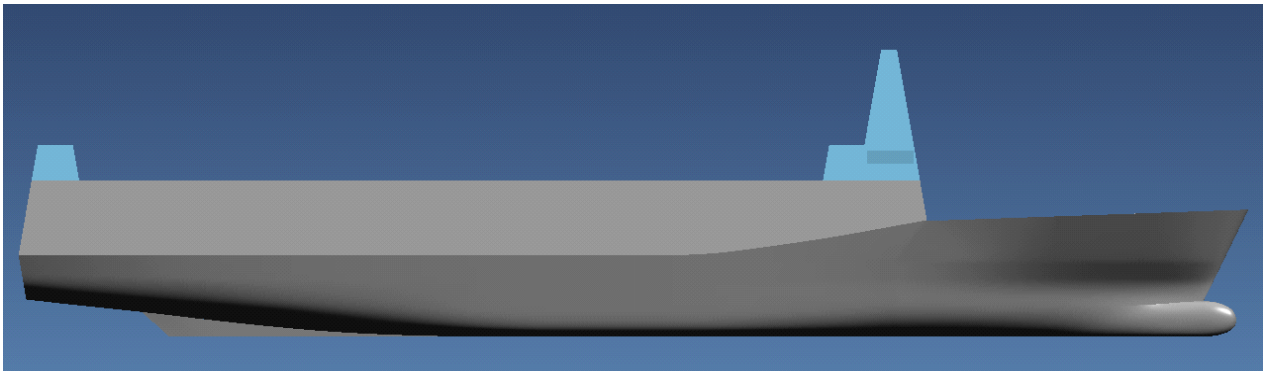
Virginia Tech
Aerospace & Ocean Engineering

CUVX Design Report

Unmanned Combat Air Vehicle Carrier

VT Total Ship Systems Engineering Approach



CUVX HI2 Option
Ocean Engineering Design Project
AOE 4065/4066
Fall 2002 – Spring 2003

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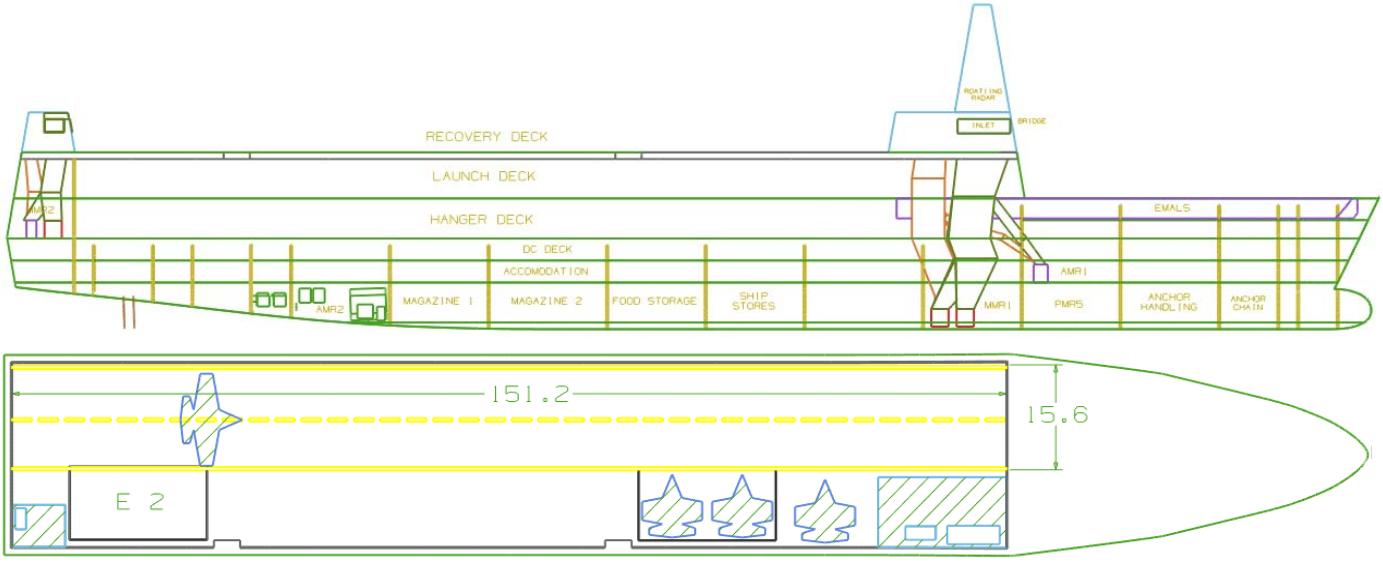
Executive Summary



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 will 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 surveillance, reconnaissance 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) 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 HI2 Baseline Concept Design and define Operational Requirements (ORD1) based on the customer's preference for cost, risk and effectiveness in this baseline.

CUVX HI2 is a high-end alternative on the lead-ship acquisition cost frontier. This high-end design was chosen to provide a challenging design project using higher risk technology. CUVX HI2 characteristics are listed below. This is a (very) modified-repeat LPD-17 design. It has 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 arrangements, general arrangements, combat system selection, seakeeping analysis, cost analysis and risk analysis. The final concept design satisfies critical operational requirements within cost and risk constraints with additional work being required to improve seakeeping and further reduce manning and cost.

Ship Characteristic	Value
LBP [m]	201.0
Beam [m]	29.54
Draft [m]	7.00
D10 [m]	26.63
Lightship weight [MT]	21140
Full load weight [MT]	25943
Block Coefficient, CB	0.609
Prismatic Coefficient, CP	0.647
Sustained Speed [knots]	24.5
Endurance speed [knots]	20
Range at 20 knots [nm]	4000
Propulsion and Power	Integrated Power System (IPS), 2 shafts, 3 x WR-21 29 ICR
Propellers	2 x FPP
BHP [hp]	55352
Manning	691
Effectiveness OMOE	0.878
Risk OMOR	0.182
Lead ship acquisition cost	$952M
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
UCAV-N's	30
UAV's	19
LAMPS	4