

OFFENSIVE AND DEFENSIVE CAPABILITY COMPARISON BETWEEN IVER HUITFELDT CLASS AND PKR105 CLASS BASED ON SALVO MODEL

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ABSTRACT

Warship ability owned by Indonesian Navy is expected to have deterrence effect on other countries that want to disturb the sovereignty of Indonesia. Therefore, the right decision is needed to determine which warship should be chosen to carry out the task of guarding Indonesia's territorial waters. The newest warship that has a deterrence effect and is owned by the Indonesian Navy is the KRI PKR105 class. This ship has reliable capabilities both in terms of offensive and defensive because it is equipped with qualified equipment and weapons. Meanwhile, in future plans, the Indonesian Navy is interested in having a Danish-made Iver Huitfeldt class warship which also has a fairly reliable capability. In this paper, we will discuss the calculation of the capabilities of the PKR105 class and Iver Huitfeldt class which are planned to be purchased by the Indonesian Navy based on the Salvo Model. From the calculation, it can be seen that PKR105 class has the same offensive capability as Iver Huitfeldt class but Iver Huitfeldt class has higher defensive capability than PKR105. This is because the tonnage of Iver Huitfeldt class is greater than PKR105 as one of the staying power parameters for calculating defensive ability. To overcome the shortage of PKR105 defensive capabilities, a \$ 21 million CIWS can be added as one of the defensive power parameters in calculating defensive capability considering that there is still a difference in the PKR105 price of \$ 285 million with the Iver Huitfeldt class price of \$ 325. With this upgrade option then it can be used as one of the considerations in determining the type of ship that can be selected to increase the combat capability of the fleet.

Keywords : Iver Huitfeldt Class , PKR105 class, reserve fuel, Salvo Model.

1. INTRODUCTION

1.1 Background

In accordance with Law No. 34 of 2004 concerning the TNI, the main task of the TNI is to uphold state sovereignty, maintain the territorial integrity of the Unitary State of the Republic of Indonesia based on Pancasila and the 1945 Constitution of the Republic of Indonesia, and protect the entire nation and all Indonesian blood from threats and disturbance to the integrity of the nation and state. Meanwhile, Article 9 states that one of the duties of the Indonesian Navy is to carry out the duties of the Navy in the defence sector. The consequence of this task is that the Indonesian Navy must have a strong fleet of warships as a deterrent effect for other countries in order to support the implementation of this main task. Indonesia has met the percentage of 67.71% of the target MEF (minimum essential forces) consisting of 159 Warships, 91 Air Craft, and 437 Marine Combat Vessels in various types. In the 2020-2024 strategic plan, the Indonesian Navy plans to add 51 KRI warships consisting

of 3 Submarines, 4 Frigates, 1 Frigate Train, 2 BHO + I Submarine Resane Vehicle Sgstem, 2 MCMV, 9 KCR-60, 9 OPV, 6 LPD, 3 BU, 2 BCM, 1 BRS, 6 PC-60 and 3 PC-40. It is hoped that the addition of these warships will increase the fleet's ability to secure Indonesian territorial waters.

In the 2020-2024 Medium-Term National Development Plan (RPJM), the UO of the Indonesian Navy in the modernization program for *Alutsista and Non-Alutsista* and the development of Navy facilities and infrastructure is IDR 27.6447 trillion so it should be taken into consideration to decide which types of warships do we need to multiply in relation to the warship's combat capabilities and the country's ability to buy those ships. For information, the newest and most sophisticated warship currently owned by the Indonesian Navy is the PKR105 RE Martadinata class which is a 2014 Indonesian-made ship. Meanwhile, in the future, the Indonesian Navy plans to buy a Danish-made Iver Huidfelt class warship. The purpose of this paper is to

calculate the capabilities of the KRI PKR105 and Iver Huitfeldt class which are planned to be purchased by the Indonesian Navy based on the Salvo Model as one of the considerations in determining the type of ship that can be selected to increase the fleet's combat capability.

2. LITERATURE REVIEW

2.1 Salvo Model Of Modern Missile Combat

This theory was put forward by Capt. Ret. Wayne P. Hughes Jr. which states that modern naval warfare is a war that uses a missile launched from a warship whose effectiveness can be calculated using several parameters, including:

a. *Staying power* of a defender is the number of nominal ASCM hits (an Exocet could be the nominal missile) needed to put the ship out of action, denoted a_1 and b_1 .

b. *Salvo size* of each attacker is the number of missiles that will be launched successfully, denoted a_2 and b_2 . These numbers do not appear in the two salvo equations because only a fraction of the missiles will hit, denoted H_a and H_b .

c. *Striking power* of each attacker is the number of accurate ("good") ASCMs launched, denoted α and β . This is the number of missiles that will hit if there is no defence.

d. *Defensive power* is the number of good shots that each defender will destroy or deflect when alert and ready to do so, denoted a_3 and b_3 . (*Survivability* is the combined resistance of a ship due to both defensive power and staying power).

e. The equations give the number of enemy ships ΔA or ΔB , put out of action by a salvo. The two equations are:

f.

$$\Delta B = \frac{\alpha A - b_3 B}{b_1}$$

is the effect of A 's salvo in B 's ships put out of action.

$$\Delta A = \frac{\beta B - a_3 A}{a_1}$$

is the effect of B 's salvo in A 's ships put out of action.

2.2 PKR 105 Class And Iver Huitfeldt Class Technical Specification Comparison

2.2.1 PKR 105 Class

PKR105 class is a warship belonging to the Indonesian Navy with dimensions of 105 m long, 14 m wide and weighs 2,365 tons. In principle, the PKR105 has the functions of Anti-Surface Warfare, Anti Sub Surface Warfare, Electronic and Acoustic Warfare, Anti Air Warfare, Mine Warfare, Strike Warfare and Special Naval Warfare. With these various functions, the PKR105 class is equipped with sufficient equipment, including:

- a. Weaponry System.
 - 1) 1 x 76 mm OSRG.
 - 2) 2 x 20 mm Rheinmetal Gun
 - 3) 8 x SSM Exocet MM40 Block III.
 - 4) 12 x SAM VL Mica.
 - 5) 2 x 3 Torpedo Launcher B515.
 - 6) 1 x CIWS Oerlikon Millennium Gun 35 MM.
- b. Air, Surface and Sub Surface Detection System.
 - 1) SMART-S Mk II Radar.
 - 2) ARPA Sperry Marine Radar.
 - 3) HMS Kingklip UMS4132 Sonar.
- c. Electronic Warfare System.
 - 1) ESM Vigile 100 Mk II.
 - 2) ECM Scorpio 2L.
 - 3) SKWS Decoy Terma.

With the equipment that is owned as above, it can be assumed that the values that will be the parameters for the calculation of the Salvo Model Theory based on the ATP 31 B Above Water Warfare Manual are as follows:

- a. *Staying Power* : 2
PKR105 class is a frigate with tonnage more than 2000 ton.
- b. *Defensive Power* : 2 (Good)
PKR105 class has low range SAM, 76 mm OSRG and CIWS as hard kill weapon system.
- c. *Striking Power* : 7
PKR105 class has 8 missiles with good hit probability 0.9 for each missile.

Meanwhile, the price for PKR105 class according to the 2014 contract is \$ 520 million or Rp 6.76 T for 2 vessels or \$ 260 million which is equivalent to Rp. 3.38 T (exchange rate of Rp 13,000) for each ship. This price includes the crew training package and the spare part package. Taking into account the annual inflation rate, the price of 1 PKR105 class in 2020 is around \$ 285 million or the equivalent of around Rp 4 T (exchange rate of Rp 14,000).

2.2.2 Iver Huitfeldt Class

In June 2020, there was a news that Indonesia would carry out the purchase of the Iver Huitfeldt class warship. The purchase of this type of frigate warship is to strengthen the Indonesian Navy's fleet in the face of threats from other countries that want to interfere with Indonesian sovereignty, especially in the territorial waters. This Iver Huitfeldt class warship is a Danish-made ship which has a length of 138 m, a width of 19 m and has a weight of about 6,645 tons. Meanwhile, the equipment and weaponry owned by the Iver Huitfeldt class warships are as follows :

- a. Weaponry System.
 - 1) 1 x 76 mm OSRG.
 - 2) 2 x 12,7 mm FN M3 Gun.
 - 3) 8 x SSM Exocet MM40 Block III.
 - 4) 16 x SAM VL Mica.
 - 5) 2 x 3 Torpedo Launcher B515.
 - 6) 1 x CIWS Oerlikon Millennium Gun 35 MM
- b. Air, Surface and Sub Surface Detection System.
 - 1) SMART-L Radar.
 - 2) Terma SCANTER 6000 Radar.
 - 3) HMS ASO 94 Sonar.
- c. Electronic Warfare System
 - 1) ESM ES-3701.
 - 2) Seagnat Mark 36 SRBOC.
 - 3) SKWS Decoy Terma.

With the equipment that is owned as above, it can be assumed that the values that will be the parameters for the calculation of the Salvo Model Theory based on the ATP 31 B Above Water Warfare Manual are as follows :

- a. *Staying Power* : 4
Iver Huitfeldt class is a frigate with tonnage more than 6000 ton.
- b. *Defensive Power* : 2 (Good)
Iver Huitfeldt class has has low range SAM, 76 mm OSRG and CIWS as hard kill weapon system.
- c. *Striking Power* : 7
Iver Huitfeldt class has 8 missiles with good hit probability 0.9 for each missile.

Meanwhile, the Iver Huitfeldt class warship in 2020 is estimated to have a price of \$ 325 million or the equivalent of Rp 4.55 T (exchange rate of Rp 14,000) for each ship.

2.3 PKR105 Class and Iver Huitfeldt Class Combat Capability Comparison

In accordance with the formula given by Capt. Ret. Wayne P. Hughes Jr., we can calculate the capability of a warship in modern naval combat using a missile with known parameters. In this case we will assume the

opponent's strength is a constant so that we can compare the capabilities possessed by the PKR105 class and Iver Huitfeldt class. This capability is divided into two which are the capability from an offensive perspective and the capability from a defensive perspective. In this calculation, we will compare the capabilities of 2 PKR 105 class with 2 Iver Huitfeldt class.

2.3.1 PKR105 Class Combat Capability.

If it is assumed that the potential opponent comes with 2 frigate class with the criteria of attacking power 4, defensive power 2 and staying power 2 and symbol A is us and symbol B is the opponent, then the PKR105 class offensive capability can be calculated as follows :

$$\Delta B = \frac{\alpha A - b3B}{b1}$$

$$\Delta B = \frac{2(7) - 2(2)}{2}$$

$$\Delta B = 5$$

The calculation above means that the PKR105 class will be able to destroy all of potential opposing frigates with the provision the PKR105 class shoots first.

Meanwhile, the defensive capability of the PKR105 class can be calculated as follows :

$$\Delta A = \frac{\beta B - a3A}{a1}$$

$$\Delta A = \frac{2(4) - 2(2)}{2}$$

$$\Delta A = 2$$

The calculation above means that no PKR105 class will survive against 2 corvettes from the potential opponent with the provision potential opposing corvettes shoot first.

2.3.2 Iver Huitfeldt Class Combat Capability.

With the same assumption, if there is a potential opponent of 2 frigates with the criteria of attacking power 4, defensive power 2 and staying power 2 and symbol A is us and symbol B is the opponent, then the offensive capability of Iver Huitfeldt class can be calculated as follows:

$$\Delta B = \frac{\alpha A - b3B}{b1}$$

$$\Delta B = \frac{2(7) - 2(2)}{2}$$

$$\Delta B = 5$$

The calculation above means that the Iver Huitfeldt class will be able to destroy all potential opposing frigates with the provision Iver Huitfeldt class shoots first.

Meanwhile, the defensive capability of Iver Huitfeldt class can be calculated as follows:

$$\Delta A = \frac{\beta B - a3A}{a1}$$

$$\Delta A = \frac{2(4) - 2(2)}{4}$$

$$\Delta A = 1$$

The calculation above means that the 1 PKR105 class will survive against 2 corvettes from the potential opponent with the provision potential opposing frigates shoot first.

2.3.3 PKR105 Upgrade.

From the comparison above, it can be seen that the offensive capabilities of PKR105 and Iver Huitfeldt are the same because they have attacking power with 8 missiles, each of which has a probability of 0.9 or the equivalent of 7 missiles shot well. The difference is the defensive capabilities of the two ships. PKR105 class has lower defensive capability because based on Salvo Model its staying power is 2. This is because PKR105 class' tonnage is only about 2,365 tons. Meanwhile, Iver Huitfeldt class has a higher defensive capability because it has a staying power of 4 effects from its weight of around 6,645 tons.

Because there is a different price between the PKR105 class and Iver Huitfeldt class which is around \$ 40 million, the PKR105 class' defensive capability can be increased by adding 1 unit of CWIS Millennium Gun at a price of around \$ 21 million at the stern as defensive power reinforcement. By adding 1 unit of CWIS, it will increase the defensive power value of PKR105 from the previous 2 to 3, so that if you use the same scenario, the calculation of defensive power will be obtained as follows:

$$\Delta A = \frac{\beta B - a3A}{a1}$$

$$\Delta A = \frac{2(4) - 2(3)}{2}$$

$$\Delta A = 1$$

The calculation above means that after the upgrade, there will be 1 PKR105 ship that can still survive against 2 frigates from potential opponent, provided that the other country's frigates shoot first. This proves that by increasing the defensive power, the ship's defensive capability will increase as a whole.

5. Conclusions

5.1 Conclusions

Based on the results of the above calculations, it can be concluded that with the current conditions, both the PKR105 class and

the Iver Huitfeldt class warships that are planned to be purchased by Indonesia, have the same offensive capabilities. This is due to the parameters set by Capt. Ret. Wayne P. Hughes in the Salvo Model Theory, namely striking power which is influenced by the number of ASCM (anti-ship cruising missile) carried. Meanwhile, the PKR105 class' defensive capability is still below the Iver Huitfeldt class because the PKR105 class' weight is lighter than the Iver Huitfeldt class according to the Salvo Model Theory which states that defensive capability is influenced by defensive power which can be in the form of a cannon or air defence missile and staying power that is influenced by ship's tonnage.

To overcome the problem of defensive capability in PKR105 class, 1 CIWS can be added so that it adds to the defensive power value which will affect the overall defensive capability. This option can be taken because there was a price difference of about \$ 40 million between the Iver Huitfeldt class and the PKR105 class, while the CWIS price itself was around \$ 21 million. After adding CWIS, the PKR105 class will have almost the same defensive capability as the Iver Huitfeldt class because even though it has a lighter weight, PKR105 class has an air defence system that is superior to Iver Huitfeldt class.

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