

SENEDIA Defense Innovation Days

5 September 2014



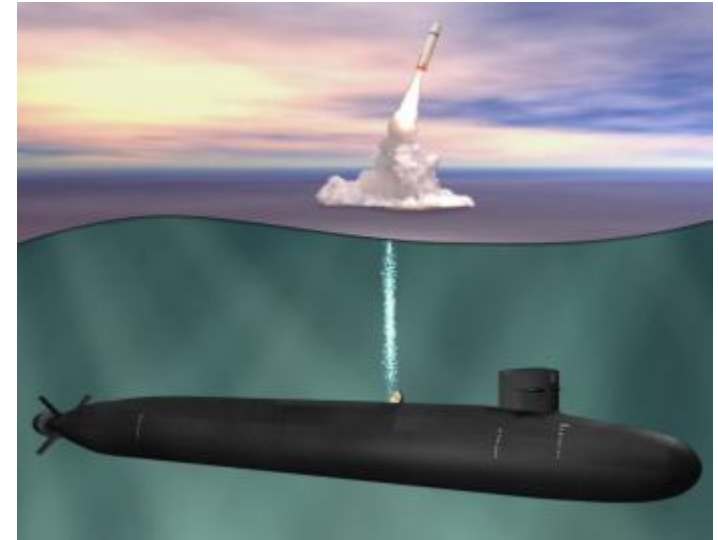
PMS397 Program Director
Mr. Jack Evans



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.



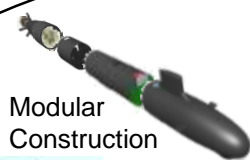
OHIO Replacement SSBN Attributes:

- 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"



Modular Construction



Integrated Tube / Hull Construction



SSBN Design



Propulsor



Electric Drive



Coordinated Stern

Survivability,
Essential Stealth,
and Force Protection



Updateable
Electronics Systems
Extended Service Life



Life of Ship Reactor Core

Improved
Availability



Strategic
Weapons
System (D5LE)



U.S. - UK
Common Missile
Compartment

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

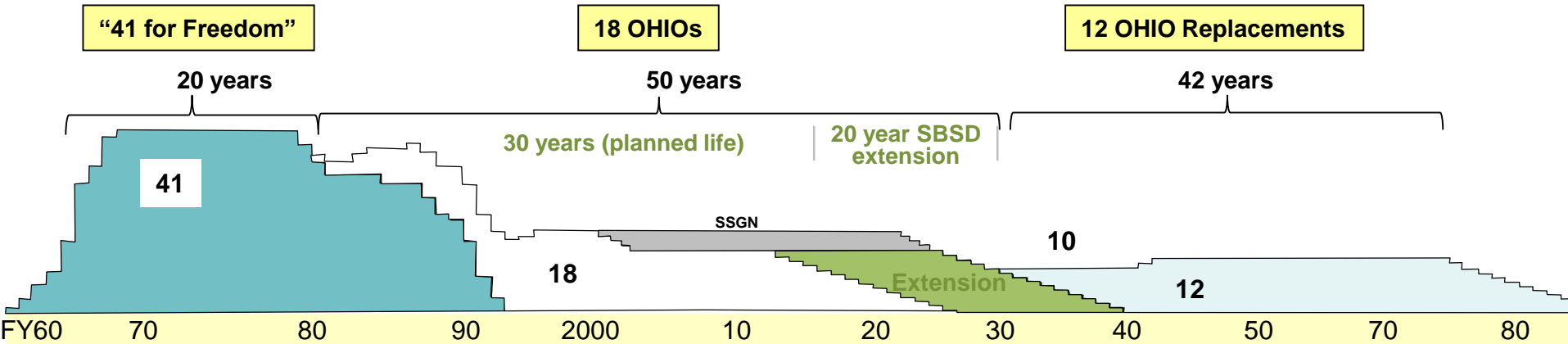
- **SSBN Force is a reliable and survivable leg of the U.S. nuclear triad**
 - SSBNs will be responsible for ~70% of deployed nuclear warheads under New START
 - Impeccable record of 150 successful flight tests

- **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?

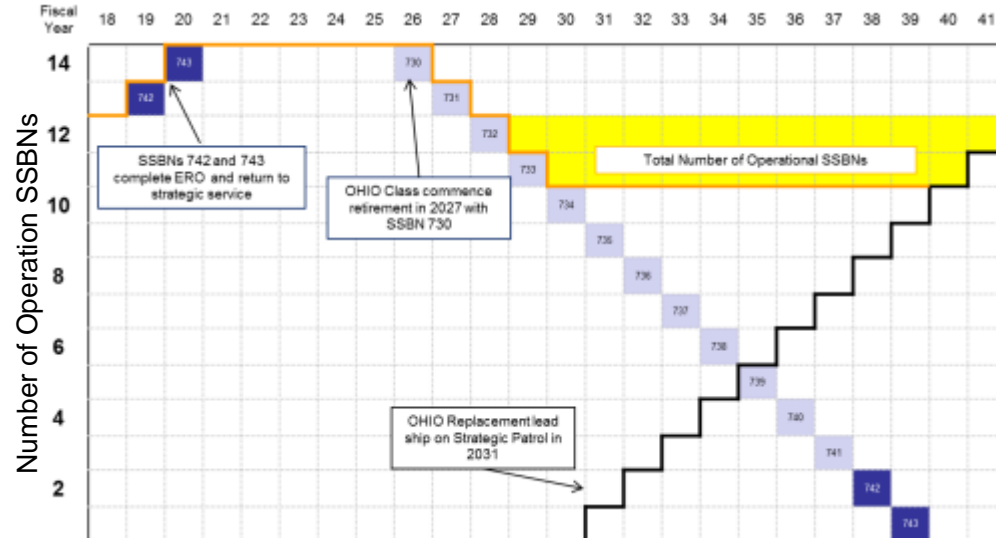
Historical SBSD Force Structure



Planned recapitalization *extended 20 years*; “There is no more margin”

- 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

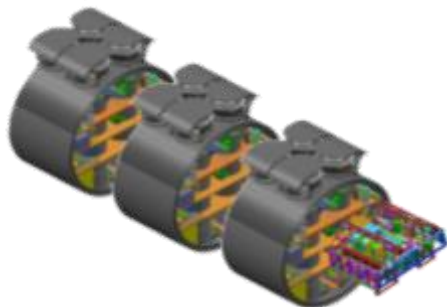
SSBN Force Structure





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)

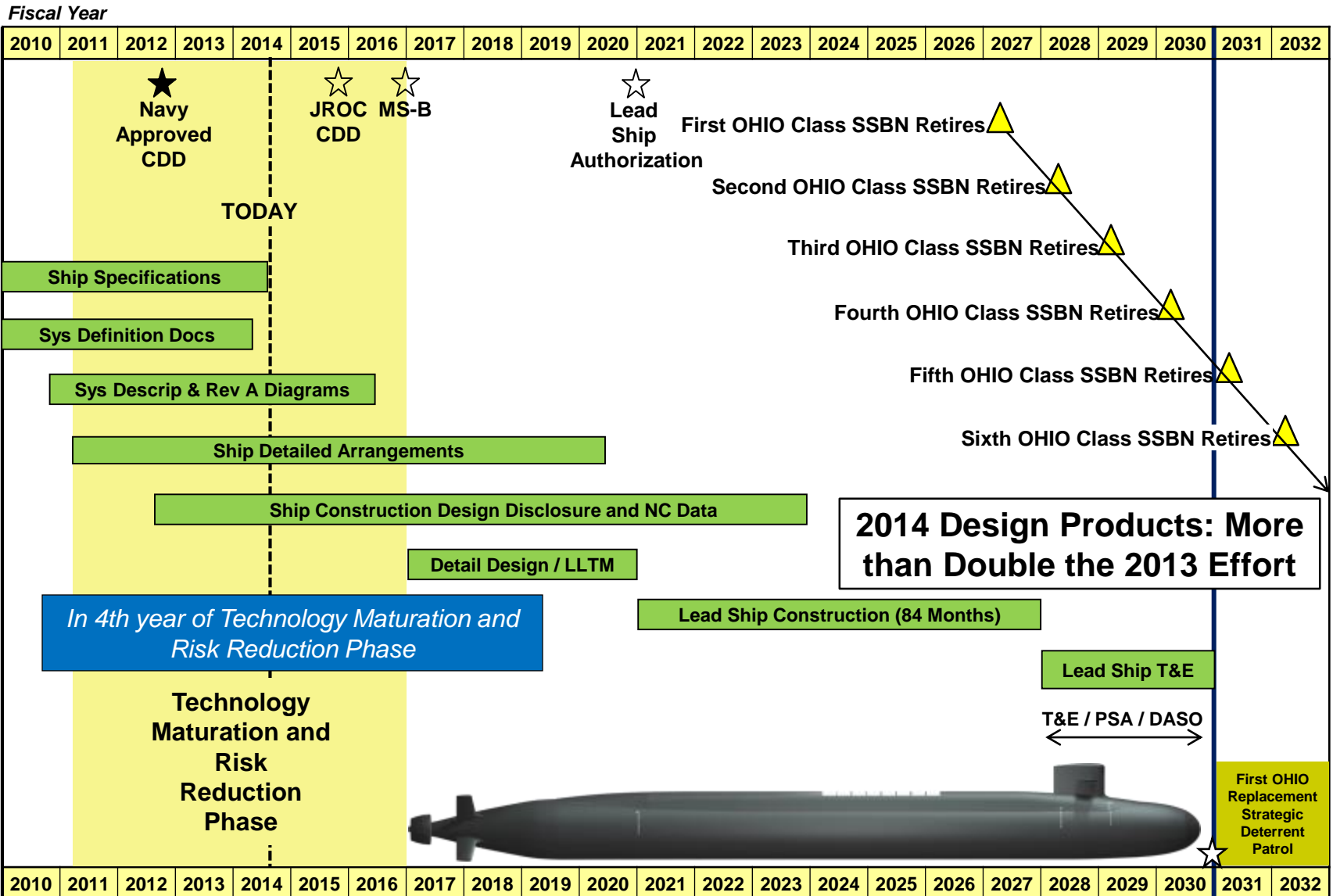


Common Missile Compartment
(12-tubes & MCCM Raft)

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



OHIO Replacement Schedule

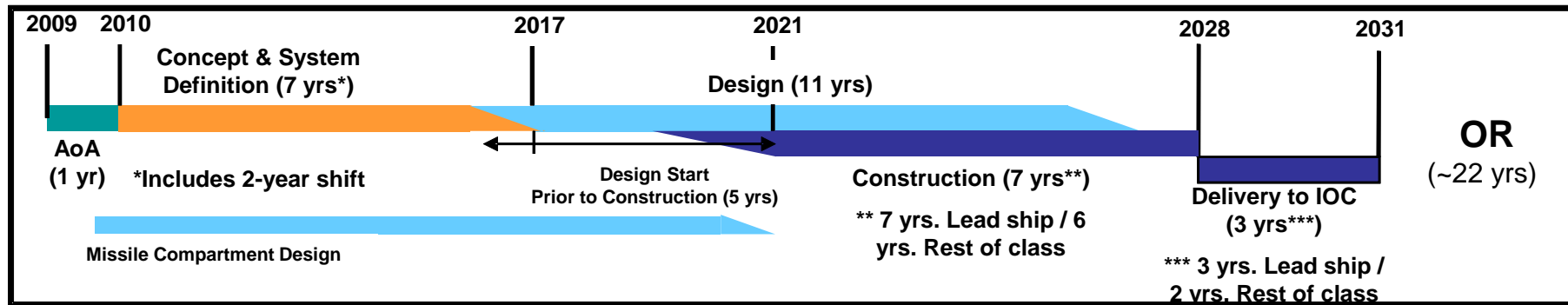




A High Degree of Design Completion is Critical to a Successful Lead Ship Construction Program

OHIO Replacement Lead Ship Construction Timeline

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



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

The Scope of the OHIO Replacement Design Effort is Unparalleled



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**

Delivering the Core Essential Military Capability at the Lowest Possible Cost

(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



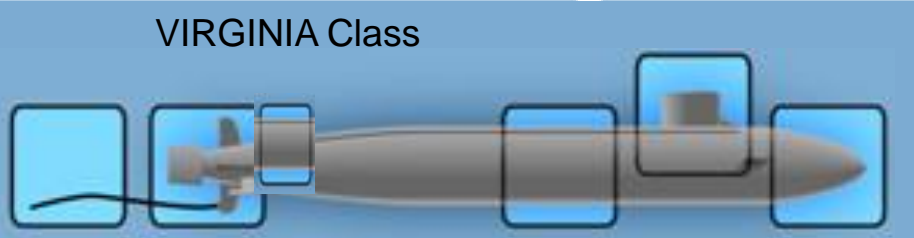
Cost Savings: Re-host TRIDENT II (D-5)

- 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

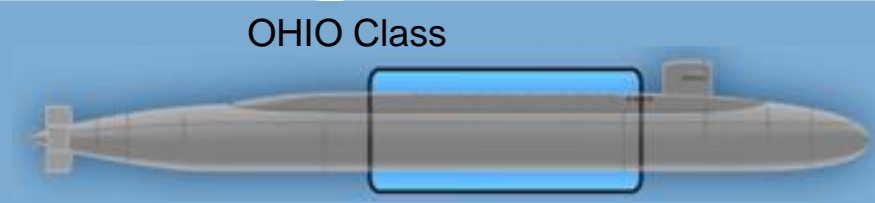


Propulsor



Modular Construction

OHIO Class



Strategic Weapons System and Support Systems



Closure Segments



Fire Control System



Innovation: New Developments and Improvements



Innovation: New Developments



X-Stern



Electric Drive



Out of Autoclave
Bow Dome



Integrated Tube / Hull Construction

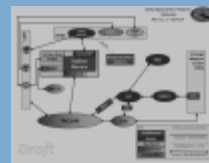
Shaft Life and Change-out

Atmosphere Control and Monitoring

Life-Of-Ship Reactor Core

42 Year Operational Life

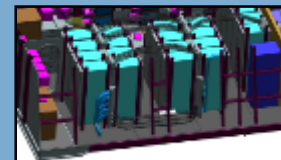
Innovation: Improvements



Networks and
Cybersecurity



Modular
Workstations



Cabling in
Conduit



Submarine Warfare Federated Tactical System

SWFTS

Modular Workstations

Standardized Cabling Conduits

Sensors, Networks,
Cybersecurity



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)

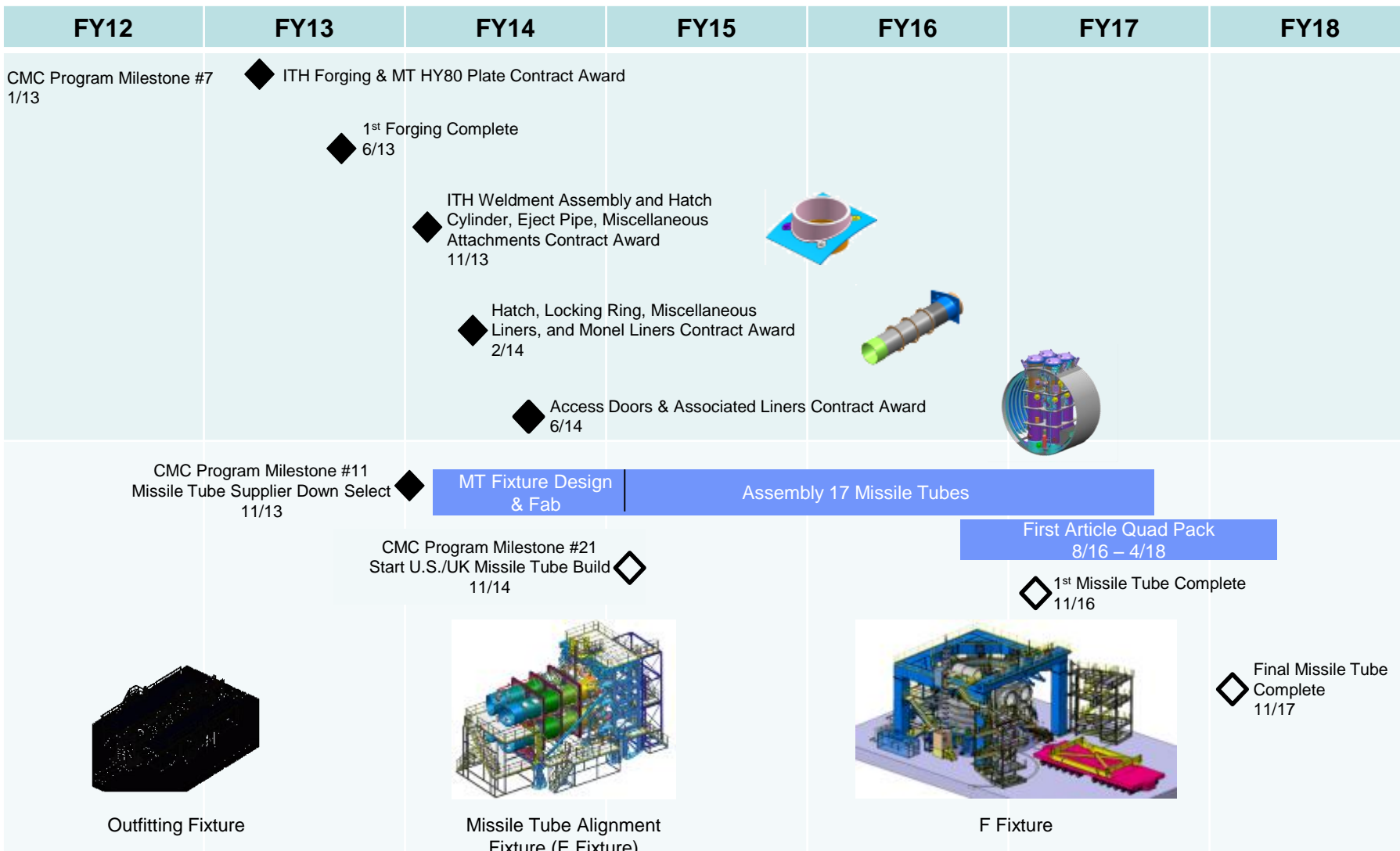


Integrated Tube & Hull (ITH) Prototyping

Long Lead Time Material (LLTM) and Assembly Procurement

Long Lead Time Material

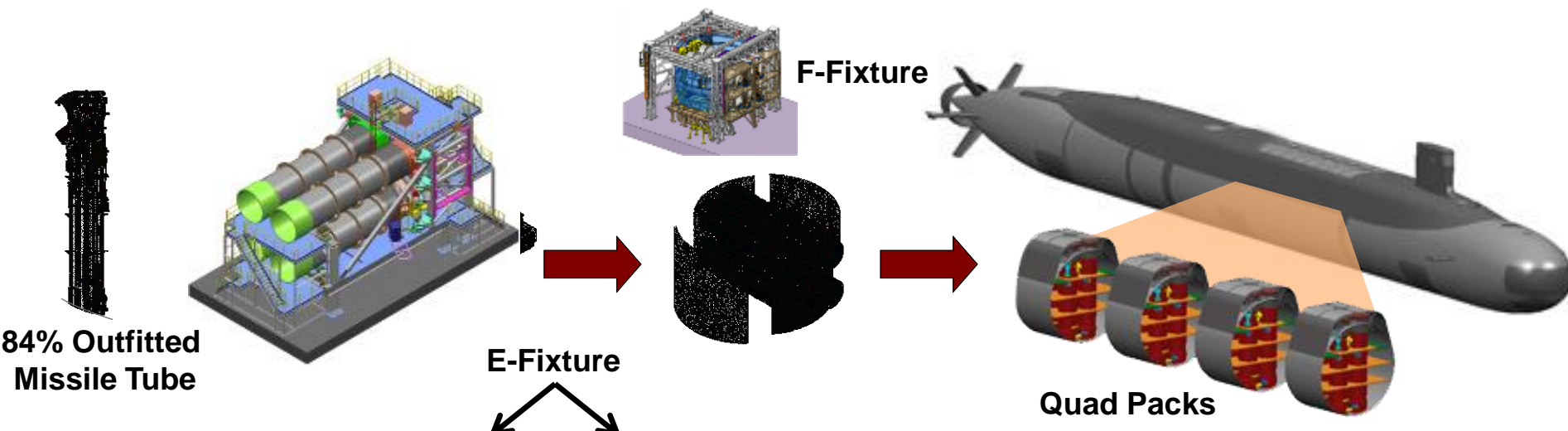
Assembly





State of the Art Construction Processes Minimize Cost and Save Time

OHIO Replacement "Quad Pack" Construction Process



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)

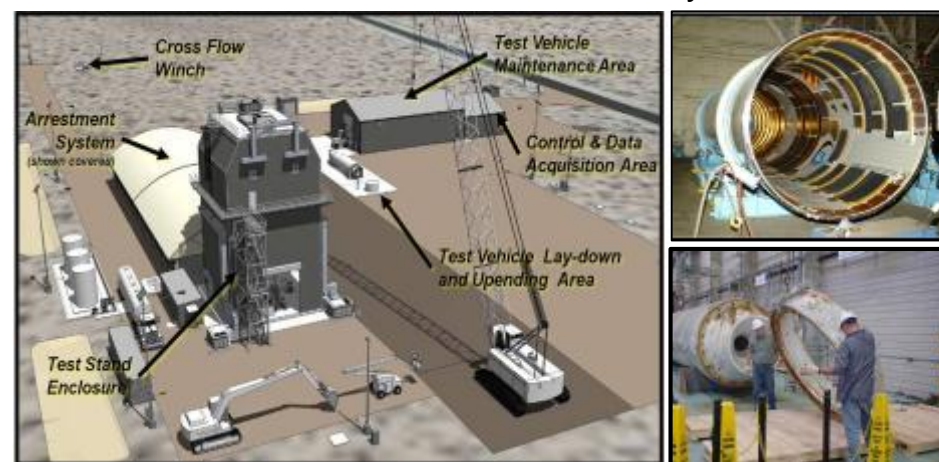
On-Going & Upcoming

- 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





Contractors and Government Field Activities Map

501 Vendors / Suppliers
41 States
3 Countries

WASHINGTON

- Kitsap Naval Base
- NUWC Keyport
- Bradken-Atlas

IDAHO

- NSWC ARD Bayview

ILLINOIS

- Scott Forge

NEW YORK

- Lockheed Martin Mission Systems

MAINE

- Bath Iron Works

MASSACHUSETTS

- General Dynamics Advanced Information Systems (GDAIS)
- L-3 – Henschel

UNITED KINGDOM

- Sheffield Forgemasters
- BAE Submarine Solutions
- Babcock
- Rolls Royce

SWITZERLAND

- APCO Technologies

CONNECTICUT / RHODE ISLAND

- NUWC Newport, RI
- Quonset Point, RI
- Electric Boat, CT

PENNSYLVANIA

- ARL / Penn State
- Naval Foundry & Propeller Center
- WHEMCO, Inc.

MARYLAND

- NAVAIR
- NSWC Carderock
- JHU / APL

VIRGINIA

- SPAWAR Norfolk
- HII-Newport News Shipbuilding
- Lockheed Martin Mission Systems and Sensors
- NSWC Dahlgren
- Northrop Grumman–Sperry Marine

SOUTH CAROLINA

- SPAWAR Charleston

FLORIDA

- Naval Ordnance Test Unit Cape Canaveral
- Goodrich

GEORGIA

- Kings Bay Naval Base

MISSISSIPPI

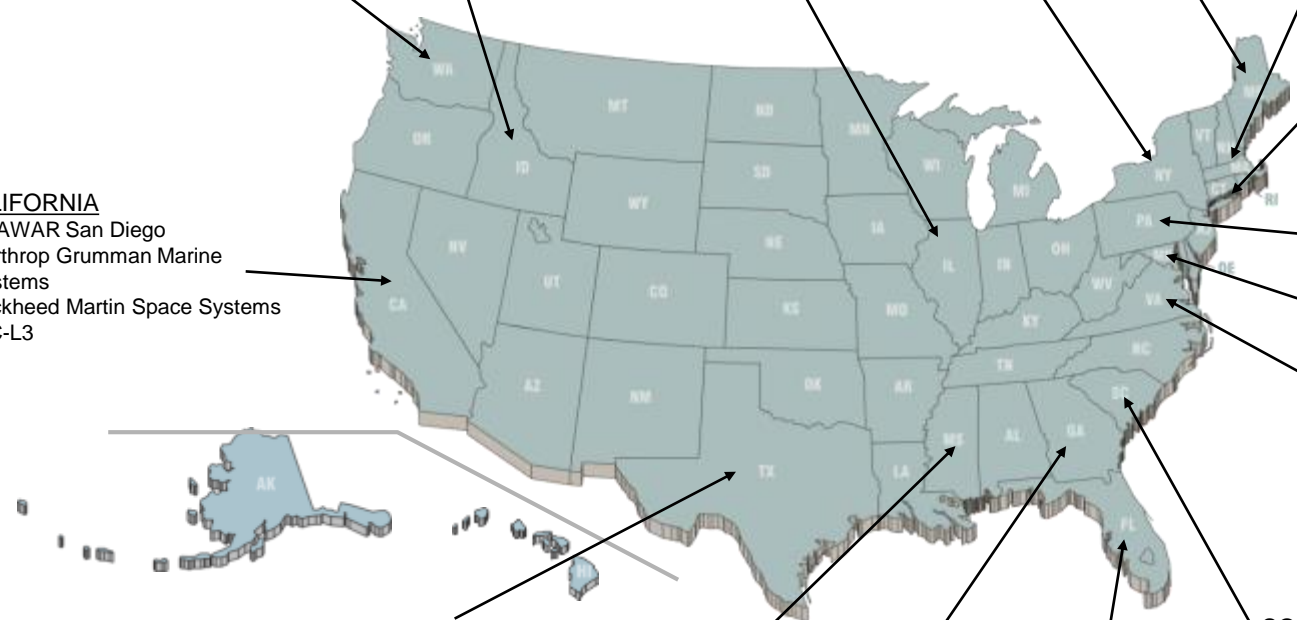
- Rolls Royce
- Seemans Composites

TEXAS

- Oil States Industries
- National Instruments

CALIFORNIA

- SPAWAR San Diego
- Northrop Grumman Marine Systems
- Lockheed Martin Space Systems
- IEC-L3



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