



## Optimization of Radar Navigation Tools When Passing through the Indonesian Archipelago Sea Lanes on the Srikandi 511 SPOB Ship

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**Info Artikel :**

Diterima September 2026

Direvisi 20 September 2026

Dipublikasikan 30 September 2026

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**Keyword:**

*Navigation,*

*Radar,*

*ALKI*

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**ABSTRACT**

Radar will be very useful during bad weather, foggy conditions and sailing at night, especially when navigational instructions such as beacons, buoys, hills or buildings cannot be visually observed. So, prospective ship officers must know and understand how to use radar navigation tools, because shipping lanes or ALKI are prone to collisions and running aground. The aim of the research was to find out the role of radar navigation equipment on ships when passing ALKI and to find out the efforts to optimize the use of radar when passing ALKI. The data analysis technique in this study was a qualitative descriptive analysis, namely by describing the data obtained from literature and field studies. On the basis of the data collected, it was then analyzed to find a solution for optimizing radar navigation tools when passing through the Indonesian archipelago sea lanes on the SPOB Srikandi 511 ship. The results of the study were the role and function of the radar during sailing, namely: Positioning and plotting; Identifying targets; and detecting the risk of collision, to optimize the function of the radar on the ship, namely: Master: guidance during familiarization, other officers: mutual learning cooperation and sharing knowledge and sharing experiences, Company: Carrying out tests/selection of capabilities and skills for new crew and providing training and refreshing radar operation.



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**Introduction**

The law of the sea in general is the law governing international sea areas which are regulated in international treaties, namely the United Nations Convention on the Law of the Sea abbreviated as UNCLOS, also called the Law of the Sea convention or The Law of the Sea Treaty is an international agreement resulting from the third United Nations Conference on the law of the sea (UNCLOS III) which took place from 1973 to 1982. This Law of the Sea Convention defines rights and

responsibilities in the use of the world's seas and sets guidelines for business, environment, and marine natural resource management. The convention concluded in 1982 superseded the 1985 international treaty on the seas. UNCLOS entered into force in 1984, after Guyana became the 60th State to sign the treaty. To date, 158 countries, including the European Union, have joined the convention.

Indonesia is the largest archipelagic country in the world consisting of 17,000 large and small islands with a national sea area of 3.1

million square kilometers. However, in practice, we only use our oceans as fishing grounds and petroleum miners. The oceans are so vast that they can be used for fish farms and in the field of shipping/transportation media. With the increasing sophistication of technology in the field of shipping, especially in ship navigation systems, the use of radar as a navigation aid is very important. Where the radar functions to overcome targets that are not directly visible to the human eye, for example due to the long distance of the target as well as due to high sea waves. By taking into account the vast sea area it owns and its position as an international trade route, Indonesia is on a strategic route for shipping traffic. And the increasing tonnage of commercial ships, especially tankers, which have now reached the Ultra Large category.

One of the incidents related to the radar navigation device on board when passing through the Indonesian Archipelagic Sea Channels (Alur Laut Kepulauan Indonesia-ALKI) was the Tragedy on 17 December 2015 at 15.39 WIB the MV. Thorco Could and MT. Stolt Commitment collided in Riau waters. The incident occurred near Karang Batu Berantai in Indonesian waters. The Indonesian and Singaporean authorities worked together to evacuate the crew and ensure that the shipping lanes were not disrupted. MV. Thorco, which flew the Cayman Islands flag, was known to be carrying pipes and oil. While MT. The Stolt Commitment, which flew the Antigua-Barbuda flag, was known to be transporting chemicals. At the time of the incident, the two ships were sailing in the Singapore Strait. On Wednesday evening, the Batam maritime authority received a distress signal from the two ships already in a sunken position behind. The incident occurred due to Human Error on the reading of the navigation tool. One of them was a radar navigation tool that detected signal emission when a sea accident occurred. Radar will be very useful during bad weather, foggy conditions and sailing at night, especially when navigational instructions such as beacons, buoys, hills or buildings cannot be visually observed. So, prospective ship officers must know and understand how to use radar navigation tools, because shipping lanes or ALKI are prone to collisions and running

aground. So Ship Officers must be observant when passing through shipping lanes when using Radar on board.

## Literature Review

Radar is an equipment used to emit electromagnetic signals and receive echo signals from objects/targets within its scope of coverage. The presence of the target is detected from the echo signal or from the transponder response (Nazir, Suryo, 2017). Some radars may also operate in a passive mode, in which the transmitter is turned off and information about the target is obtained by receiving radiation emitted from the target itself or reflected by the target from external sources. Radar is also known as a field of science and technology including methods and equipment to carry out basic operations against targets. Radar is an electromagnetic system for detecting and locating the position of objects. Radar operates by transmitting one type of waveform, for example a pulse modulated sine wave and detecting the authenticity of the echo signal. Radar is used to increase the ability of one of the senses to observe the environment, especially the sense of sight. Radar is designed to see environmental conditions and targets to be more resistant to darkness, blur, fog, rain and snow. Radar also has the advantage of being able to calculate the distance to an object. Radar is used to regulate the ship's travel path so that each ship can walk and pass on its own path and not collide with each other, even in unfavorable weather, for example foggy weather. The wavelengths emitted by radar range from a few millimeters to a meter. Radio waves/signals emitted and reflected from a certain object will be captured by radar. The working principle of radar as electronic navigation is that when sending a signal, the antenna rotates 10 to 30 times/minute by emitting pulses of 500 to 3000 times/second. When transmitting, this pulse will be reflected back when it hits the target in the form of a radio echo (radio echo). This reflected pulse will be received back by the antenna and sent to the receiver via the transmit/receive selector switch. Each time an electric pulse is emitted, white spots will stretch out from the center of the screen/radar scope at a constant speed and will create a sweeping line. This sweep line will move around the

center of the scope and rotate clockwise where its rotation is aligned with the rotation of the antenna. If a video signal is used in the indicator, the white dot above the sweep line will be converted into an image/shadow. The position of this image will be in line with the direction of the emitted electric waves and the distance between the position of this image and the center of the radar scope is based on the distance of the ship from the target somewhere. Thus the position of the ship's signal receiver is always at the center of the scope on the cathode ray tube and surrounded by objects/targets.

With the enactment of the United Nations Convention on the Law of the Sea (UNCLOS), Indonesia is recognized as a whole archipelagic country in accordance with Chapter IV UNCLOS 1982, which contains the provisions on the principles and provisions of International Law, which underlies 'an archipelagic state is seen as a territorial unit'. whole country'. As a consequence, Indonesia is required to grant access to innocent passage rights in accordance with UNCLOS 1982 article 53 paragraph 9, which contains "in determining or changing a traffic separation scheme, an archipelagic country must submit a proposal to an authorized international organization with the intention of being accepted" In accordance with that provision, Indonesia has the obligation to provide ALKI (Archipelagic Sea Lanes) lanes Indonesia). Arrangements regarding the right of innocent passage and the right of archipelagic passage are regulated in Law no. 6 of 1996, namely in addition to guaranteeing the interests of international shipping and the interests of security, order and peace of the Unitary State of the Republic of Indonesia (Hasibuan R, 2002). ALKI (Indonesian Archipelagic Sea Channels) is a consensus stipulated in Government Regulation No. 37 of 2002, by dividing the territory of Indonesia to be passed by 3 ALKI routes. Regarding the advantages and disadvantages of ALKI IV (east-west ALKI), those who need the ALKI line seem to be American, British or Australian countries where there are military or trade interests. For these big countries, without any provision for ALKI IV lanes, their ships can pass through any area at will as long as the route has not been determined. But if the ALKI IV line is determined, of course foreign countries will

respect it by only going through the ALKI IV line that has been determined.

## Research Methods

The type of research used in this research was descriptive qualitative research which aimed to reveal all the facts in the field by describing, recording, analyzing and interpreting. The activities carried out after starting the analysis step were conducting sea practice on a ship to find out the situation with the provision of knowledge of what is expected through literature studies. Next we began to identify existing problems and determine what the goal of the problems we encounter. Then we could determine the appropriate research method. This research was conducted on the SPOB Srikandi 511 ship when the cadets carried out sea practice with a research period of approximately twelve months. PT Lima Srikandi Jaya was a business entity in the field of shipping transportation for the transportation of goods. It served the delivery of bulk cargo in the form of mining products and palm oil. Currently the company is starting to expand its business into the shipyard business, as well as supporting the operational system of the company's ships. PT Lima Srikandi Jaya is a sea transportation service company that has a vision to create a company that is tough, independent, competitive and efficient with the mission of empowering human resources and fleet to provide excellent service to customers by prioritizing safety, security and comfort. In carrying out its activities, PT Lima Srikandi Jaya prioritizes safety, quality, and focuses on customer needs (safety, quality and customer focus) has optimally trained staff who are open to feedback and changes and to continuously improve customer service and partnering capabilities through customer & partner feedback, innovation, and technology.

The operational definition was intended to avoid misunderstandings and differences in interpretation related to the terms in the research being carried out. In accordance with the research title, "Optimization of radar navigation tools when passing through the Indonesian Archipelagic Sea Lanes on the SPOB Srikandi 511 ship", the operational definition that needed to be explained was that navigation or direction guidance was the

determination of the position (position) and direction of travel either on the actual terrain or on a map, and that's why knowledge about compasses and maps and their use techniques must be owned and understood. Optimization is the achievement of results according to expectations effectively and efficiently. Indonesian Archipelagic Sea Lanes (ALKI). ALKI is a sea channel designated as a channel for the implementation of the Right of Archipelagic Sea Lane Passage based on international law of the sea conventions. To obtain the data needed in this study, the authors used several methods, namely data analysis used in observational research was to use descriptive methods in the form of written or oral data of the observed object, namely by providing an overview of the facts that occur in the field and then compared with existing theories so that a solution could be given to the problem. The data analysis technique used was by observing the technique of using the radar navigation tool carried out by the officer on duty whether its used on the ship was optimal or not. , theory, proposition or law, and others related to research problems. Interview is a way of collecting data that is used to obtain information directly from the source. The interview is a question and answer process orally which is carried out to the officer on duty during navigation.

## Results and Discussion

The role and use of radar on ships in the implementation of safe navigation. When sailing in shipping lanes when passing ALKI there are several possible risks faced. Maritime radar is an important technology for observation and tracking systems in various marine applications. Compared to terrestrial radar systems, maritime radar faces the challenge of large signal jamming, which is contributed by sea waves. This problem becomes even more critical when the system detects relatively small vessels, where the probability of detection is reduced due to the small radar cross-section (RCS) of the ship itself (Suraya Zainuddin et al., 2019).

According to Allen (2010), the potential costs caused by a collision when passing ALKI include; human, environmental and financial companies and countries. Ship accidents in

restricted shipping lanes can be very worrying. Ship collisions in ALKI shipping lanes do not only threaten the ships, crew, passengers and cargo involved; may also contaminate or obstruct shipping lanes and possibly close shipping lanes to other seagoing traffic. In addition, if there is overtaking or crossing paths with other ships in the shipping channel.

One way to minimize this is to have navigation aids that function to detect objects including other ships that are around the ship. Radar is one of the most potential navigational aids on a ship, both in positioning and detecting the danger of collision. When sailing waters with dense traffic, the role of radar in helping to support shipping safety is quite dominant (Qin & Chen, 2019). In this regard, the 1974 SOLAS International regulations require that every ship measuring 1600 GT (Gross Tonnet) or more must be equipped with a radar. and every ship of 10,000 GT or more must be equipped with two radars. A radar transmitter on a ship or on land produces short pulses of radio waves and the beam is directed to a certain area through a radar antenna which is often called a scanner (Mohovic et al., 2016).

If this radio wave pulse hits a target, for example an island, another ship, bouy then some of this wireless wave energy will be reflected back by the target in all directions, including one returned to the radar that was transmitting earlier. So that the radar can be used as a navigation aid in a safe voyage (Fei Cai, Hongqi Fan, 2014).

### *Efforts to optimize the use of radar when passing ALKI*

At SPOB Srikandi 511, one of the radars which should be able to function properly was damaged, so that during sea voyages only one radar was able to work properly. This can affect the ship's maneuvers, which should be a radar that can operate alternately. Knowledge of deck officers in using and operating Radar on Ships. In accordance with PP No.7 of 2000 concerning Maritime Affairs article 6 (2), the types of special skills certificates consist of (h) Radar simulator certificates, (i) ARPA simulator certificates. The International Regulations for Preventing Collisions at Sea 1972 (Colreg, 1972) rules 5 concerning circumambulation, that is, every ship must always carry out proper

circumnavigation with sight and hearing as well as using all available equipment in the existing circumstances and conditions, so that it can properly take into account the situation and the danger of collision and rule 7 concerning collision hazard prevention is Radar aircraft must be used properly, if available and properly operated, including long-range research to obtain early warning of the danger of collision and radar plotting or similar systematic observation of detected objects, amplifies and will be detected in the form of radio signals which are then amplified. again its power is on indicators. Estimates should not be made on the basis of inadequate information, especially with regard to radar information. Crude Carrier (ULCC), the Malacca Strait will be increasingly avoided by ships with a tonnage of over 100,000 tons. Apart from that, the silting of the Malacca Strait is also another reason why these waters will be abandoned by large tonnage ships.

In the field of shipping, radar is used to regulate ship travel paths so that each ship can walk and pass on its own path and not collide with each other, even in unfavorable weather, for example foggy weather.

## Conclusions

The role and function of the radar while sailing in the Indonesian Archipelagic Sea Lanes, namely; to determine the ship's position from time to time; guiding ships in and out of harbors or narrow waters; and help determine whether a collision hazard exists or not. Optimizing the radar function on the ship, namely: Captain: guidance during familiarization, other officers: mutual learning cooperation and knowledge sharing and experience sharing, Company: Carrying out tests/selection of capabilities and skills for new crew and providing training and refreshing radar operation It is advisable for the company must take action as quickly as possible if there is damage to the radar on board, because radar is a navigation tool that has an important role in making voyages on board. In order to further improve skills in terms of using radar navigation tools, and must make optimal use of the help of tools.

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