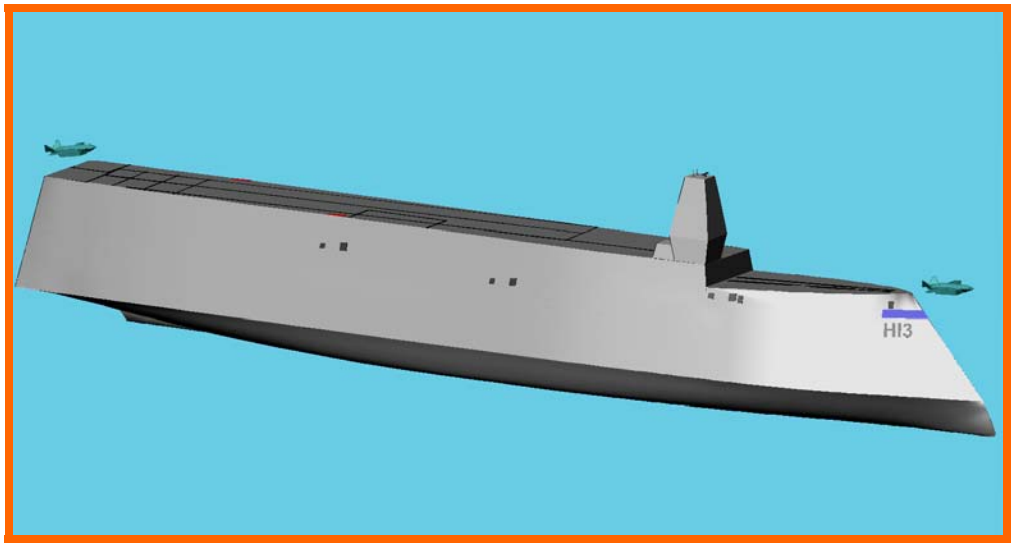
Virginia Tech
Aerospace & Ocean Engineering

CUVX Design Report

Unmanned Combat Air Vehicle Carrier

VT Total Ship Systems Engineering Approach



CUVX HI3 Option

Ocean Engineering Design Project

AOE 4065/4066

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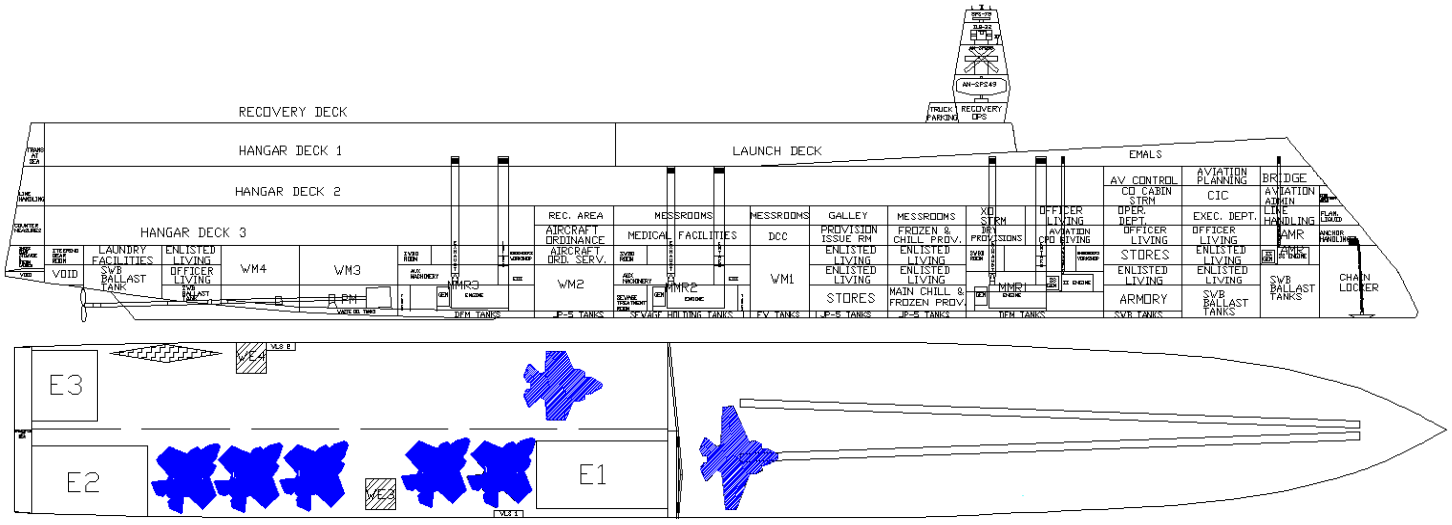
Executive Summary



This report describes the Concept Exploration and Development of an unmanned combat air vehicle carrier (CUVX) for the United States Navy. This concept design was completed in a two-semester ship design course at Virginia Tech.

The CUVX requirement is based on a CUVX Mission Need Statement and Acquisition Decision Memorandum (ADM). CUVX will operate in littoral areas, close-in, depend on stealth, with high endurance and low manning (for an aircraft carrier). It is required to support UCAV's, UAV's and LAMPS, providing for takeoff and landing, fueling, maintenance, weapons load-out, planning and control. The UAV's will provide surface, subsurface, shore, and deep inland intelligence, surveillance, reconnaissance (ISR) and electronic warfare. LAMPS will provide Anti-Submarine Warfare (ASW) and Anti-Surface Ship Warfare (ASUW) defense. UCAV'S will provide initial/early conflict Suppression of Enemy Air Defenses (SEAD), ISR and Strike.

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 (lead ship acquisition cost and mean follow ship acquisition cost, performed separately), 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 the CUVX HI3 Baseline Concept Design and define Operational Requirements (ORD1) based on the customer's preference for cost, risk and effectiveness.

CUVX HI3 is the highest-end alternative on the follow-ship acquisition cost frontier. This design was chosen to provide a challenging design project using higher risk technology. CUVX HI3 characteristics are listed below. CUVX HI3 has a wave-piercing tumblehome (WPTH) hullform to reduce radar cross section, and a unique launch deck arrangement to enable simultaneous launch and recovery of UCAVs. It uses significant automation technology including an electromagnetic aircraft launching system (EMALS) with pulse power from the integrated power system (IPS) propulsion bus, autonomous spotting dollies, and automated pit stops. Concept Development included hull form development and analysis for intact and damage stability, structural finite element analysis, IPS system development and arrangement, aviation system analysis and arrangement, general arrangements, combat system selection, seakeeping analysis, cost and producibility analysis and risk analysis. The final concept design satisfies critical operational requirements within cost and risk constraints with additional work required to improve seakeeping and further reduce manning and cost.

Ship Characteristic	Value
LWL	213 m
Beam	29.04 m
Draft	7.01 m
D10	29.58 m
Lightship weight	24770 Mton
Full load weight	29640 Mton
Block Coefficient, C_B	0.667
Prismatic Coefficient, C_P	0.702
Sustained Speed	20.6 knots
Endurance Speed	20 knots
Range at 20 kts	4000 nm
Propulsion and Power	Integrated Power System (IPS), 2 shafts FPP, 5 x PC2.5V16
BHP	52000 Hp
Personnel	898
OMOE (Effectiveness)	0.902
OMOR (Risk)	0.288
Lead ship acquisition cost	$1196M
Follow ship acquisition cost	$775M
Combat Systems	SSDS, AN/SPS-49A(V)1, AN/SPS-73(V)12, AN/SLQ-32A(V)2, CIFF, 2xCIWS; Mk36 DLS, Combat DF, IRST, ESSM w/VLS, AN/SPQ-9B, MK91 MFCS
Catapaults	2 x EMALS
UCAV-N's	28
UAV's	18
LAMPS	4