Designing 69 Meters Littoral Mission Ship Based on the 60 Meters Fast Patrol Boat Platform to Improve Multi-Task Warfare

A. Santoso
Department of Marine Engineering, Institut Tenologi Sepuluh Nopember, Surabaya, Indonesia

Abstract. 60 meters fast patrol boat class is well known as one of the successful programs in the build of local warship in the national shipyards. Due to the higher tension in the South China Sea recently, therefore, it is urgently to have some better ships both quantitatively and qualitatively. To reduce procurements costs and shorten the delivery time then an LMS type with a length of 69 meters would be proposed based on the proven design of 60 meters FPB. Improvement of the platform not only about its size and capacity but also multi-task missions. The LMS will support missions of patrolling and intercepting as a fast patrol craft, moreover additional tasks including anti-surface warfare, mines-warfare, hydrography and intelligence, surveillance, and reconnaissance (ISR), also bio & chemical warfare duties. LMS will have a low radar cross-section by improving its stealth design and the addition of a helideck to accommodate a medium-sized helicopter. Ship able carries up to three standard ISO-containers as complementary logistics when the deck not being occupied by helicopter. LMS needs only 20% more engine power when its draught is 0.1 m higher and 21.5% more displacement compare with the FPB at a similar speed of 24 knots.

Keywords: Littoral Mission Ship, LMS, Fast Patrol Boat, FPB, Warship, Warfare

1. Introduction
Recently there is higher tension in the South China Sea when it involves two big countries China and the USA. Due to the geographical position, the conflict affects many countries such as Indonesia, Malaysia, Taiwan, etc. In this crucial situation, a strong military power is high in demand. Basic philosophy in defense is how to show that the country is not in the weak condition in military assets. This idea can prevent potential disturbances from other countries. Indonesian MoD do actual acts by considering buying several military weapons includes a naval ship, main battle tank, jet-fighter, combat heli, etc. The capabilities of the national industry also take into account building specific war machines [1]. In the maritime sector, many local shipyards have been proven to build many types of a fast patrol boats and a special shipyard PT. PAL Indonesia excellently capable of the built corvette, LPD, and even submarine. This potential resource becomes a vital backbone to support national military defense and security. Therefore, build a combat ship such as LMS or LMV will be a good challenge for national shipyards. Building strategy and engineering planning must be setup effectively based on yard capacity, facilities, experience, human resources and expertise, and finances [2].

2. Literatures Review
2.1. LMS Definition and Duties
Littoral Mission Ship (LMS) also named as Littoral Mission Vessel (LMV) for the bigger size. There are two types of LMS developed by certain countries. Firstly, it is a monohull model and secondly is a trimaran model called Littoral Combat Ship (LCS) [3]. The LMS is a type of small surface combatant vessel considered to perform littoral or coastal mission and security tasks in which high-speed maneuverability, agility, and sprint speed are required [4]. The ship can be equipped with a helicopter flight deck and missiles. This class of warship insists on
fully electronics support to control the weapons system known as Combat Management System (CMS). The ship can also be provided with a drone launcher facility.

2.2. Arrangement and Systems of LMS

Typical arrangement and system of the LMS not so different from any type of patrol boat [5]. The unique system is additional equipment and weapon to support the multi-mission of the ship. The relatively small size of this combatant ship looks likely complicated and robust. The body of the ship and exterior silhouette similar to a common patrol boats. It is a key point to develop an LMS from the basic hull of the FPB type. Extensive length can be developed in the sectional area called the parallel middle body.

![Figure 1. Technical Specification of the Developed 69 Meter Littoral Mission Ship.](image)

3. Development Model

Figure 2 shows the design of 60 meters fast patrol boat. This one has been built by several shipyards for Indonesian Navy. Main hull uses high tension AH-36 and the superstructure use aluminium 5086.

![Figure 2. Profile View of the Existing 60 Meter Fast Patrol Boat.](image)
Figure 3 shows the developed design of the LMS. There are two decks above the main deck compared with FPB that only has one deck. LMS needs more internal space to accommodate more crews and passengers [6], electronic equipment and command room, etc. Similar to FPB, the LMS uses high tension steel AH-36 for the main hull and aluminium 5086 for superstructure and welded together via bi-metal technology. Light aluminium as a superstructure gives better stability and easier shaped [7].

4. Analysis and Discussion

Upgrading the FPB to be an LMS mostly simple in terms of the hull construction. Based on the steel weight calculation, there is a relatively small addition of the hull materials at about 29 tonnes of aluminium and 66 tonnes of AH-36. The additional steel cost is about IDR 8.44 billion or it can say less than 1% from the LMS platform price. More details of the technical specification data of the ships can be resumed in Table 1 below. The hull outfitting may improve higher even it is not significant values, also for machinery and electrical outfitting for the basic platform. The electronic combatant system takes much bigger budgeting value due to the more complicated warfare’s mission of the LMS [8] compared with the FPB.

Table 1. Comparison of the Technical Specification Data

| Specification Parameter     | Unit | 60 Meter Fast Patrol Boat | 69 Meter Littoral Mission Ship |
|----------------------------|------|---------------------------|--------------------------------|
| Length Over All (LOA)      | m    | 60.00                     | 69.20                          |
| Length of Water Line (LWL) | m    | 56.96                     | 64.14                          |
| Breadth (mld) (B)          | m    | 8.20                      | 9.00                           |
| Height (D)                 | m    | 4.90                      | 5.60                           |
| Draught (T)                | m    | 2.30                      | 2.40                           |
| Displacement               | Ton  | 506                       | 679                            |
| Lightweight (LWT)          | Ton  | 342                       | 459                            |
| Deadweight (DWT)           | Ton  | 164                       | 220                            |
| Coefficient Block          |      | 0.483                     | 0.499                          |
| Cruising Speed (Vs)        | Knots| 24                        | 24                             |
| Engine Power               | HP   | 2 x 4130                  | 2 x 4830                       |
| Crews                      | person| 46                        | 49                             |
| Guest + cadets + detention| person| 10                        | 27                             |
| FOT                        | KL   | 130                       | 160                            |
| FWT                        | KL   | 30                        | 20                             |
| Endurance (cruising)       | NM   | 2500                      | 2500                           |
The main propulsion system commonly takes bigger budgeting at almost 40% for military high-speed platforms [9]. The higher the speed needs the bigger power of engines that is correlated with the more expensive engine prices. Theoretically, the power demand of a ship is rank three of the ship’s speed as shown in Equation 1 below.

\[ HP \approx (V_s)^3 \]  \hspace{1cm} (1)

For a fully combatant ships that occupied an advanced CMS, the prices of platforms commonly less than the price of the electronic combatant system, moreover to the main propulsion system. Upgrading the size of the ships from 60 meters FPB to the 69 meters LMS needs 20% more powerful engines to overcome the increasing ship draught at about 0.1 meters and 21.5% of bigger displacement to achieve a similar speed at 24 knots. Figure 4 resumes all of the designed speeds that was simulated by software where the power demand is relatively increasing at the average value of about 1500 HP.

![Power Speed Prediction](image)

**Figure 4.** Power Speed Prediction for the Developed 69 Meter Littoral Mission Ship.

Based on the calculation of the speed power prediction above, then the suitable engine maker can be selected and determined. Both of the ships can be served by using MTU engines range power. FPB proposes to use MTU type 16V4000M93 and the LMS uses MTU type 20V4000M73L. Based on the basic requirement as a fast ship, the LMS still possible to upgrade up to 27 knots by using MTU type 20V4000M93L without any much penalty to the engines’s weight and dimension which are primary constraints in the development of the fast patrol ships. The LMS can also be equipped by using diesel-electric propulsion technology integrated with the latest automation system such as PMS and IPMS that already installed in the predecessor PKR Class and SIGMA Class [10].

5. **Conclusion**

LMS needs only 20% more engine power when its draught is increase at about 0.1 meters and 21.5% more displacement compare with the FPB at a similar speed of 24 knots. Bigger displacement is a worthy value to make improvements of the interior functioning to fulfill the more complex duty of the LMS. It is still possible to be upgraded up to 27 knots by using a power engine of 2 x 5765 HP. From the shipbuilder’s point of view, the capability to construct LMS gives more benefits in the financial aspect. The LMS budget is about two times more than the FPB Class based on the platform only exclude the CMS and electronic warfare supporting system.
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