SSN 774 *Virginia*-Class Submarine

Executive Summary

- The Navy deployed the first *Virginia*-class Block III submarine, USS *North Dakota* (SSN 784), in May 2015, with only limited developmental testing of the platform's major subsystem upgrades. Major testing phases included developmental testing of the new Large Aperture Bow (LAB) sonar array, testing of the system to support weapon system accuracy (this included sonar performance assessments), testing of the weapon system interfaces, and a limited operational assessment phase to support deployment certification.
- DOT&E submitted a classified Early Fielding Report in September 2015 detailing the results of the testing to date. DOT&E concluded that:
  - The changes to the *Virginia*-class Block III submarine do not appear to improve or degrade the system's ability to conduct submarine missions.
  - The LAB array used on the *Virginia*-class Block III submarine has the potential to perform as an adequate replacement for the spherical array used on previous *Virginia*-class variants.
  - System reliability meets the Navy's thresholds.
- The Navy commenced operational testing of the *Virginia*-class Block III submarine in June 2017 that included anti-submarine warfare, anti-surface warfare, strike warfare, and mobility in support of the intelligence collection mission area. The Navy expects to complete operational testing in November 2017. DOT&E assessment of the *Virginia*-class Block III submarine is ongoing. DOT&E will submit a classified FOT&E report in FY18.
- The Navy submitted the *Virginia* Block III Vulnerability Assessment Report for DOT&E review in August 2017. The Navy expects to publish a final report by January 2018.

System

- The *Virginia*-class submarine is the Navy's latest fast-attack submarine and is capable of targeting, controlling, and launching MK 48 Advanced Capability torpedoes and Tomahawk cruise missiles.
- The Navy is procuring *Virginia*-class submarines incrementally in a series of blocks; the block strategy is for contracting purposes, not necessarily to support upgrading capabilities.
  - Block I (hulls 1-4) and Block II (hulls 5-10) ships were built to the initial design of the *Virginia* class.
  - Block III (hulls 11-18) and Block IV (hulls 19-28) ships, starting with SSN 784, include the following affordability enhancements:

    - A LAB array in place of the spherical array in the front of the ship
    - Two *Virginia* payload tubes replace the 12 vertical launch tubes; each payload tube is capable of storing and launching 6 Tomahawk land-attack missiles used in strike warfare missions
  - Block V and beyond will increase strike payload capacity from 12 to 40 Tomahawk land-attack missiles by adding a set of 4 additional payload tubes in an amidships payload module, capable of storing and launching 7 Tomahawk missiles each, as well as providing the potential to host future weapons and unmanned systems.

Mission

The Operational Commander will employ the *Virginia*-class Block III submarine to conduct open-ocean and littoral covert operations that support the following submarine mission areas:

- Strike warfare
- Anti-submarine warfare
- Intelligence, surveillance, and reconnaissance
- Mine warfare
- Anti-surface warfare
- Naval special warfare
- Battle group operations

Major Contractors

- General Dynamics Electric Boat – Groton, Connecticut
- Huntington Ingalls Industries, Newport News Shipbuilding – Newport News, Virginia

Activity

- In September 2015, DOT&E submitted a classified Early Fielding Report on the first *Virginia*-class Block III submarine due to submarine deployment prior to the completion of operational testing.
- In September and October 2016, the Navy conducted a cybersecurity assessment of the *Virginia*-class Block III submarine.
- In February and April 2017, the Navy conducted operational testing of the strike warfare capabilities of the *Virginia*-class Block III submarine.
- In June 2017, the Navy conducted a comprehensive operational test of the *Virginia*-class Block III submarine. The Navy evaluated the Block III submarine in the following mission areas:
  - Surface warfare, including torpedo employment, against U.S. naval vessels in open-ocean near Fort Pierce, Florida.
  - Mobility is support of intelligence collection in a high density contact environment off the coast of Port Everglades, Florida. The focus of this test was the crew's capability to maintain situational awareness both when the submarine was deep and when the submarine was at periscope depth among a large number of surface ships.
  - Anti-submarine warfare, inclusive of submarine search through prosecution, against a high-end nuclear submarine in the Port Everglades Operating Area. Testing included a detection/classification range comparison test between the Block I/II spherical array and the Block III LAB array, as well as a search rate test against a high-end threat nuclear submarine surrogate.
- To date, the Navy completed testing in accordance with a DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plans.
- In October 2017, the Navy completed test strategy and test design development for operational test of the *Virginia*-class Block V submarine. The Navy expects to submit the *Virginia*-class Block V submarine TEMP for approval in FY18.
- In August 2017, the Navy submitted the *Virginia* Block III Vulnerability Assessment Report for DOT&E review.
- The Navy scheduled the remaining operational test event, a maximum Tomahawk Land Attack Missile alignment, in November 2017.
- The Navy completed the shock qualification testing for the *Virginia* Common Weapons Launcher and the *Virginia* Payload Tube hatch in late 2014, but has since redesigned a subcomponent of the hatch. General Dynamics Electric Boat requested hatch shock qualification with a noted exception of the modified component. The Navy continues to evaluate the subcomponent redesign and has not determined a method to approve the exception.
- The Navy continued its verification, validation, and accreditation (VV&A) of the Transient Shock Analysis modeling methods used for the design and shock qualification of the *Virginia*-class Block III items. The Navy expects to complete this effort in 2QFY18.

Assessment

- The September 2015 DOT&E classified Early Fielding Report details the effects of new major system components with respect to the intended mission during the early deployment. The report concluded the following:
  - The changes to the *Virginia*-class Block III submarine do not appear to improve or degrade the system's ability to conduct submarine missions.
  - The LAB array demonstrates the potential to perform as an adequate replacement for the legacy spherical array.
  - The sonar Light Weight Wide Aperture Array experienced a hardware fault which limited the ability to assess effectiveness of the system.
  - Developmental testing of the system indicates that system software reliability meets the Navy's thresholds. Testers could not evaluate hardware reliability because of limited time.
- The FOT&E assessment of the *Virginia*-class Block III submarine remains ongoing. DOT&E will submit a classified FOT&E report in FY18.
- DOT&E review of the draft *Virginia* Block III Vulnerability Assessment Report is in progress. The Navy expects to publish the report by January 2018.

Recommendations

- Status of Previous Recommendations. The following are recommendations that remain from FY16. The Navy should:
  1. Test against a diesel submarine threat surrogate in order to evaluate the *Virginia*-class submarine's capability, detectability, and survivability against modern diesel-electric submarines.
  2. Conduct an FOT&E to examine the *Virginia*-class submarine's susceptibility to airborne anti-submarine warfare threats such as Maritime Patrol Aircraft and helicopters.
  3. Complete the verification, validation, and accreditation of the Transient Shock Analysis method used for *Virginia*-class Block III items.
  4. Complete the FOT&E event to determine the *Virginia*-class submarine's susceptibility to low-frequency active sonar and the submarine's ability to conduct anti-surface ship warfare in a low-frequency active environment. This testing should include a *Los Angeles*-class submarine operating in the same environment to enable comparison with the *Virginia*-class submarine.
  5. Investigate and implement methods to aid Special Operations Forces in identifying the submarine during operations in conditions of low visibility.
  6. Address the three classified recommendations listed in the September 2015 Block III *Virginia* class Early Fielding Report.
- FY17 Recommendations. None.