Nov 2016 |
| Milestone C | N/A | N/A | N/A | N/A |
| IOC | N/A | Apr 2030 | N/A | Oct 2030 |
| Total Cost (TY $M) | N/A | 128238.0 | N/A | 127603.9 |
| Total Quantity | N/A | 12 | N/A | 12 |
| PAUC | N/A | 10686.500 | N/A | 10633.658 |

## Cost Variance

| Summary TY $M | | | | |
|---|---|---|---|---|
| **Item** | **RDT&E** | **Procurement** | **MILCON** | **Total** |
| SAR Baseline (Development Estimate) | 13020.3 | 115044.3 | 173.4 | 128238.0 |
| Previous Changes | | | | |
| Economic | +32.3 | +662.5 | +2.1 | +696.9 |
| Quantity | -- | -- | -- | -- |
| Schedule | -- | -- | -- | -- |
| Engineering | -- | -- | -- | -- |
| Estimating | -13.2 | -2133.3 | +10.7 | -2135.8 |
| Other | -- | -- | -- | -- |
| Support | -- | -9.7 | -- | -9.7 |
| Subtotal | +19.1 | -1480.5 | +12.8 | -1448.6 |
| Current Changes | | | | |
| Economic | +13.5 | +187.8 | +0.3 | +201.6 |
| Quantity | -- | -- | -- | -- |
| Schedule | -- | -- | -- | -- |
| Engineering | -- | -- | -- | -- |
| Estimating | -24.0 | +596.2 | +21.4 | +593.6 |
| Other | -- | -- | -- | -- |
| Support | -- | +19.3 | -- | +19.3 |
| Subtotal | -10.5 | +803.3 | +21.7 | +814.5 |
| Total Changes | +8.6 | -677.2 | +34.5 | -634.1 |
| Current Estimate | 13028.9 | 114367.1 | 207.9 | 127603.9 |

| Summary BY 2017 $M | | | | |
|---|---|---|---|---|
| **Item** | **RDT&E** | **Procurement** | **MILCON** | **Total** |
| SAR Baseline (Development Estimate) | 12648.1 | 87426.5 | 147.3 | 100221.9 |
| Previous Changes | | | | |
| Economic | -- | -- | -- | -- |
| Quantity | -- | -- | -- | -- |
| Schedule | -- | -- | -- | -- |
| Engineering | -- | -- | -- | -- |
| Estimating | -1.4 | -1298.0 | +8.7 | -1290.7 |
| Other | -- | -- | -- | -- |
| Support | -- | -11.5 | -- | -11.5 |
| Subtotal | -1.4 | -1309.5 | +8.7 | -1302.2 |
| Current Changes | | | | |
| Economic | -- | -- | -- | -- |
| Quantity | -- | -- | -- | -- |
| Schedule | -- | -- | -- | -- |
| Engineering | -- | -- | -- | -- |
| Estimating | -21.3 | +555.8 | +18.3 | +552.8 |
| Other | -- | -- | -- | -- |
| Support | -- | +11.2 | -- | +11.2 |
| Subtotal | -21.3 | +567.0 | +18.3 | +564.0 |
| Total Changes | -22.7 | -742.5 | +27.0 | -738.2 |
| Current Estimate | 12625.4 | 86684.0 | 174.3 | 99483.7 |

Previous Estimate: December 2018

| RDT&E | $M | |
|---|---|---|
| Current Change Explanations | Base Year | Then Year |
| Revised escalation indices. (Economic) | N/A | +13.5 |
| Revised estimate reflects updated Advance Materials Propeller requirements (Estimating) | +7.3 | +8.0 |
| Revised estimate reflects updated COLUMBIA Class requirements (Estimating) | -12.9 | -13.8 |
| Revised estimate reflects updated Department-wide adjustment (Estimating) | -3.7 | -4.7 |
| Adjustment for current and prior escalation. (Estimating) | -5.9 | -6.2 |
| Revised estimate to incorporate updated escalation assumptions (Estimating) | -6.1 | -7.3 |
| RDT&E Subtotal | -21.3 | -10.5 |

| Procurement | $M | |
|---|---|---|
| Current Change Explanations | Base Year | Then Year |
| Revised escalation indices. (Economic) | N/A | +187.8 |
| Revised estimate for Industrial Base Supplier Development requirements (Estimating) | +108.4 | +122.0 |
| Revised estimate and funds realignment for COLUMBIA Class Integrated Enterprise Plan construction efficiencies and schedule acceleration (Estimating) | +5.9 | -47.9 |
| Revised estimate for updated Critical Prototype testing requirements (Estimating) | +164.9 | +194.8 |
| Revised estimate for updated Lead Ship engineering and design to meet COLUMBIA specifications and performance requirements (Estimating) | +37.0 | +42.8 |
| Revised estimate in anticipation of updated COLUMBIA Class 2019 Cost Estimate (Estimating) | +410.4 | +500.0 |
| Adjustment for revised program requirements (Estimating) | -29.5 | -28.1 |
| Adjustment for current and prior escalation. (Estimating) | -9.6 | -10.6 |
| Revised estimate to incorporate updated escalation assumptions (Estimating) | -131.7 | -176.8 |
| Increase in Other Support (Navy). (Support) | +12.5 | +20.0 |
| Decrease in Other Support (Navy). (Support) | -1.3 | -0.7 |
| Procurement Subtotal | +567.0 | +803.3 |

| MILCON | $M | |
|---|---|---|
| Current Change Explanations | Base Year | Then Year |
| Revised escalation indices. (Economic) | N/A | +0.3 |
| Revised estimate for updated COLUMBIA Class requirements (Estimating) | +18.6 | +21.7 |
| Revised estimate to incorporate updated escalation assumptions (Estimating) | -0.3 | -0.3 |
| MILCON Subtotal | +18.3 | +21.7 |

## Deliveries and Expenditures

| Deliveries | | | | |
|---|---|---|---|---|
| **Delivered to Date** | **Planned to Date** | **Actual to Date** | **Total Quantity** | **Percent Delivered** |
| Development | 0 | 0 | 0 | -- |
| Production | 0 | 0 | 12 | 0.00% |
| Total Program Quantity Delivered | 0 | 0 | 12 | 0.00% |

| **Expended and Appropriated (TY $M)** | | | |
|---|---|---|---|
| Total Acquisition Cost | 127603.9 | Years Appropriated | 13 |
| Expended to Date | 11709.8 | Percent Years Appropriated | 37.14% |
| Percent Expended | 9.18% | Appropriated to Date | 16994.5 |
| Total Funding Years | 35 | Percent Appropriated | 13.32% |

The above data is current as of February 10, 2020.

# Operating and Support Cost

## Cost Estimate Details

| | |
|---|---|
| **Date of Estimate:** | September 26, 2019 |
| **Source of Estimate:** | POE |
| **Quantity to Sustain:** | 12 |
| **Unit of Measure:** | Ship |
| **Service Life per Unit:** | 42.50 Years |
| **Fiscal Years in Service:** | FY 2031 - FY 2084 |

## Sustainment Strategy

The SSBN 826 COLUMBIA Class Submarine will operate with two crews (Blue/Gold) in two oceans under current strategic presence requirements from existing bases in Bangor, WA and Kings Bay, GA. The COLUMBIA Class Submarine SSBN will have an approximately 42.5-year service life from delivery to retirement, with the following life cycle as described below:

- Sea Trials that include Alpha/Bravo Trials and Board of Inspection and Survey
- Operational and Development test period (lead ship only)
- Two operating cycles during which the ship will conduct about 124 operating intervals
- Two Extended Refit Periods (ERPs) of about 6 months at its one-quarter and three quarter periods of life
- An extended shipyard maintenance period not to exceed 24 months at mid-life, consisting of 16 months for Engineered Overhaul (EOH) and 7 months for weapons handling operations and crew certification

Each 112 day operating interval includes:

- 77-day patrol
- 35-day refit and resupply period consisting of 22 days for refit production

Approximately every fourth refit and resupply period will be 50 days in duration including 35 days of refit production and dry -docking. The patrol period following a dry-docking refit will normally be shortened to keep the overall operating interval to about 112 days. All availabilities including ERPs will be conducted at the respective homeport and EOH will be conducted at either Norfolk Naval Shipyard (NNSY) or Puget Sound Naval Shipyard (PSNSY). Additionally, COLUMBIA will leverage OHIO existing infrastructure to the maximum extent possible.

Achieving this life cycle is the foundation of the product support model for the COLUMBIA Class Submarine Program and all support elements must be aligned to support the life cycle as described. The COLUMBIA Class Submarine life cycle is essentially the same as the current OHIO Class SSBN life cycle with the exception of the mid-life overhaul which will be shorter for COLUMBIA Class Submarines because refueling will not be required. The support model needed for the SSBN life cycle is well understood and being exercised today in support of the OHIO Class. The design of COLUMBIA Class Submarine and its product support strategy must be capable of meeting this life cycle in order to meet its availability requirements.

## Antecedent Information

The Antecedent System is the SSBN 726 OHIO Class Submarine. The ship's O&S estimate is based on a Blue/Gold manning philosophy analogous to the OHIO Class manning structure, current maintenance and modernization requirements, and historical submarine data. There are currently 14 OHIO Class Submarines.

| Annual O&S Costs BY2017 $M | | |
|---|---|---|
| **Cost Element** | **SSBN 826 Average Annual Cost Per Ship** | **SSBN 726 (Antecedent) Average Annual Cost Per Ship** |
| Unit-Level Manpower | 30.249 | 30.843 |
| Unit Operations | 2.725 | 1.826 |
| Maintenance | 35.121 | 35.829 |
| Sustaining Support | 5.500 | 4.598 |
| Continuing System Improvements | 31.529 | 22.518 |
| Indirect Support | 15.719 | 16.010 |
| Other | 3.151 | -- |
| Total | 123.994 | 111.624 |

O&S costs reflect revised requirements from updated 2019 analysis. Other costs reflect Disposal costs.

| Item | Total O&S Cost $M | | | |
|---|---|---|---|---|
| | SSBN 826 | | | SSBN 726 (Antecedent) |
| | Current Development APB Objective/Threshold | | Current Estimate | |
| **Base Year** | 60574.4 | 66631.8 | 63236.8 | 66416.0 |
| **Then Year** | 138910.5 | N/A | N/A | N/A |

Disposal Cost is included in the Operating and Support Cost of the current APB objective and threshold for this program.

**Equation to Translate Annual Cost to Total Cost**

Total Ship O&S = unitized cost * number of ships * service life per ship
Total Ship O&S = $123.99M/ship/year * 12 ships * 42.5 years = $63,236.8 CY17$M (includes Disposal and USNS Waters Operation and Replacement).

| O&S Cost Variance | | |
|---|---|---|
| **Category** | **BY 2017 $M** | **Change Explanations** |
| Prior SAR Total O&S Estimates - Dec 2018 SAR | 61290.6 | |
| Programmatic/Planning Factors | 1946.2 | Updates to Technical Foundation Paper Revision B, updated lifecycle T&E costs, and revised manpower profile |
| Cost Estimating Methodology | 0.0 | |
| Cost Data Update | 0.0 | |
| Labor Rate | 0.0 | |
| Energy Rate | 0.0 | |
| Technical Input | 0.0 | |

| | |
|---|---|
| Other | 0.0 |
| Total Changes | 1946.2 |
| Current Estimate | 63236.8 |

## Disposal Estimate Details

**Date of Estimate:** September 26, 2019
**Source of Estimate:** Current Estimate
**Disposal/Demilitarization Total Cost (BY 2017 $M):** 1607.0