

SSN XIPHIAS

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The Navy is always searching for tomorrow's weapons and platforms that will give its sailors an edge over adversaries across a range of mission areas. The next generation of nuclear-powered attack submarines, classified as SSNs, is no exception. It is critical that the new generation of SSNs replacing the Virginia Class Submarine embraces technologies that can deliver platform performance that rivals growing threats posed by present and future adversaries in the undersea warfare domain. A range of SSN attributes are required to create the most capable undersea warfighting platform, from speed and acoustic superiority to weapons payload. This design project aims to achieve these attributes, by embracing unique design features not traditional to the U.S. submarine fleet.

Dubbed SSN XIPHIAS, this project explores the concept design of a double hull, sailless submarine to improve performance while maintaining all other attributes and requirements. The design must also compensate for changes to operational practices driven by these unique features. The team also considered present and future mission areas by incorporating tried-and-true technology where beneficial and by adopting emerging technologies where necessary to improve the platform's longevity. To accomplish this, knowledge and resources outside the normal U.S. Navy practices were leveraged to alter and improve traditional tools and practices for submarine concept development.



Figure 1: Final XIPHIAS concept design.

The concept design requirements were collectively determined with the project sponsor. These requirements aim to achieve the most capable platform possible, while wholly committing to the unique design features. Therefore, the team embraced the double hull, sailless design and performed hydrodynamic, hull optimization, arrangements, structural, concept of operations, and maintenance studies. Through the formulation of a concept design and the studies performed, the team found that a double hull design complements a sailless submarine by providing additional freeboard for surfaced operations while retaining a smooth body of revolution outer hull.

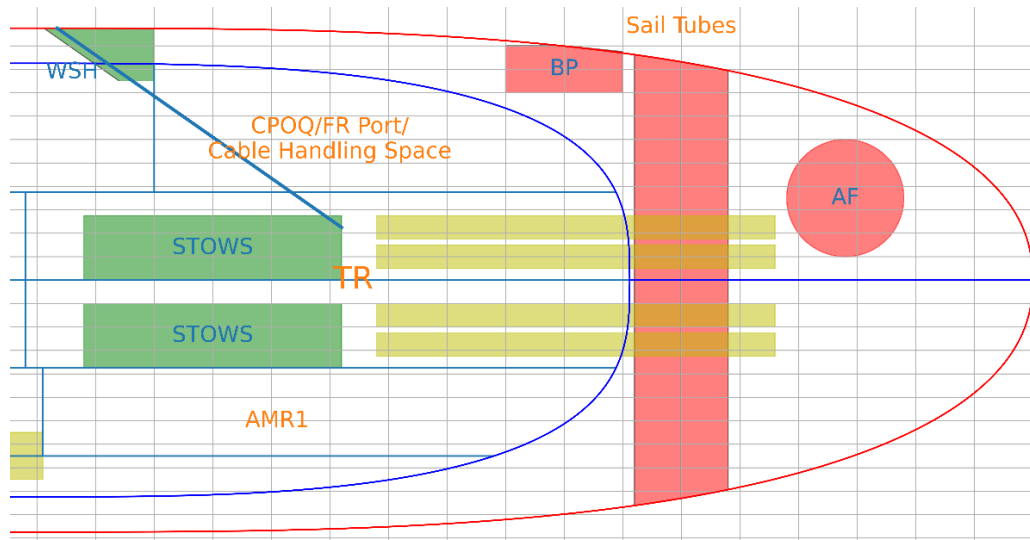


Figure 2: Side view of torpedo room and sail tubes.

The sail removal and double hull construction created distinctive challenges for the team across all aspects of the concept design process. Chiefly among them is determining arrangements and operational considerations for a large payload and the placement of components usually placed within a sail (e.g., communication masts and periscopes). Thus, these two platform qualities drove most of the design. The team designed for no topside manning during normal surfaced operations and opted to use eight individual telescoping masts placed in the forward main ballast tank, immediately forward of the pressure hull forward closure head. This placement minimizes the impact of the scopes and antennas on internal arrangements, at-sea and in-port maintenance operations, and reduces the number of complex pressure hull penetrations.

The team was able to develop a double hull, sailless submarine that exceeds threshold requirements for speed, vertical launch capability, and small horizontal payload, while meeting objective requirements for torpedoes and cost. Final design characteristics seen in Table 1.

XIPHIAS Final Specifications			
Hull Length	344 ft	Cost (5 th ship in class)	\$4.7 B
Hull External Diameter (LOD)	43 ft (8.0)	Electric Plant	8000 kW
Maximum Speed	33.3 kts	Surfaced Draft	31.7 ft
Shaft Hp	45,000 Hp	Freeboard	11.3 ft
VLS	14	GM	1.26 ft
Torpedo Tubes/Stows	8/48	Margin Lead	10.9%
Small Torpedo/Stows	4/28	Volume Error	4.9%
Submerged Displacement	10,986 tton	Reserve Buoyancy	25.0%

Table 1: Final XIPHIAS concept design specifications.