



# The Employability of Heavy Lift Class Ships for Logistics and Maintenance and Its Application in Military Means - Part I

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**Abstract:** The purpose of this article is to present a concept of the Heavy Lift Ship already used in the maritime market, aiming to propose viable alternatives for its employability, taking as its main focus the performance of the same in military operations, however the versatility of this class of ship, allows a wide range of activities. Currently, the theme of docking, maintenance, repair and logistics is in constant evidence due to the high level demanded by operational means of navies around the world, their maintenance is of essential importance for the preparation and use of Naval Power. The implementation of a ship of this class to a fleet or fleet allows its use to perform the function of a floating dock, for example, being able to carry out the transport of other ships or floating structures. Considering the incorporation of a medium with these characteristics, it allows the performance, in addition to services related to maintenance, repair and transport, the possibility of carrying out missions together with other bodies or companies such as Petrobras, for example, in addition to supporting existing military assets and that will still be incorporated. In general, the concept of using a ship with these characteristics can be put to good use, mainly evaluating the plurality that this means can provide to a Navy.

**Keywords:** Heavy Lift Ship, Logistics, Military Operation, Strategy, Dry Docking

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## 1. Introduction

Currently, the maritime transport market, particularly the Heavy Lift Ship (HLS) class, is experiencing gradual growth. The heavy cargo maritime transport sector remains in massive demand, driven by other sectors such as the naval and offshore industry, civil construction and the oil industry. Companies such as Petrobras, ExxonMobil and Chevron are some examples that use these means to transport platforms, oil production and refining modules, in addition to other equipment related to their areas of operation.

The ships used for these transport operations are of a robust nature and their crews are made up of specialized personnel adequately trained in pumps, docking, welding and as some of the requirements, relying on a portfolio of vast experience. This fact can be well presented according to Ship Production [1], and L. Harrington in Marine Engineering [2].

## 2. HLS: An Overview

### 2.1. HLS Initial Considerations

These ships were initially designed to meet a demand for the transport of point loads. Its concept emerged in the mid-1970s, LAMB, Thomas, ShipDesign Construction 2<sup>nd</sup> Ed, driven by the growth of the oil industry around the globe, however, these ships are currently used for shipping heavy goods that are not possible to be transported on ships. conventional ships to the transport of other ships around the world. It is worth mentioning that since then the performance of this class of ship has been increasingly used in the current scenario. What sets them apart from conventional transport ships is their ability to handle loads that could otherwise compromise the structural integrity of the hull. The transport carried out by an HLS often uses slightly more daring techniques of engineering and design, that is, this class of

ships has the purpose of transporting non-standard cargo, with different purposes.

Another relevant factor, according to data presented by LAMB [8], is that the number of ships of this type in the world is approximately 80 ships. However, such data were obtained in 2003. It was also noted, in this period, a trend of transformation of merchant ships into HLS. Taking as an example, the conversion of oil tankers and bulk carriers, which, due to their dimensions, suit the necessary characteristics to carry out such modifications.

## 2.2. HLS Are Classified Into Four Main Classes According to Their Respective Categories

- 1) Standard cargo ships: This category includes various machinery, port equipment, locomotives, cranes, small vessels, etc.;
- 2) Open Deck Cargo Ships: These ships can transport oil platform modules, cranes, various non-floating equipment, etc.;
- 3) Dock ships: They can transport containers, cranes, yachts and medium and small vessels, etc.; and
- 4) Semi-submersible ships: Ships, semi-submersible oil platforms, barges, offshore equipment, floating docks, military ships, etc.

This article focuses on the HLS Semi-Submersibles class. These particular vessels are characterized by having a wide open deck and being able to submerge part of the hull in order to allow other means to be able to float under the submerged deck area, thus enabling the assembly and adjustment of berths or riding arenas to carry out docking for transport and even repair of other vessels.

## 3. Logistics and Military Action



Figure 1. HMAS Canberra being carried by HLS.

Regarding logistics, the operation of a Semi-Submersible HLS meets numerous transport requirements. Such vessels are capable of docking and transporting other vessels in different operating conditions, being able to carry out support missions and transport of materials of the most varied types and characteristics. In practical terms, it would be possible, for example, to use this class of vessel for humanitarian

missions, an act that has recently proved to be extremely important due to the pandemic scenario experienced, and can also be used in disaster situations and other adverse circumstances, as well presented by M. Selfridge and C. Kennell in Application of Heavy Lift Ship Technology to Expeditionary Logistics/Seabasing [3].

These ships perform functions similar to those of a floating dock, however with the advantage of moving by transporting the medium docked on its main deck to a repair yard or carrying out the repair while docked on the ship itself. Some of this basic concepts can be as C. Gillmer and Bruce Johnson, Introduction to Naval Architecture [4] and Tupper in Introduction to Naval Architecture [5].

In 2010, the Canberra Multipurpose Helicopter Carrier (HMAS Canberra) was delivered by the Spanish shipyard Navantia to the Australian Navy for commissioning and installation of superstructure, carried out in Australia. The use of an HLS to transport the 230-meter-long hull and displacement of 28,000 tons stands out, tracing a route of approximately 13,000 nautical miles, it is estimated that the total cost of the helicopter carrier is around US\$ 1.5 billion.

The use of this class of ships has become increasingly common to the detriment of the numerous operations carried out by navies around the planet [13].

It should be noted that the navies of England and the United States of America have charter contracts for ships of this class with companies such as SEAWAY and Cormorant Shipholding Corporation, which operate in support of the ships of these respective fleets.

The costs associated with rescue operations and transport of military assets vary according to the complexity and availability of the HLS suitable for use. Studies carried out by the Center for North American Naval Projects (CISD) indicate that approximately US\$ 5.1 million was spent on the transport of the destroyer USS Cole, the target of a terrorist attack in Yemen on October 12, 2020. On October 11, 2017 A collision with a merchant ship resulted in serious damage to the destroyer USS John MacCain, costing about US\$ 4.5 million to transport the medium that was east of the Straits of Malacca to a repair shipyard located in Singapore. It is worth noting that such maneuvers avoided the loss of said means, valued at approximately US\$ 700 million and US\$ 500 million respectively.



Figure 2. Incident involving USS John MacCain demanded use of HLS.

Another incident involving a military ship took place in November 2018, where a tanker collided with the frigate HNoMS Helge Ingstad belonging to the Royal Norwegian Navy which was returning to its base after carrying out exercises, however there was no time to rescue the medium, which resulted in its loss generating an estimated loss of around US\$ 1.4 billion, the ship in question had less than 10 years of activity. Such occurrences are faced with the level of risk linked to the operations involved to rescue the damaged environment, which requires an entire rescue logistic structure involved.



*Figure 3. Collision of Frigate Norwegian Warship HNoMS Helge [7].*

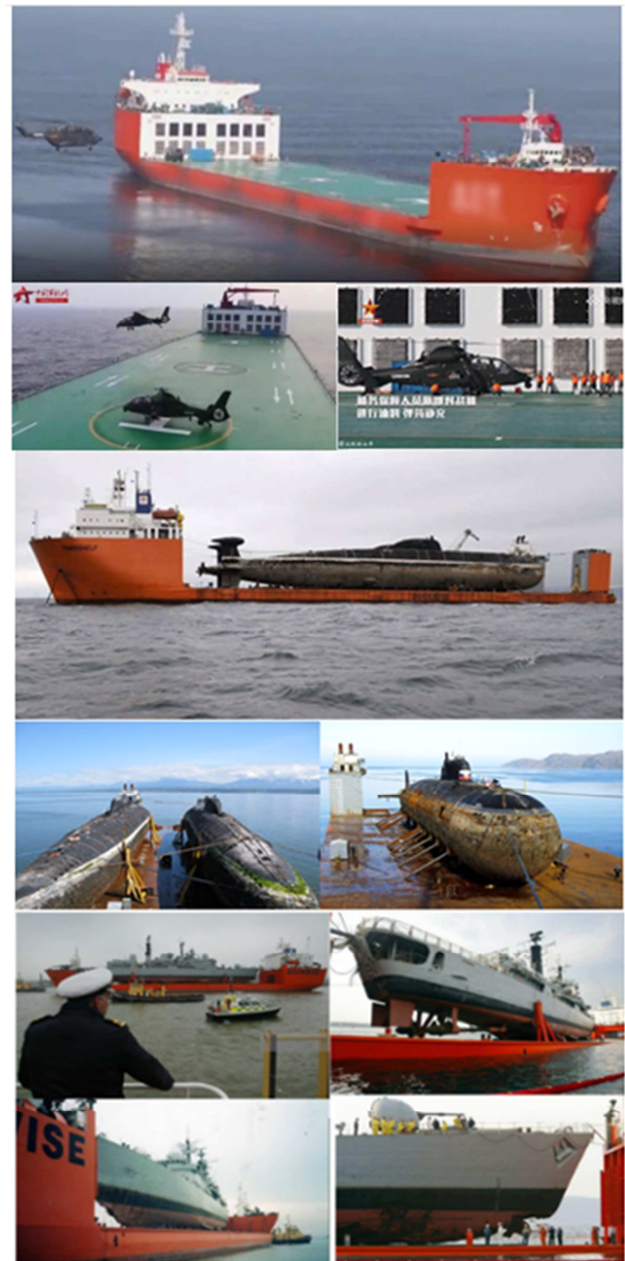
The Russian navy has already carried out the transport of Kilo-class submarines in September 2006, as reported by the newspaper Ship of the Day, together with the company Dockwise. And according to the Global Security news portal [9], in August 2020 exercises carried out by the 71st Air Brigade of the Chinese People's Liberation Army were recorded, using an HLS as a support point where the deck was used as a helipad for maneuvering with CAIC Z helicopters. -10. The case studies presented highlight the high complexity linked to the maneuver of military means, which involve constant maneuvers added to the high degree of demand to which these means may be subject.

The diversity of maneuvers that the HLS presents within this logistical scenario envisage employment possibilities for training missions in different segments, according to the multifunctionality provided by this class of ship.

Given the constant need for personnel improvement, the implementation of an HLS in military activities can be considered an economically viable alternative, optimizing operating costs related to rescue, maintenance and support in other sectors affected by the scope assigned to this class of ship.

Based on all the history presented, the versatility that this class of ship provides, is capable of expanding the range of action for different demands of the most different possible,

which allows the fulfillment of missions of different levels of application. Regarding the use of these ships for maintenance of other means, it becomes a panacea within the context addressed in order to remedy the diversity of occurrences in the military scope for rescue, repair and transport. The option of carrying out support and maintenance in different locations can provide a horizon with the possibility of maintaining the environment in which the envisioned mission is intended to be carried out.



*Figure 4. Activities with military assets using HLS as support.*

## 4. An Economic and Strategic Analysis

Regarding strategic issues, it is worth mentioning the versatility of operations in which it is possible to use an HLS, which can be used in functions of the most varied purposes



such as serving the rescue and rescue sectors of operational means, providing support in the repair function of ships, among others. The use of an HLS for navies that have a fleet fits as a vital support point for the preservation and maintenance of their operational means, given the risks already pointed out in this article. It should be noted that many navies around the world have naval bases that are vital to maintain their respective means in operating conditions and that many of them have a docking system carried out through a career, dry dock or floating dock and other systems such as Shiplift, however, the incorporation of an HLS allows not only the docking of an operating medium, as well as its rescue and transport in the event of an eventual occurrence. In terms of economic viability, it is noteworthy that the use of an HLS covers many possibilities of operation.

The comparison with a floating dock, which is better suited to a comparison, allows us to present a technical notion regarding operating and maintenance costs. In this case, both means carry out docking of ships, and even transport, but the HLS presents itself as the most suitable means for carrying out this type of maneuver. When it comes to acquisition costs, it can become somewhat controversial, since admitting that the cost of a floating dock is lower than an HLS is quite simple and very subjective, given that, as they have some characteristics in common, the HLS has a operating range greater than that of a floating dock. Depending on the analysis to be carried out, obtaining a floating dock by a shipyard can often be equivalent to acquiring an HLS by opportunity that appears on the market or in a converted medium to act for this purpose. In a consultation with the South Korean shipyard Hyundai Mipo Dockyard, in terms of capital contributed for the acquisition of means with similar characteristics in dimensions, docking capacity and support equipment such as cranes, the difference in acquiring an HLS is about 45% higher to that of a floating dock, due to the equipped machinery and propulsion system.

According to the authors William M. Arkin and Jshua Handlar [8], during the period between 1945 and 1988, after the Second World War, more than 1200 serious accidents involving military ships were registered by several navies around the world, which resulted in dozens of ship wrecks, causing significant losses. This database generated during this period presents valuable analyzes of probabilistic damage to the hull and the damage in which the loss of the medium may result, with many of the accidents having little or no disclosure due to the reserved status. As discussed by Introduction to Practical Marine Engineering [10], it is also possible note such risks related to operational damage.

## 5. Applicability of HLS Military Means

The incorporation of an HLS to a fleet can enable an expansion of its capabilities, both in terms of the docking of its subordinate means, an alternative to do so, in addition to the applicability of this means in search and rescue maneuvers. According to B Lima in O Emprego de um Novo Conceito de Docagem [11], which promotes a dynamic and

operational concept for docking.

In addition, it would allow for an increase in the professional training of military personnel, especially with regard to maintenance and repair maneuvers, logistical support and missions of different scopes, enabling the joint work of officers and enlisted personnel from different cadres and corps.

In the not-too-distant past, the use of the Workshop ship concept is intended to support other operating means as a workshop ship. This ship concept is intended to support joint missions with other operating means, in addition to meeting demands with different particularities. Currently, with the future incorporation of ships with cutting-edge technology such as submarines with nuclear propulsion systems, frigates and corvettes with increasingly high levels of automation, Antarctic Support Ships, point out that the implementation of an HLS proves to be extremely relevant. and with the possibility of supporting not only future means that will be developed and designed, but also those currently in active service and even museum ships.

An HLS could also expand new horizons by operating together with companies in the energy sector such as Petrobras and Eletrobras, acting in the expansion and development of new sources of renewable energy generation such as the implementation of floating wind farms, expanding the wind potential over a period of time. coastal shores; or even the use of decommissioned offshore platforms for the deployment of solar panels, which could also be used for wave energy generation. There is, however, a vast diversity of exploration of energy potential with regard to this concept that continues to expand.

There is also the possibility of supporting semi-submersible platforms from Petrobras and even from Transpetro in any need to support their fleets. It is worth noting the accident that occurred on March 20, 2001 with the P-36 platform in the Campos Basin, which sank, causing deaths and generating numerous losses that amounted to around US\$ 356 million at the time [12].

Such possibilities of acting together with companies in the energy sector, can allow the operability and employability of the Navy in constant actions relevant to the main strategic matters related to the interest of the Homeland.

## 6. Conclusion

The multifunctionality of the HLS allows the use of this medium in a wide range of operations, allowing the elaboration of missions with different demands, how it is possible to follow according to the Defence Media [14] and Heavy Lift News [15] sites.

Regarding employment in the military, it should be noted that maneuvers with military ships are intrinsically linked to high levels of added risks, as they imply bold maneuvers, however, with the occurrences already addressed here, they positively contextualize the use of an HLS properly in numerous aspects. for its employability and applicability by navies worldwide. The application of this class of ships in

military operations continues to grow, with its use for rescue, maintenance and transport as its main premises.

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