Large Surface Combatant (LSC)

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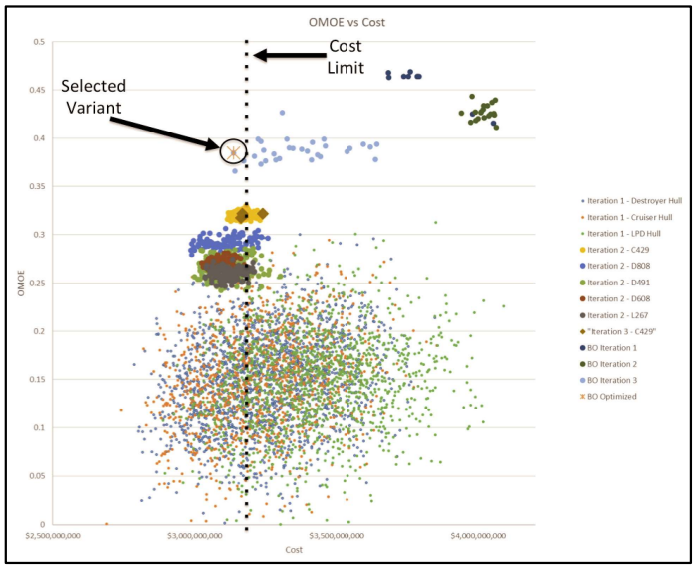
Due to the evolving capabilities of our foreign adversaries and our aging inventories of Cruisers and Destroyers, the time has come for the United States Navy to determine effective and viable replacements for the future fleet. This led to the creation of the Future Surface Combatant Force comprised of large, small, and unmanned surface combatant ships. Specifically, the Large Surface Combatant (LSC) will serve as the replacement for Cruisers and Destroyers by encompassing the multi-mission capabilities of each platform, respectively.

The goal for this project was to conduct an in-depth evaluation of a concept design for the Large Surface Combatant. The LSC is a multi-mission capable platform with the capability and flexibility to take advantage of both current and future technologies. This study includes in-depth analyses on requirements for adaptable design, the integration of advanced weapon systems including the electromagnetic railgun and high-energy laser, and incorporation of various UxV platforms.



The hull-form and allocated support for installed mission systems of the preferred variant were selected by taking a set-based design approach coupled with machine learning. Specifically, the machine learning techniques applied were Gaussian process regression and Bayesian optimization. The set-based design was conducted using the Rapid Ship Design Environment (RSDE) and ASSET programs to produce thousands of unique variants within the design space. Gaussian process regression was trained using these variants to build surrogate models for Overall Measure of Effectiveness (OMOE) and Bayesian optimization was implemented to search these models for the optimal solution.

The LSC features a flexible architectural arrangement for inclusion of both existing and future technologies. This was accomplished by taking a zonal approach for ship systems and equipment configurations. These zones are predetermined spaces with maximum allowances for space (area and volume), weight, power, and cooling (SWAPC). The zones are categorized into four overall system groups:

SYSTEMS	ZONES
Weapon Systems	Main Battery
	Secondary Armament Large
	Secondary Armament Medium
	Secondary Armament Small
	High Energy Defensive Weapon
	Defensive Weapon
Sensors	Air Search Radar
	Surface Search Radar
	Fire Control
	Electronic Countermeasure
	Communications
	Undersea Sensors
Aviation	Aviation Zone
Waterborne Vehicles	Waterborne Vehicle Zone

1) Weapon Systems
2) Sensors
3) Aviation
4) Waterborne Vehicles

Each system is comprised of zones based on their specific functionality.

The Large Surface Combatant developed by the project is a feasible and highly mission-capable design. The capabilities and concepts introduced in this project will provide the Navy with the most technologically advanced, multi-mission surface combatant in the world which will not only surpass our existing Cruisers and Destroyers, but will far exceed the capabilities of any of our foreign adversaries at the tip of the spear.

Large Surface Combatant Characteristics	
Parameter	Value
LOA (m)	175.56
LBP (m)	167.02
Beam (m)	25.25
Draft (m)	7.51
Full Load Displacement (mton)	17571.8
Endurance Range (nm)	5796.35
Maximum Speed (kt)	29.09