**OHIO Replacement Program**

**Mission:** Strategic deterrence

**Description:** Develop submarine to replace existing OHIO Class SSBNs as they reach the end of their service lives. A portion of effort develops a Common Missile Compartment (CMC) that will be used by both the U.S. and UK for their replacement SSBNs.

**OHIO Replacement SSBN Attributes:**
- 12 OR SSBNs to replace 14 OHIOs
- Sufficient payload to meet USSTRATCOM requirements: 16 x 87” missile tubes
- Sufficient stealth to address the projected threat through the 2080s
- Life of ship reactor core – Reduced mid-life maintenance period
- First Strategic Patrol in 2031 (IOC)
- Launch TRIDENT D5 LE Missiles

**Employment:** Strategic deterrent patrols
A Holistic Plan to Deliver SBSD:
“Aligned Execution of Multiple Discrete Elements”

Ship, propulsion plant, and SWS development are synchronized to deliver SBSD in 2031
No margin for delay
Why Recapitalize Our SSBN Force?

“As long as these weapons exist, the United States will maintain a safe, secure, and effective arsenal to deter any adversary, and guarantee that defense to our allies…”

**President Obama**
(Nuclear Posture Review, April 2010)

- **U.S. Strategic Deterrence Promotes Global Stability**
  - Deterrence relies on the credible threat to impose unacceptable consequences
  - Deters aggression against the U.S. and our allies

- **SSBN Force is a reliable and survivable leg of the U.S. nuclear triad**
  - SSBNs will be responsible for ~70% of deployed nuclear warheads under New START
  - Impeccable record of 150 successful flight tests

- **Effective Sea-based Strategic Deterrent:**
  - Must have **adequate range** to allow operation far from adversaries, in broad ocean areas to promote survivability
  - Must have **requisite stealth** technology and innovation into the 2080s regardless of advances made by near-peer navies (stealth enables a smaller force to provide assured response)
Why Now?

Current OHIO Class is reaching the end of its operational life
- Designed in 1970, commissioned between 1984 and 1997, and will begin to retire in 2027
- Operational life already extended from 30 years to an unprecedented 42 years

Lead OHIO Replacement construction must commence in 2021
- Maintains fleet of 10 operational SSBNs through transition with moderate risk
- Lead ship unique treaty requirements must be completed

CMC and Strategic Weapons System (SWS) designs synchronized with UK
- Supports UK continuous at sea deterrence
- Reduces U.S. development costs
Strategic Partnership with UK

- U.S. and UK strategic deterrence cooperation has underpinned UK SSBN systems since the 1963 Polaris Sales Agreement (PSA)
  - UK deploys TRIDENT II (D5) system
  - Missiles shared from a common pool
  - UK SSBN force constitutes 100% of the UK’s national nuclear deterrent

- UK VANGUARD Class SSBN force begins retirements before OHIO Class
  - UK Successor IOC’s in 2028, two years prior to OHIO Replacement IOC
  - VANGUARD Class cannot be extended further

- Common Missile Compartment (CMC) developed under cost share arrangement
  - UK funded CMC efforts in 2008 to meet UK Successor SSBN schedules
  - CMC designed to be constructed by either nations’ submarine build yards
    - UK plans to purchase outfitted missile tubes from U.S.
  - Realized and future cost savings and economic order quantity opportunities

- U.S. committed to meeting UK Successor need date (2028)
  - “It is the sense of Congress that the Secretary of Defense and the Secretary of the Navy should make every effort to ensure that the common missile compartment associated with the OHIO-Class ballistic missile submarine replacement program stays on schedule and is aligned with the Vanguard-successor program of the United Kingdom in order for the United States to fulfill its longstanding commitment to our ally and partner in sea-based strategic deterrence.” (Sec 26,FY14 NDAA)

Common Missile Compartment Efforts Critical to both U.S. and UK Strategic Deterrence
OHIO Replacement Program

OHIO Replacement Schedule

Fiscal Year


- Navy Approved CDD
- JROC CDD
- Lead Ship Authorization
- First OHIO Class SSBN Retires
- Second OHIO Class SSBN Retires
- Third OHIO Class SSBN Retires
- Fourth OHIO Class SSBN Retires
- Fifth OHIO Class SSBN Retires
- Sixth OHIO Class SSBN Retires

- Ship Specifications
- Sys Definition Docs
- Sys Descrip & Rev A Diagrams
- Ship Detailed Arrangements
- Ship Construction Design Disclosure and NC Data
- Detail Design / LLTM
- In 4th year of Technology Maturation and Risk Reduction Phase

2014 Design Products: More than Double the 2013 Effort

- Lead Ship Construction (84 Months)
- Lead Ship T&E
- T&E / PSA / DASO

In 4th year of Technology Maturation and Risk Reduction Phase

Updated 9/26/13
Navy Approved CDD
First OHIO Class SSBN Retires
Second OHIO Class SSBN Retires
Third OHIO Class SSBN Retires
Fourth OHIO Class SSBN Retires
Fifth OHIO Class SSBN Retires
Sixth OHIO Class SSBN Retires

OHIO Replacement Program – Defense Innovation Days, 5 September 2014
A High Degree of Design Completion is Critical to a Successful Lead Ship Construction Program

**OHIO Replacement Lead Ship Construction Timeline**

- 84 month build span supports FY31 readiness for 1st strategic deterrent patrol

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>AoA (1 yr)</td>
</tr>
<tr>
<td>2010</td>
<td>Concept &amp; System Definition (7 yrs*)</td>
</tr>
<tr>
<td>2017</td>
<td>Design Start Prior to Construction (5 yrs)</td>
</tr>
<tr>
<td>2021</td>
<td>Design (11 yrs)</td>
</tr>
<tr>
<td>2028</td>
<td>Construction (7 yrs**)</td>
</tr>
<tr>
<td>2031</td>
<td>Delivery to IOC (3 yrs***)</td>
</tr>
</tbody>
</table>

*Includes 2-year shift

** 7 yrs. Lead ship / 6 yrs. Rest of class

*** 3 yrs. Lead ship / 2 yrs. Rest of class

The Scope of the OHIO Replacement Design Effort is Unparalleled

83% Design Maturity is required at Construction Start

**Key Program Elements:**

- **Ship Design**
  - Over 9000 Design Products (twice VIRGINIA Class)
  - ~ 60 million manhours of design effort

- **Systems Development**
  - ~ 60 Procurement Specifications
  - ~ 60 Prototypes

- **Modeling and Testing for:**
  - Performance, Ruggedness, Reliability, Operability, Validation, Technology Readiness Levels

- **Construction**
  - Suppliers ➔ Shipyards ➔ Government Acceptance

---

OHIO Replacement Program – Defense Innovation Days, 5 September 2014
## Driving Down Cost

Delivering the Core Essential Military Capability at the Lowest Possible Cost

### Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY2011

| Unit Cost CY10 $ = | $6B to $7B |

### Detailed requirements review produced savings

| Reduced number of missile tubes | 20 to 16 tubes |
| Reduced missile tube diameter | 97 inches to 87 inches |
| Reduced torpedo room capacity | Minimum capacity for defensive load only |
| Removed chin array | Minimum acoustic sensors for defensive detection; leverage VIRGINIA-Class combat systems |
| Reduced sail mast capacity | 10 to 6 masts |
| Reduced force protection features | Current OHIO-Class system |
| Reduced OHIO Replacement unique design features | Increased use of VIRGINIA-Class components |

### Milestone A Service Cost Position

| Average Follow-on Ship CY10 $ = | $5.6B |

### Recent Affordability Initiatives

- EOQ and multi-year procurement
- Facilities
- Design for producability
- Requirements and regulations
- Integrated Product Development Environment (IPDE)
- Manufacturing technologies, service, and support

### Milestone A Cost Target

| Average Follow-on Ship CY10 $ = | $4.9B |

(CY10 $s) Costs developed by NAVSEA05C for OHIO Replacement Service Cost Position; inflation based on NAVSEA 05C Jan 2010 SCN Shipbuilding Composite Inflation Table
Delivering Required Capability at the Least Cost

Cost Savings:
Re-host TRIDENT II (D-5)
- Most Reliable Strategic Nuclear Weapon System
- Strategic Launched Ballistic Missile (SLBM) leg responsible for ~70% of operationally deployed warheads under New START
- Long-range of D-5 enables operations in broad operational areas, assuring survivability with smaller SSBN force
- Leverages D-5 Life Extension and Modernization Investments
- Avoids cost and risk of new weapon system development

Cost Savings:
Re-use Systems and Components

VIRGINIA Class
- Ship Control System
- Propulsor
- Modular Construction

OHIO Class
- Closure Segments
- Strategic Weapons System and Support Systems
- Fire Control System
Innovation: New Developments

- X-Stern
- Electric Drive
- Out of Autoclave Bow Dome
- Integrated Tube / Hull Construction
- Shaft Life and Change-out
- Atmosphere Control and Monitoring
- Life-Of-Ship Reactor Core
- 42 Year Operational Life

Innovation: Improvements

- Networks and Cybersecurity
- Modular Workstations
- Cabling in Conduit
- SWFTS
- Modular Workstations
- Standardized Cabling Conduits
- Sensors, Networks, Cybersecurity

Submarine Warfare Federated Tactical System
Areas for Future Innovation

- Cybersecurity
- Reduced Electronics Footprint
- Reduced power consumption/heat loads for electronic equipment
- Improved Secure Long Distance Communications
- Reliability/fault tolerance of software systems
- Sensor improvements for own ship awareness
- Improved submarine battery technology (life span)
- Electric Actuation with improved reliability/backup features to allow meeting Subsafe and ship recoverability requirements
- Improved hull coatings
- Improved corrosion coatings and application processes (e.g. paint schemes)
## Integrated Tube & Hull (ITH) Prototyping

Long Lead Time Material (LLTM) and Assembly Procurement

<table>
<thead>
<tr>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
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<tbody>
<tr>
<td>CMC Program Milestone #7 1/13</td>
<td></td>
<td>ITH Forging &amp; MT HY80 Plate Contract Award</td>
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<td></td>
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<td>1st Forging Complete 6/13</td>
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<td>ITH Weldment Assembly and Hatch Cylinder, Eject Pipe, Miscellaneous Attachments Contract Award 11/13</td>
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<td>Access Doors &amp; Associated Liners Contract Award 6/14</td>
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<td>Outfitting Fixture</td>
<td>MT Fixture Design &amp; Fab</td>
<td>Assembly 17 Missile Tubes</td>
<td>First Article Quad Pack 8/16 – 4/18</td>
<td></td>
<td>1st Missile Tube Complete 11/14</td>
<td>Final Missile Tube Complete 11/17</td>
</tr>
</tbody>
</table>
State of the Art Construction Processes
Minimize Cost and Save Time

OHIO Replacement “Quad Pack” Construction Process

84% Outfitted Missile Tube

E-Fixture

F-Fixture

Quad Packs

Prototype Missile Tube

Reduces Missile Compartment Costs and Construction Time
FY13-14 OHIO Replacement Accomplishments

Accomplished
- Set Stern Control Surface Configuration (X-Stern (Apr 2013))
- Joint U.S. / UK CMC Schedule approved (Jun 2013)
- Strategic Weapon Systems Ashore (SWS-A) Test Facility (FL) Construction Start (Jun 2013)
- Superstructure Hydro Testing (Aug 2013)
- Initiated procurement of Long Lead Time Material for Missile Tube procurement (Nov 2013)
- Set Ship Length (Jan 2014)
- Completion of Ship Specifications (Mar 2014)

On-Going & Upcoming
- Propulsor testing
- HM&E component prototyping (ex. Diesel Generator, Air Conditioning Plant, Reverse Osmosis Unit, and Light Emitting Diode (LED) Lighting)
- Ship Control Concept of Operation Exercise
- Procurement of U.S. and UK Missile Tubes
- Preparation for Quad Pack Missile Compartment construction

Manufacturing Fixtures

Surface Launch Test Facility
Vendor activities are expected to increase as OHIO Replacement design matures and construction begins.
OHIO Replacement Takeaways

- OHIO Replacement is a cost-effective recapitalization of our Nation’s Sea-Based Strategic Deterrent
- 12 OHIO Replacement SSBNs meet requirements for strategic deterrence mission
- Lead ship construction must begin in 2021 in order to build, test, and certify the Lead Ship prior to first strategic patrol in 2031
- Aggressively working to reduce costs without compromising capability

Focused on a successful Technology Development and Engineering Integration to support an affordable FY21 lead ship construction for the 12 ship class