

## SSN 774 *Virginia*-Class Submarine

### Executive Summary

- The Navy completed FOT&E on the *Virginia*-class Block III submarine. FOT&E focused on testing significant modifications from Block I to Block III, specifically the replacement of a legacy submarine spherical array with a Large Aperture Bow (LAB) array and the replacement of 12 vertical launch tubes with 2 large diameter *Virginia* Payload Tubes (VPTs). The Navy tested the *Virginia*-class Block III submarine in anti-submarine, anti-surface, and strike warfare, and situational awareness in areas with significant shipping activity.
- DOT&E will submit a classified FOT&E report in 2QFY19. Based on preliminary assessment, the primary modifications (LAB array and two VPTs) are effective replacements to their legacy components in the *Virginia*-class Block I submarine. *Virginia*-class Block III is operationally effective and operationally suitable for the primary missions affected by these modifications, specifically anti-submarine and strike warfare.

### System

- The *Virginia*-class submarine is the Navy's latest fast-attack submarine and is capable of targeting, controlling, and launching MK 48 torpedoes and Tomahawk land-attack missiles (TLAMs).
- 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 large diameter VPTs replace the 12 vertical launch tubes; each payload tube is capable of storing and launching 6 TLAMs used in strike warfare missions



- Block V and beyond will increase strike payload capacity from 12 to 40 TLAMs by adding a set of 4 additional VPTs in an amidships payload module, capable of storing and launching 7 TLAMs 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 Block III submarine deployment prior to the completion of operational testing.
- In December 2017, the Navy completed FOT&E of the *Virginia*-class Block III submarine. The Navy completed FOT&E events in accordance with DOT&E-approved test plans. The *Virginia*-class Block III submarine employed the

Advanced Processing Build (APB-09) software version of the submarine sonar system and the submarine combat system. FOT&E events tested the following capabilities.

- Anti-submarine warfare against a high-end nuclear submarine
- Surface warfare, including torpedo employment
- Strike warfare capabilities, including operator employment of TLAMs using a new common weapon launcher and a

demonstration of two TLAMs (without warheads) fired from the new VPTs

- Submarine mobility to include the crew's ability to maintain situational awareness in the presence of significant shipping activity
- Cybersecurity
- The Navy concluded FOT&E on *Virginia*-class Block III with insufficient data collected on the anti-surface warfare mission. The Navy collected data; however, post-test evaluation determined the data were not valid for assessment. The Navy determined that the limited impact of Block III modifications on submarine capability to support this mission did not warrant extending the FOT&E to collect additional data.
- The Navy completed development of a *Virginia*-class Block V submarine Test and Evaluation Master Plan, which is in formal routing for approval.
- The Navy issued the *Virginia*-class Block III Vulnerability Assessment Report (VAR) supplement for Block III.
- The Navy issued the VPT Shock Test Report. Based on the VPT shock tests, completed in 2014, Electric Boat requested the shock qualification of hatch components. The Navy is evaluating the request.

## Assessment

- DOT&E will submit an FOT&E report on the *Virginia*-class Block III submarine in 2QFY19. The preliminary analyses indicate the following:
  - *Virginia*-class Block III submarine is operationally effective for anti-submarine warfare. The LAB array is an effective replacement for the legacy spherical array. The *Virginia*-class Block III submarine capability against diesel submarines remains unknown because submarine acoustic security restricts operational testing against real-world diesel submarines. Further, the absence of a mobile set-to-hit target limits the Navy's evaluation of submarine torpedo performance.
  - *Virginia*-class Block III submarine is operationally effective for strike warfare. Two VPTs are an effective replacement for 12 legacy vertical launch tubes.
  - *Virginia*-class Block III submarine did not meet Navy requirements for situational awareness in the presence of significant shipping activity. This capability of *Virginia*-class Block III submarine is highly dependent upon the submarine sonar system and the submarine

combat system, which have undergone three increments of improvement from the APB-09 variants employed in the *Virginia*-class Block III submarine test. Operational testing of APB-15 software of these tactical systems in FY19 will directly inform *Virginia*-class Block III submarine capability to support situational awareness upon scheduled upgrades.

- *Virginia*-class Block III submarine is operationally suitable with no significant deficiencies identified with operational availability or reliability.
- Analysis of the *Virginia*-class Block III VAR supplement identify that the modifications from Block I to Block III do not degrade the *Virginia*-class submarine's ability to support fleet missions.
- DOT&E intends to provide cybersecurity results that affect operational effectiveness in the classified FOT&E report.
- The Navy's decision to conclude FOT&E on *Virginia*-class Block III submarine is appropriate. The Navy completed adequate testing on the primary missions impacted by the significant modifications between Block I and Block III of the *Virginia*-class submarines. The *Virginia*-class Block III submarine derives its mission capability in anti-surface warfare primarily from the submarine sonar system, the submarine combat system, and the submarine torpedoes. The Navy intends these supporting systems to undergo periodic improvement on a 2- to 3-year cycle, and each system has a formal operational test program. DOT&E will evaluate anti-surface warfare capability of the *Virginia*-class Block III submarine through the test programs of these supporting systems.

## Recommendations

The Navy should:

1. Monitor *Virginia*-class Block III submarine capability to support anti-surface warfare during the test programs associated with the submarine sonar system, the submarine combat system, and submarine torpedo improvement.
2. Monitor *Virginia*-class Block III submarine capability to support situational awareness in environments with significant shipping activity during the test programs associated with submarine sonar and submarine combat system improvement.