

Ship Conversion: Addition of a 150MT Active Heave Compensated Crane and Dynamic Positioning System Thrusters on a Decommissioned LSD-41

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Study Selection

The call for diving and salvage maritime capability is growing. Due to great power competition in the U.S. Pacific Fleet, the demand for maritime salvage and Ship Wartime Repair and Maintenance (SWaRM) has increased. The SWaRM concept identifies the processes required to provide in-theater ship and submarine repair. Most salvage platforms are outsourced through commercial contracts, offering only a temporary solution. When the United States goes to war it will be all about time; how much time does it take to get the right equipment on location? Recapitalizing a decommissioned LSD-41 hullform for a command diving and salvage ship could alleviate these issues if the converted ship is capable of fleet salvage and diving multi-mission operations. This conversion project conducted a feasibility study on the addition of a 150MT active heave-compensated (AHC) crane and dynamic positioning system (DPS) to a decommissioned LSD-41 amphibious warship.

The motivation for the 150MT AHC crane was commercial best practices and the anticipated need during SWaRM. The motivation for the DPS was the dive manual, as divers must either have DP2 capability or a 2 (or more) point moor. The moor takes time, skill, and space to set, and is only good in shallow water. The LSD-41 offered the capability of fleet salvage and diving operations by providing communications, offices, space, and accommodations, as well as a large unobstructed flight and well deck that allowed for the embarkation of a variety of stand-alone and interchangeable vehicles/systems. The converted command diving and salvage ship can support missions in humanitarian assistance, oil spill response, rescue, salvage, towing, and wide area search and surveillance (UUV and UAV).

Technology Selection

MacGregor's 150MT AHC knuckle jib crane was selected because it was commercially accepted and offered a similar foundation footprint size as the 60t starboard crane already in place that could either be welded or bolted to the deck. Additional upgrades support 3D motion compensation and ship to ship transfer.

Thrustmaster's Portable Dynamic Positioning System (PDPS) was selected because it is DP-2 ABS class certified and saved time and money. The modularly designed hydraulic power units were completely independent and did not require vessel utilities, eliminating intrusive engineering work. The thrusters can be quickly and easily installed and removed pierside without requiring drydocking.

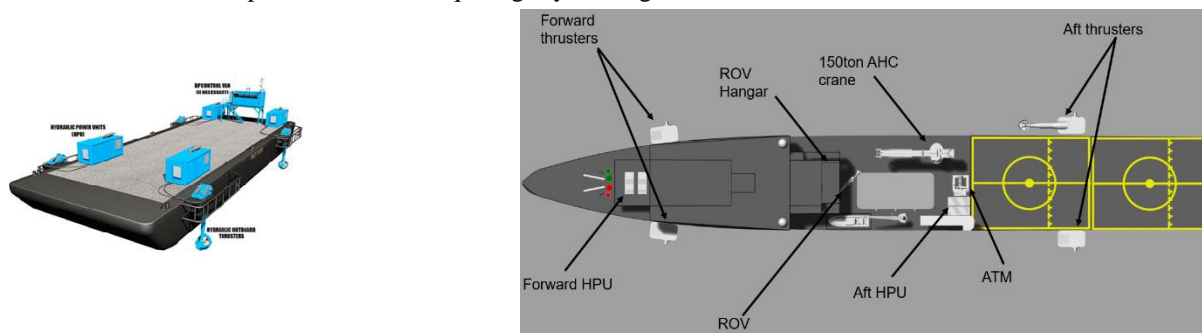


Figure 1: Thrustmaster Portable Dynamic Positioning System Installed on a Vessel (left) and Conversion (Right)

Ship Selection

The Dock Landing Ship (LSD) is a Naval warship designed to support the Navy's amphibious assault operations by transporting and launching amphibious craft and vehicles near shore. The *Whidbey Island* class (LSD-41) is comprised of eight ships and was designed specifically to permit Landing Craft Air Cushion (LCAC) operations. The LSD-41 hullform offers a 134m well deck which is flooded to launch and recover landing craft for amphibious assault, as well as a flight deck to land and launch up to two CH-53E helicopters. The LSD-41 was selected because of the limitless conversion opportunities due to the flight deck, well deck, and accommodations. Table 1 summarizes the converted operational profiles and design characteristics based on the new missions.

Table 1: Diving and Salvage Command Ship Operational Profiles and Design Characteristics

	Lightship	Full Load	Minimum Operating Condition	Units
LOA	186	186	186	m
L _{pp}	177	177	177	m
Max Beam	35	35	35	m
Speed	20+	20+	20+	kts
Displacement	13004	16735	15136	MT
Trim	0.73A	0.62A	0.71A	m
Heel Angle	0	0	0	degrees
GMt	3.17	3.86	3.57	m
Draft MS	5.02	6.06	5.62	m

Design Philosophy and Assumptions

All calculations were based on the standard LSD-41 hullform values. The major assumption of this project was that the original hullform and propulsion system would remain unchanged in the converted ship design. The controllable pitch propellers (CPP) served as the primary transit propulsion and were integrated with the thrusters for towing, debeaching, and station keeping evolutions. The focus of this study was on the naval architecture feasibility on the installation of a 150MT AHC crane and DP-2 system.

Feasibility and Performance

The focus of this study was to determine the feasibility of installing a 150MT AHC crane and DP-2 thruster system on a decommissioned LSD-41. A naval architecture analysis of the arrangements, weights, stability, structural integrity, and seakeeping determined that the conversion to a diving and salvage command ship is feasible. Stability and structural integrity results were verified with ABS and U.S. Navy standards and regulations. The seakeeping results identified the ships operational areas up to and including sea state five for various tasks and locations. The bollard pull of the diving and salvage ship was calculated with the use of both the CPP and thrusters to validate the towing of an aircraft carrier. The selling point of this conversion would focus on the financial and multi-mission benefit of recapitalizing a decommissioned amphibious warship to a diving and salvage command ship versus the new construction rescue and salvage ships.

Conclusion:

This team found that the LSD-41 hullform is a viable conversion for a diving and salvage command ship. To determine if this conversion provides a payback to the U.S. Navy a further cost analysis should be completed and compared with the new construction cost of the T-ATS *Navajo* class rescue and salvage ships. Additionally, further detailed studies should be included in the added benefits of the well deck and flight deck have to offer for a multi-mission diving and salvage command ship in support of battle-damage repair.

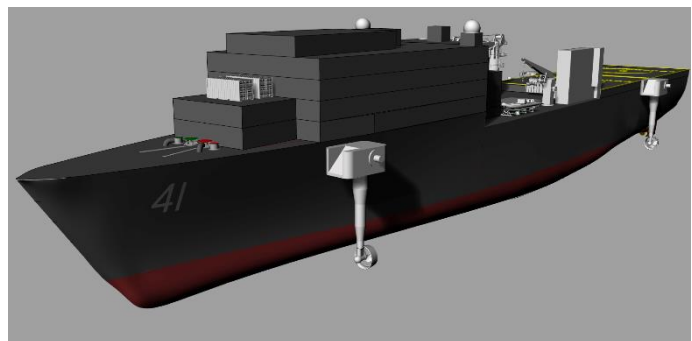


Figure 2: Current LSD-41 (Left) and Modified (Right)