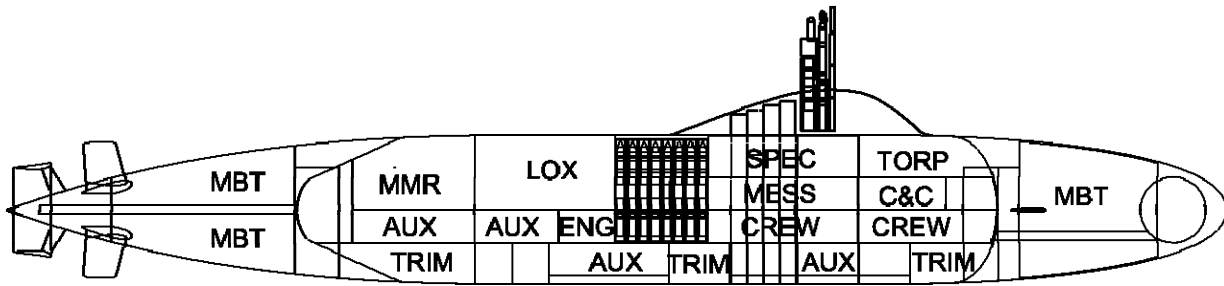


Executive Summary



This report describes the Concept Exploration and Development of a Diesel/ AIP Ballistic Missile Defense Submarine (SSBMD) for the United States Navy. This concept design was completed in a two-semester ship design course at Virginia Polytechnic Institute and State University.

The SSBMD requirement is based on the SSBMD Initial Capabilities Document (ICD) and Virginia Tech SSBMD Acquisition Decision Memorandum (ADM). The submarine addresses the need to provide a sea-based ballistic missile defense launch capability to guard against rogue and hostile nation missile attack.

The submarine platform allows for covert positioning near potential enemy launch sites and provides a favorable launch angle for missile interception with guidance from surface or air borne assets. By utilizing a diesel-electric/AIP design, a ballistic missile defense capability is achieved without endangering US nuclear assets or incurring the diplomatic risk inherent to nuclear submarine operations in or near foreign waters. The submarine is expected to operate in littoral and open ocean environments.

The primary threats expected to be encountered include operating in areas of dense contact with high levels of civilian vessels present (near international shipping lanes).

The primary missions carried out by the submarine are Ballistic Missile Defense (BMD), Intelligence, Reconnaissance & Surveillance Operations, Inland Missile Strike, as well as anti-submarine (ASW) and anti-surface ship (ASuW) capability (primarily for self defense).

SSBMD is a high effectiveness and moderate risk, high end alternative selected from the non-dominated frontier. This design was chosen to provide a ground-breaking, challenging project in which modern, innovative technologies such as PEM fuel cells for air-independent propulsion, two five torpedo rotary launch systems, and four Kinetic Energy Interceptor (KEI) missiles contained in an advanced composite sail were utilized. SSBMD has many other attractive qualities including high

maneuverability, an axi-symmetric hullform for producibility, and a sonar system capable of both active and passive sonar ASW missions.

The basic cost of construction of SSBMD is \$1.575 billion. This satisfies the goal of a lead ship BCC less than \$1.6 billion. The final concept design satisfies key performance requirements in the CDD within cost and risk constraints. The basic characteristics of SSBMD are listed in the table below.

Ship Characteristic	Value
LOA	261.2 ft
Beam	32 ft
Diameter	32 ft
Submerged Displacement	3962 tton
Submerged Displaced Volume	138027 ft ³
Sprint Speed	22 knt
Snorkel Range @ 12 knt	5356 nm
AIP Endurance @ 5 knt	24 days
AIP Sprint Endurance	56 minutes (21 nm)
Propulsion and Power	Open Cycle Diesel/AIP, 2xCAT 3512 V12 + 2x500kW PEM; 5000kW-hr Zebra batteries, Shrouded Propeller
Weapon Systems	4 KEI in sail, Reconfigurable torpedo room, 2x21" tubes, 8 reloads; 24 Cell VLS (16 SM-3, 8TLAM),
Sensors	BSY-2 w/ CCSM EDO Arrays
P _{req} for AIP 5knt	76 kW
P _{req} for Sprint Speed	6010 kW
P _{req} for Snorkel	1136 kW
Battery Capacity	5000 kW-hr
Diving Depth	570 ft
Total Officers	8
Total Enlisted	47
Total Manning	55
Basic Cost of Construction	\$1.6 billion