SSN 774 *Virginia*-Class Submarine

Executive Summary

- In April 2019, DOT&E approved a Test and Evaluation Master Plan covering the Block V variant of the *Virginia*-class submarine. The Navy expects operational test of the *Virginia*-class Block V submarine in FY27.
- In July 2019, DOT&E submitted a classified FOT&E report on the *Virginia*-class Block III submarine. The *Virginia*-class Block III submarine is operationally effective and operationally suitable. The survivability of the *Virginia*-class Block III submarine is unchanged from Blocks I and II. The Large Aperture Bow (LAB) array is an effective replacement for the legacy spherical array, and the two *Virginia* Payload Tubes (VPTs) are an effective replacement for 12 legacy vertical launch tubes.

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 *Virginia* Payload Modules in an amidships hull extension, capable of storing and launching 7 TLAMs each, as well

as providing the potential to host future weapons and unmanned systems. The Navy also intends Block V to include acoustic enhancements and quieting improvements.

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 April 2019, DOT&E approved a Test and Evaluation Master Plan covering the Block V variant of the *Virginia*-class submarine. The Navy expects operational test of the *Virginia*-class Block V submarine in FY27.
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- In FY19, the Navy completed two live fire test series that support a survivability assessment of the vessel to underwater

shock events. Both test series will improve the confidence in the modeling and simulation (M&S) used to assess *Virginia*-class Block V survivability. These test series were conducted in accordance with DOT&E-approved test plans and included:

- Shallow submergence underwater explosion testing to validate M&S predictions of the structural response of

representative scaled Tube Stiffened Models (TSM) to underwater shock loading.

- Deep submergence underwater explosion tests to assess structural response of the TSMs to combined shock and pressure loading. This testing utilized explosive charges against TSMs inside a pressure vessel held at deep submergence pressures to build confidence in the ability of M&S tools to predict the onset of structural collapse at operational depths.

Assessment
- The DOT&E FOT&E report dated July 31, 2019, concluded the following regarding performance:
  - *Virginia*-class Block III submarine is operationally effective.
    - The LAB array is an effective replacement for the legacy spherical array and supports effective use of *Virginia*-class Block III submarine for anti-submarine warfare. The *Virginia*-class Block III submarine capability against diesel submarines remains unknown because submarine acoustic security restricts operational testing against real-world diesel submarines.
    - Two VPTs are an effective replacement for 12 legacy vertical launch tubes and support the effective use of *Virginia*-class Block III submarine for strike warfare.
  - *Virginia*-class Block III submarine is operationally suitable with no significant deficiencies identified with operational availability or reliability.
  - Cybersecurity results that affect operational effectiveness are in the classified FOT&E report.
  - Analysis of the *Virginia*-class Block III Vulnerability Assessment Report supplement identify that the modifications from Block I to Block III do not degrade the *Virginia*-class submarine's ability to support fleet missions or survivability against operationally relevant threat engagements.

Recommendation
1. The Navy should address the 15 recommendations in the classified DOT&E FOT&E report.