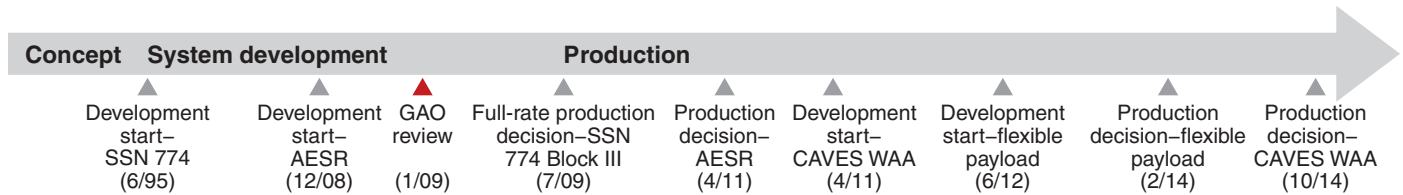


## Virginia Class Submarine (SSN 774)

The Navy's Virginia-class attack submarine is designed to combat enemy submarines and surface ships, fire cruise missiles, and provide improved surveillance and special operation support to enhance littoral warfare. The Navy is gradually introducing three new technologies to improve performance and lower construction costs. The Navy is also working towards a goal of reducing construction costs by approximately \$400 million per ship by fiscal year 2012. We assessed the status of the three new technologies and the cost reduction effort.



Source: U.S. Navy.



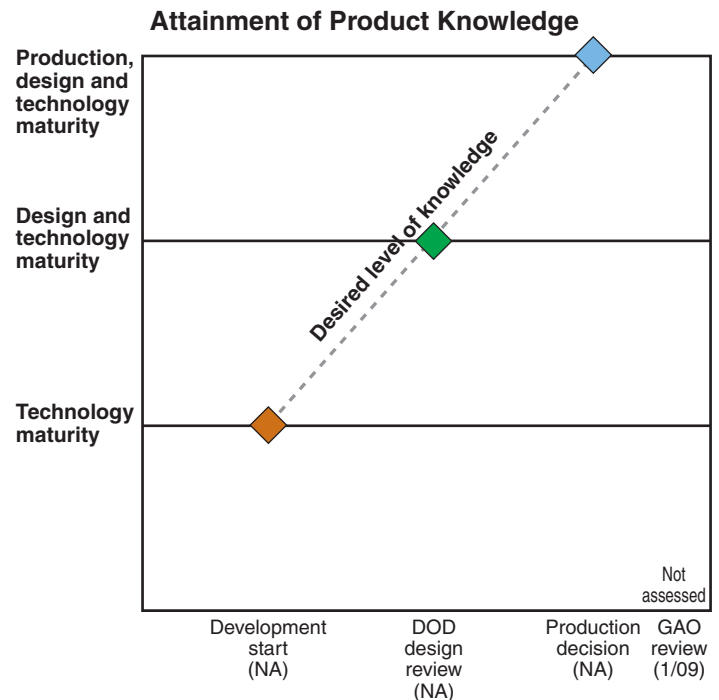
**Program Essentials**

Prime contractor: General Dynamics, Electric Boat Corporation  
 Program office: Washington, DC  
 Funding needed to complete:  
 R&D: \$1,026.4 million  
 Procurement: \$46,119.0 million  
 Total funding: \$47,145.4 million  
 Procurement quantity: 20

**Program Performance (fiscal year 2009 dollars in millions)**

	As of 06/1995	Latest 12/2007	Percent change
Research and development cost	\$4,349.8	\$6,233.8	43.3
Procurement cost	\$54,027.8	\$75,322.4	39.4
Total program cost	\$58,377.5	\$81,556.2	39.7
Program unit cost	\$1,945.918	\$2,718.540	39.7
Total quantities	30	30	0.0
Acquisition cycle time (months)	134	151	12.7

The Navy is gradually introducing three new technologies—advanced electromagnetic signature reduction, a flexible payload sail, and a conformal acoustic velocity sensor wide aperture array—on new or existing submarines as they mature. The Navy has also focused on reducing the cost per submarine from \$2.4 billion to \$2.0 billion (in 2005 dollars, or \$2.2 in 2009 dollars), and seems to be on track to achieve this goal. The Navy has invested \$600 million in this cost reduction effort and, according to Navy officials, reduced costs by more than \$172 million per ship through design changes and construction time reductions. Many of the design changes will be implemented beginning with the first ship of Block III currently scheduled for fiscal 2009. Navy officials stated plans to order two submarines a year in 2011 to further reduce costs.



## Virginia Class Submarine Program

### Technology Maturity

There are three new technologies that the Navy plans to incorporate on current and future Virginia Class submarines once they mature. Advanced electromagnetic signature reduction is a software package comprised of two systems that use improved algorithms to continuously monitor and recalibrate the submarine's signature. The basic algorithms required to support this technology have been proven on other submarines, and Navy officials stated they are now developing software and conducting laboratory tests in support of algorithm development. Navy officials stated they expect the technology to be installed during new construction starting with SSN 781 and back-fit during modernization for earlier ships.

The flexible payload sail (formerly the advanced sail)—a redesign of the structure that sits atop the main body of the submarine—will allow the sail to house additional systems and payloads. According to Navy officials, the flexible payload sail design replaced the advanced sail due to concerns about weight, hydrodynamic performance, and access to the weapons trunk. The design of the flexible payload is under review for inclusion on later submarines.

The conformal acoustic velocity sensor wide aperture array is intended to be a more cost-effective sensor array that replaces transducers with accelerometers, while providing the same capability. According to the Navy, the new array is expected to save \$11 million to \$12 million per submarine, and consists of panels that will be integrated with one of two types of sensors designed to detect vibrations and acoustic signatures of targets—ceramic accelerometers, a mature but more costly technology, or fiber-optic accelerometers, a less expensive but immature technology. According to program officials, testing of panels incorporating both types of sensors was completed in December 2008, and a decision on which accelerometer will be selected is expected by the end of fiscal year 2009, and at-sea testing is expected in 2010.

### Other Program Issues

Navy officials stated that they are currently conducting an operational evaluation of the Virginia class, and in July 2009 hope to conduct a milestone

review to assess the health of the program. One of the program's near-term focuses is to reduce the cost of each submarine by \$400 million (in 2005 dollars) by 2012. Thus far, the Navy has realized cost reductions of \$84.2 million through design changes. For example, the bow of the submarine has been redesigned to replace the spherical sonar array with a hull conforming sonar array, which program officials say is easier and cheaper to build. Program officials also stated that the twelve vertical launch tubes will be replaced with two large payload tubes, similar to those on guided missile submarines, to simplify construction. The Navy realized an additional \$87.9 million in cost reductions by decreasing construction time from 95 to 66 months. Program officials attributed the decrease to the shipyards gaining familiarity with building the ship, and the integration of more efficient building processes, such as coating the submarine hulls at a more efficient stage in the process. This change alone allows the shipyard to save up to 6 months in construction. Program officials told us the Block III contract, signed in December 2008, includes the design change and schedule reduction savings described above, an expected \$200 million in savings due to escalating production and beginning multi-year procurement, and a further \$28 million in reductions gained through contract negotiations.

### Program Office Comments

The program office provided technical comments on a draft of this assessment, which were incorporated as appropriate.