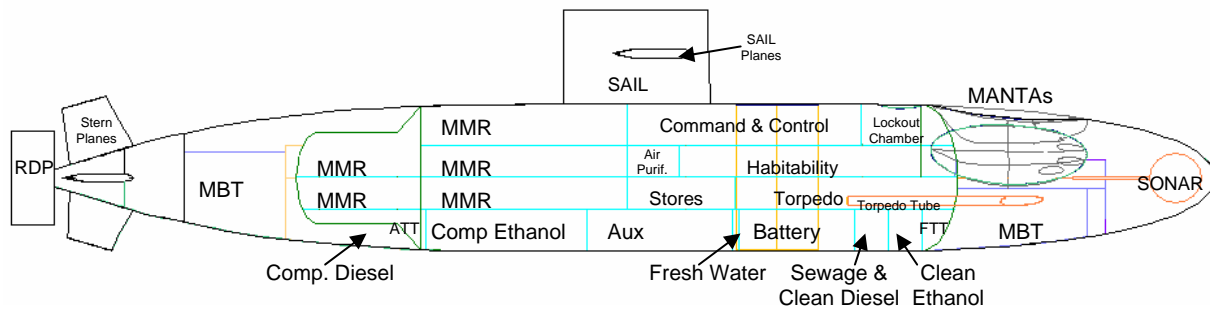


Executive Summary



This report describes the Concept Exploration and Development of a non-nuclear, Large Open Interface Submarine (SSLOI) for the United States Navy. This concept design was completed in a two-semester ship design course at Virginia Tech.

The SSLOI requirement is based on the need for persistent surveillance and reconnaissance in shallow-water regions without jeopardizing valuable nuclear assets. The shift in emphasis from global Super Power conflict to numerous regional conflicts requires increased flexibility to counter a variety of threat scenarios which may rapidly develop. Primary mission requirements for the SSLOI therefore include the time-sensitive, covert launch of mission configured UUV(s), MANTA(s) in this project, mine countermeasures, ISR, and transport of special operations Navy SEAL teams to support the Joint Force battle force from the sea.

Concept Exploration trade-off studies and design space exploration were accomplished using a Multi-Objective Genetic Optimization (MOGO) after significant technology research and definition. Objective attributes of this optimization were cost, risk (probability and consequence of technology performance, cost and schedule failures), and military effectiveness. The product of this optimization was a series of cost-risk-effectiveness frontiers, which were used to select alternative designs and define a Capability Development Document (CDD) based on the customer’s preference for cost, risk, and effectiveness.

SSLOI is a high effectiveness, moderate risk, and moderate cost alternative selected from the non-dominated frontier. This design was chosen to provide a challenging, barrier-pushing project in which modern, innovative technologies such as PEM fuel cells for air-independent propulsion, Rim-Driven Propulsor (RDP), and MANTA(s) were utilized. SSLOI has two torpedo tubes with 8 reloads and 3 MANTAs, each capable of carrying 4 torpedoes. SSLOI has many other attractive qualities including high maneuverability, an axis-symmetric hullform for producibility, and a sonar system capable of both active and passive sonar for ASW

missions. The basic characteristics of SSLOI are listed in the table below. The final concept design satisfies key performance requirements in the CDD within cost and risk constraints.

Ship Characteristic	Value
LOA	257.6 ft
Beam	32 ft
Diameter	32 ft
Submerged Displacement	3952 tton
Submerged Displaced Volume	138327 ft ³
Normal Surface Cond	3467 tton
Sprint Speed	21 knt
Snorkel Range - 12 knt	5718 nm
AIP Endurance - 5 knt	28 days
Sprint Endurance	1.1 hours
Propulsion and Power	Open Cycle Diesel/AIP, 2xCAT 3512 V12 + 2x500kW PEM; 6000kW-hr lead acid batteries, 1x19.6ft RDP
Weapon Systems	Reconfigurable torpedo room, 2x21” tubes, 8 reloads; 3 MANTA UUVs
Sensors	EDO Model 1122 Passive Bow Array, EDO Model 1121 Flank Array, high frequency sail and chin-array (mine and obstacle avoidance), Photonics Mast, Type 8 Mod 3, Type 18 Mod 3; BSY-2/CCSM
P _{req} for Sprint Speed	3930 kW
P _{req} for Snorkel	800 kW
Battery Capacity	6000 kW-hr
Diving Depth	1000 ft
Total Officers	8
Total Enlisted	44
Total Manning	52
Basic Cost of Construction	\$919M