

Mine Sweeper Replacement Platform (MSRP)

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Sea mines have long played an important role in naval warfare. The threat of mines can come from any adversary, from non-nation state actors to near-peer competitors. The U.S. Navy's dedicated MCM ships, Avenger class vessels, are aging and will soon require replacement (Cancian, 2020). Current solutions to fill this strategic gap, including Littoral Combat Ships (LCS) with MCM modules, fail to provide a dedicated platform which addresses the inherently dangerous nature of minesweeping operations. This study is motivated by the need to replace the Avenger-Class with a dedicated MCM platform, combined with the rising technological opportunities associated with autonomous vehicles to reduce the MCM mission risk to personnel.

This project focused on Concept of Operations determination, design space exploration, concept definition, and feasibility and performance analyses of our chosen design. The Minesweeper Replacement Platform (MSRP) ship designed is a Small Waterplane Area Twin Hull (SWATH) vessel made out of composites. It operates independently but can support strike group operations and is designed to be fully manned for transits while conducting minesweeping operations autonomously to reduce risk to personnel. The SWATH hullform, modeled after the TAGOS-19, was chosen as the base hullform for this vessel for a number of reasons. The stability and seakeeping characteristics of SWATH hulls make them well suited for autonomous navigation, minesweeping equipment requirements, and reduction of underwater signatures. Additionally, SWATH hulls house major equipment above the waterline which reduces underwater signatures and thus the risk of mine detonation. The composite hullform further reduces underwater signatures over that of steel or aluminum counterparts. The MSRP is equipped with two small boats to transport the crew off the ship prior to executing minesweeping operations and recover them once the ship has cleared the minefield. Figure 1 shows the final concept design of the MSRP.

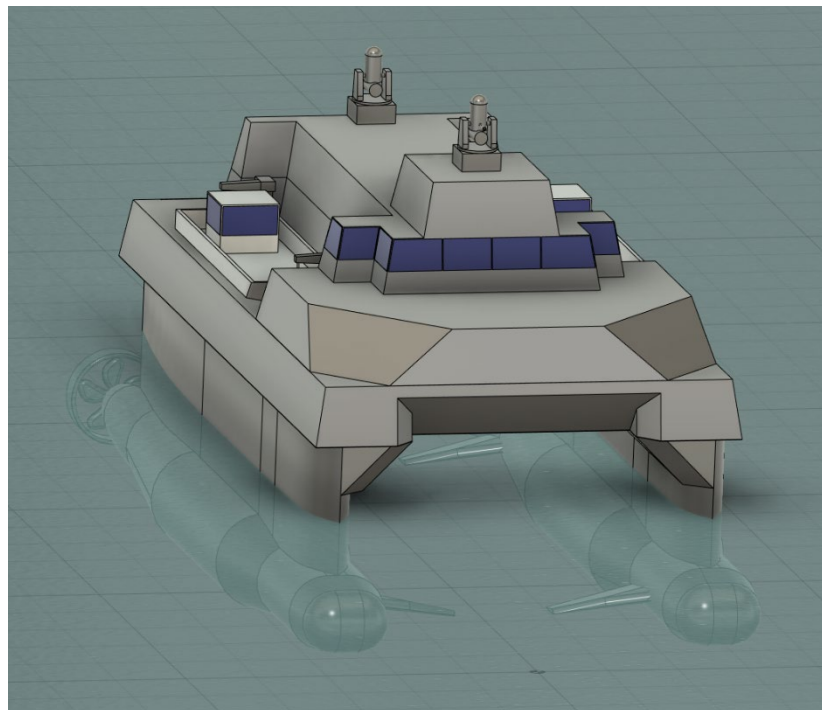


Figure 1: Final MSRP Concept Design

Seakeeping, powering and endurance and hull structural analyses were conducted with the MSRP meeting all applicable standards as well as meeting all customer requirements. Final vessel characteristics for the MSRP are shown in Table 1. The MCM systems are shown in Table 2. These systems combine to satisfy each part of the Mine Warfare Hunt-Kill Chain: Detect, ID, Control, Engage, Assess.

Metric	Value
Endurance	30 days
Range	5035 nm at 15 kts
Maximum Speed	16.7 kts
Crew Size	75
Physical Security	AT/FP, SUW/AW self-defense
Draft	7.27 m
Maximum Beam	26 m
LOA	50 m

Table 1: Final MSRP Characteristics

MCM Equipment	Use
SQQ-32 towed variable depth sonar	Detect & ID
Barracuda Launcher	Neutralize
SLQ-37	Minesweep
MPCS and MEDAL	Command & Control
MFTA	Detect
Klein Side Scan Sonar	Detect

Table 2: MSRP MCM Equipment

Significant arrangements for the MSRP are shown in Figure 2.

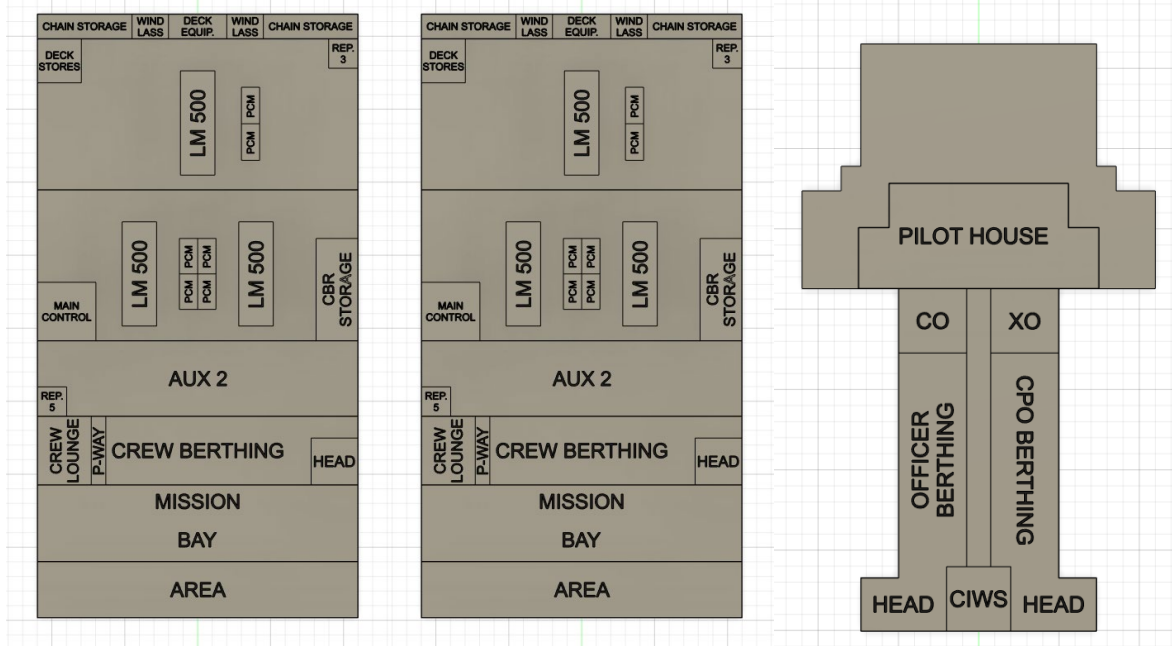


Figure 2: MSRP First Deck, 01 Level, and 02 Level

Reference

Cancian, M. F. (2020, November). U.S. Military Forces in FY2021, Navy. Center for Strategic and International Studies. https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/201109_Cancian_FY2021_Navy.pdf, Accessed July 12, 2021.