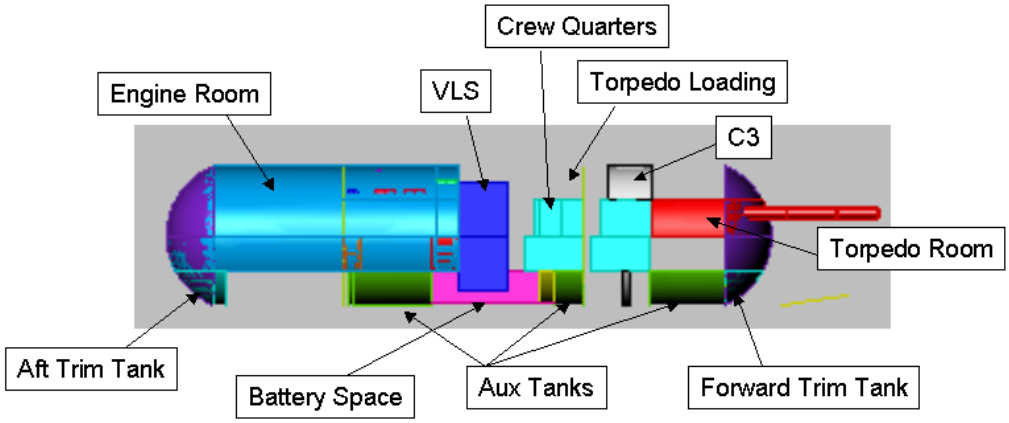
Executive Summary



This report describes the Concept Exploration and Development of a Guided Missile Submarine (SSG(X)) for the United States Navy. This concept design was completed in a two-semester ship design course at Virginia Tech.

The SSG(X) requirement is based on the Covert Missile Launch Platform Mission Need Statement (MNS), and Virginia Tech Conventional Guided Missile Submarine Acquisition Decision Memorandum (ADM).

Concept Exploration trade-off studies and design space exploration are accomplished using a Multi-Objective Genetic Optimization (MOGO) after significant technology research and definition. Objective attributes for this optimization are cost, risk (technology, cost, schedule and performance) and military effectiveness. The product of this optimization is a series of cost-risk-effectiveness frontiers which are used to select alternative designs and define Operational Requirements (ORD1) based on the customer's preference for cost, risk and effectiveness.

Concept Development included hull form development and analysis for intact and damage stability, structural finite element analysis, propulsion and power system development and arrangement, general arrangements, machinery arrangements, combat system definition and arrangement, seakeeping analysis, cost and producibility analysis and risk analysis. The final concept design satisfies critical operational requirements in the ORD within cost and risk constraints with additional work required to further refine hull size and arrangements including weights and balances.

SSG(X) will provide the Navy with a sophisticated quiet submarine able to perform littoral combat operations with covert stealth without the commitment of nuclear assets. The tools used as presented in this document ensure that the proposed ship is the best in total value based on cost, overall measure of effectiveness (OMOE) and overall measure of risk (OMOR). By performing this extensive concept design study, the SSG(X) meets and exceeds all design variables needed to perform its mission as shown in the ship characteristic table below.

Ship Characteristic	Value
Length (L)	223.3 ft
Diameter	31.9 ft
Maximum Hull Depth	870 ft
Mission Duration	30 days
Lightship weight	1983 LT
Full load weight	2668 LT
Sustained Speed	22 knots
Endurance Speed	12 knots
Sprint Range	22.2 nm
Endurance Range	3500 nm
Propulsion and Power	One Fixed Pitch Propeller, CCD, CAT 3512 V12 x2 Engines
BHP	2350 hp
Combat Systems (Modular and Core)	VLS
Personnel	26 people
OMOE (Effectiveness)	.837
OMOR (Risk)	.464
Ship Acquisition Cost	641 $M