

Shipping Safety in the Singapore Strait Tanjung Pinang, Riau Islands, Indonesia

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ABSTRACT

This study aims to determine the effectiveness of shipping safety in the Singapore Strait Shipping Channel. Safety was carried out in the Class I Tanjung Pinang Navigation District Work Area, Riau Islands. Ships passing through the Singapore Strait, require navigational aids. The research method used in this study was qualitative research, particularly descriptive evaluative and formal legality analysis. This method was purposed to evaluate the Singapore Strait in the Class I Navigation District Working Area of Tanjung Pinang and observation was carried out in the waters of the Malacca Strait. Data were collected from interviews with regulators, operators and service users as well as conducting Focus Group Discussions (FGD) and also documentation related to shipping safety. The findings of the e-Navigation research explained how to improve shipping safety in the Singapore Strait by implementing Virtual AIS AtoN. Regulations of a technical nature were indispensable for the implementation of e-Navigation in improving shipping safety.

Keywords : cruise lines, shipping safety, e-navigation, effectiveness, singapore strait

A. Preliminary

The International Maritime Organization (IMO), with the Initiative for the Protection of Vital Shipping Lines, held a conference in 2004. At the conference, IMO discussed the safety of ships crossing the Straits of Malacca and Singapore (Rusli, 2020). In this regard, IMO cooperates with the three coastal countries namely Indonesia, Malaysia and Singapore. Singapore has been working with Indonesia and Malaysia to improve navigational safety and environmental protection in the Straits since the 1970s (Beckman, 2008; Rusli, 2011). In 2007, a framework for cooperation between strait users and coastal countries was produced, known as the Cooperation Mechanism. Beckman (2008) said “which is a historic breakthrough as Article 43 of the Law of the Sea Convention”.

The formulation of the various stakeholders in the meeting, described the success of the cooperation mechanism that has been made. Cooperation continues to be carried out between users of the three coastal countries (Ho, 2009; Panduwinata et al., 2016). Research-based maritime diplomacy Suproboningrum & Kurniawan (2018), Indonesia-Malaysia-Singapore supports and facilitates the success of coordinated patrols in the Malacca Strait. The agreement was carried out through the Singapore Statement, and resulted in surveillance of marine areas in the Malacca Strait from the perspective of Indonesia in collaboration with the Malacca Strait Sea Patrols in 2011-2013 (Panduwinata et al., 2016).

The Straits of Malacca and the Straits of Singapore are one of the most important shipping lanes in the world, both from an economic and strategic point

of view. The shortest shipping lane between the Indian Ocean and the Pacific Ocean, connecting major economies such as the Middle East, China, Japan and South Korea (Qu & Meng, 2012). Previous research (Bateman, 2006; Qu & Meng, 2012) explains that shipping in the Singapore Strait is very important and strategically it is at risk from maritime terrorist attacks. Increased insurance premiums for many people using ships. Shipping safety in the Singapore strait is related to the safety and security of environmental protection. According to Rusli (2012), accidents in the Straits of Malacca and Singapore are also affected by heavy traffic density, poor visibility, frequent change of location along the waterway, confusing crossing patterns and several shipwrecks in certain places. along the Strait.

The increasing number of ships passing through the Singapore Strait has an impact on traffic management, facilities and improvements in integrated technology for shipping safety. Safety such as Sailing-Navigation Aids, Shipping Telecommunications, Radar, Human Resources and National and International Regulations that support increasing shipping safety at sea (Qu & Meng, 2012). The ship passed through the waters of the Malacca and Singapore Straits based on data from The Mandatory Ship Reporting System in the Straits of Malacca and Singapore (Straitrep). Density levels occur in the Malacca Strait and Singapore Strait as international lanes and are connected to the North Natuna Sea and the Indonesian Archipelago Passage (ALKI) as a cross-peace shipping lane.

Shipping safety in the Singapore Strait is of international concern.

Singapore Strait shipping is a congested route that requires management and technology development. Sailing-Navigation Aids overcome navigational hazards. Navigation hazards are caused by shortages, damage, theft and the unavailability of Sailing-Navigation facilities and infrastructure (Rusli, 2012). The implementation of e-Navigation in the Malacca Strait and Singapore Strait applies the Marine Electronic Highway (MEH) which has been submitted from the International Maritime Organization (IMO) to the Directorate General of Sea Transportation in 2012.

IMO recommends the implementation of Automatic Identification System (AIS) to improve navigation safety in marine traffic areas. Under regulations, IMO requires AIS to be installed on all vessels with gross tonnage above 300 Tons. Zaman (2016) International shipping, cargo ships with gross tonnage above 500 tons carry out international voyages or not and all passenger ships regardless of size. Marine Electronic Highway (MEH) is a navigation network assistance intended for ships navigating the Malacca and Singapore Straits. The aim is to support navigational safety and to avoid the danger of collision or run aground which can cause pollution in the water area. Based on research (Rusli, 2011; 2020; Oei, 2001). The Straits of Malacca and Singapore have solutions available to the littoral States of Malaysia, Indonesia and Singapore under identified international law to enhance safe navigation. Safe as important shipping lanes for oil transportation, the Straits of Malacca and Singapore must remain open for international shipping, if the closure of the Straits will harm the global economy.

Based on data on the number of navigation-assisted facilities in January 2020, there were a total of 377 building-navigation-aid facilities spread across the Tanjung Pinang Class I Navigation District Work Area as a means of shipping safety. There are 15 (fifteen) units of Sailing-Navigation Assistance Facilities (SBNP) installed along the Singapore Strait. The AtoN system facilitates the safe and efficient movement of ships through waterways. minimum requirements for safe and fast navigation through special waters according to the type and volume of traffic and the level of risk” (Wright & Baldauf, 2017). Physical AtoNs have been used for thousands of years to guide ships along routes. Physical AtonN provides assurance of safe passage using known landmarks and structures to denote safe waters. In the modern era, technology has provided lighthouses, light ranges, day signs, and other devices to achieve this capability (Wright & Baldauf, 2016).

The development, construction and maintenance of Sailing-Navigation Assistance Facilities (SBNP) in the Straits of Malacca and the Straits of Singapore refers to IMO/SGP 2.1/1 dated 16 August 2007. The Co-Operative Mechanism Between the Littoral States and User States on Safety of Navigation and Environmental Protection in The Straits of Malacca and Singapore y establishing a Cooperation mechanism. The cooperation between Indonesia, Malaysia and Singapore based on the United Nations Convention on the Law of the Sea (UNCLOS) is stated in article 43 (Wright & Baldauf, 2016). User countries and bordering countries cooperate, firstly for maintenance and safety in the strait, namely navigational aids. The second is

the prevention, reduction and control of pollution from ships.

Other Sailing Navigation Facilities are SROP (Coastal Radio Station) which is a land station in the shipping mobile service and VTS (Vessel Traffic Service). The designated ship traffic shipping is integrated with each other and carried out by the authorities, while the VTS location is in Batu Ampar Batam, Riau Islands Province. Vessel Traffic Services (VTS) operated in 2011 to monitor shipping traffic and shipping traffic flow. To improve shipping traffic safety, navigation efficiency, and environmental protection (Dahalan et al., 2013). Arrangement of general information, arrangement of special information and assisting ships requiring special assistance and Vessel Traffic Services (VTS) carrying out ship observation, detection and tracking.

Coastal Radio Stations (SROP) carry out distress alerts, dissemination of shipping safety information, search and rescue coordination communications and General Radio Communications. SROP is equipped with the Global Maritime Distress and Safety System (GMDSS) (Wright & Baldauf, 2016). e-Navigation system uses seven technologies and services-Automatic Identification Systems (AIS), Electronic Chart Display and Information System (ECDIS), Integrated Bridge Systems / Integrated Navigation Systems (IBS/INS), Automatic Radar Plotting Aids (ARPA), Radio Navigation, Long Range Identification and Tracking (LRIT) systems, Vessel Traffic Services (VTS) the Global Maritime Distress and Safety System (GMDSS) (Dahalan et al., 2013).

Shipping safety in the Singapore Strait crossing, considering the heavy national and international ship traffic (Wright & Baldauf, 2016) requires integrated shipping safety. Reliability of Sailing-Navigation Aids at sea can cause ship accidents and pollution at sea. One example is the occurrence of ships running aground in the Sunda Strait due to the unavailability of Sailing-Navigation Assistance Facilities at Karang Koliot and ships that ran aground in the Rambu Suar Batu Berhanti area of the Singapore Strait (Dahalan et al., 2013). Management of navigation facilities and infrastructure for shipping safety requires government policy. The interests of safety and people are protected (IALA, 2018) regulations must be implemented. Improvement of the shipping safety system such as the management of the integrated navigation facilities and infrastructure system, e-Navigation, is effectively applied universally. Regulations and aids of navigation-sailing as a shipping safety infrastructure (Wright & Baldauf, 2016). The increasing density of passing ships and acts of vandalism and theft have the potential to cause accidents at sea (IALA, 2018).

The main problems can be evaluated as follows. The first is the regulation on Electronic Aid-to-Navigation Aids operating in the Singapore Strait. Implementing Sailing-Navigation Assistance Facilities in physical form supported by Automatic Identification System (AIS). Technological developments can support e-Navigation management. Second, the key to the Marine Electronic Highway (MEH) is precise navigation and will utilize a network of Electronic Navigational

Charts (ENCs). These include the Electronic Chart Display and Information System (ECDIS), Differential Global Positioning System (DGPS) and Broadband Internet. The Marine Electronic Highway (MEH) in the Singapore Strait is the backbone where all technology platforms will be integrated starting with ENCs – ECDIS (Wright & Baldauf, 2016). Navigation in the Marine Electronic Highway (MEH) as the backbone of shipping safety in the Singapore Strait. The third is a means of Navigational Assistance-Sailing in the Singapore Strait. The Suar Buoys and Beacon Beacon Resilent Light Beacons are always hit by ships so they are often washed away and damaged. Implementation of the Virtual E-AtoN system which is integrated with Vessel Traffic Service (VTS) and Electronic Chart Display and Information System (ECDIS) as an integrated e-Navigation solution according to technological developments (IALA, 2018).

This study analyzes the policy on Navigation in e-Navigation, ensuring that the Marine Electronic Highway (MEH) contributes to improving shipping safety which has been implemented since 2012. This research applies Virtual Electronic Aid to Navigation which is integrated with Electronic Navigation in accordance with the development of e- navigation technology.

B. Methods

The research method used qualitative descriptive evaluative and formal legality analysis. Evaluation of the location used as a research location, namely in the Singapore Strait in the Working Area of the Class I Navigation District Tanjung Pinang, Riau Islands. The subject of this

research is Sailing-Navigation Assistance Facility in the Singapore Strait shipping lane. Research informants the sources of data collection in this paper are ten informants from service users, the Class I Navigation District Tanjung Pinang as the Technical Implementing unit or operator and facilitator and the Navigation Directorate as a Regulator. Data collection is direct observation in the waters of the Singapore Strait. The territory of the Republic of Indonesia and observing the shipping lanes in the Malacca Strait and the Traffic Separation Scheme. The second is to conduct interviews with the Directorate of Navigation and the Class I Navigation District of Tanjung Pinang. The third is the focus Group Discussion (FGD), on the Directorate of Navigation as a regulator. The last is documentation, with direct observations related to the operation and maintenance of Sailing-Navigation Assistance Facilities and e-Navigation in the Singapore Strait

C. Results and Discussion

E-Navigation and the Concept of Virtual Electronic Aid to Navigation. Implementation of e-navigation and virtual aid to navigation supporting technology for other electronic navigation-sailing aids into the Regulation of the Minister of Transportation number PM 25 of 2011 concerning Sailing-Navigation Assistance Facilities.

Table 1 Factual Conditions and Impact of Factual Conditions on E-Navigation and Concept of Virtual Electronic Aid to Navigation

No.	Factual Condition	Impact of Factual Conditions
1.	Can understand shipping safety	Desired Conditions in Shipping Safety
2.	Different understanding of shipping safety	Desired Conditions in Shipping Safety
3.	Can understand e-navigation in shipping safety	Desired Conditions in Shipping Safety
4.	Different understanding of e-navigation in data integration	Desired Conditions in Shipping Safety
5.	Not meeting the safety aspects of shipping, there are ships running aground and incidents	Desired Conditions in Shipping Safety
6.	It has fulfilled the shipping safety aspect but there is a Human Error, it is necessary to communicate and hear suggestions from VTS	Desired Conditions in Shipping Safety
7.	Very very important, many interests in the Singapore Strait	Desired Conditions in Shipping Safety
8.	Already contained in Government Regulation No. 5 of 2010 concerning Navigation and Regulation of the Minister of Transportation No. 25 of 2011 concerning Sailing-Navigation Aids	Desired Conditions in Shipping Safety
9.	There is already a Regulation of the Minister of Transportation No. 25 of 2011 regarding Sailing-Navigation Assistance Facilities, there is no explanation yet but it is at IALA	Desired Conditions in Shipping Safety
10.	SBNP Maintenance was carried out in the Singapore Strait in ANF maintenance activities and SBNP placement	Unwanted conditions in shipping safety
11.	A Joint Hydrographic Survey has been carried out with three coastal countries and Japan	Desired Conditions in Shipping Safety
12.	Can be implemented for large ships and not for fishing boats	Desired Conditions in Shipping Safety
13.	The SBNP function is used for shipping safety	Unwanted conditions in shipping safety
14.	Regulations need to be regulated, enforced and socialized	Desired Conditions in Shipping Safety
15.	Need to do for Deployment and Integration in Procedures	Desired Conditions in Shipping Safety

The factual conditions for implementing e-navigation and the concept of virtual electronic aid to navigation are undesirable conditions for realizing the implementation of e-navigation and the concept of virtual electronic aid to navigation. Different understandings of shipping safety. Different understanding of e-navigation in data integration. Not meeting the shipping safety aspects, there are still ships running aground and other incidents. The existence of regulations already contained in the Regulation of the Minister of Transportation No. 25 of 2011 regarding Sailing-Navigation Assistance Facilities has not yet been explained but is at IALA. The Marine Electronic Highway (MEH) is the backbone of shipping safety in the Singapore Strait with precision navigation.

Factual Conditions and Impact of Factual Conditions on the Implementation of the Marine Electronic Highway (MEH)

Table 2 Factual Conditions and Impact of Factual Conditions on the Implementation of the Marine Electronic Highway (MEH)

No	Factual Condition	Impact of Factual Conditions
7.	Broadcast as Information Navigation Service	Conditions that support the Implementation of the Marine Electronic Highway (MEH)
8.	It is the obligation of VTS to broadcast to the Shipping World	Conditions that support the Implementation of the Marine Electronic Highway (MEH)
9.	Passing ships provide information to VTS	Conditions that support the Implementation of the Marine Electronic Highway (MEH)
10.	There are still those who have not mastered the rules	Conditions that do not support the Implementation of the Marine Electronic Highway (MEH)
11.	The latest ENC has not been used because it is still in the Hydrographic survey process	Conditions that support the Implementation of the Marine Electronic Highway (MEH)
12.	Still don't know the agency that will issue ENCs	Conditions that do not support the Implementation of the Marine Electronic Highway (MEH)

Factual conditions that do not support the implementation of the Marine Electronic Highway (MEH). First, the Hydrographic Survey has not been carried out. Both have not discovered the latest danger. Third, there are still those who have not mastered the rules. Lastly, we still don't know the agency that will issue ENCs.

Factual Conditions About the Implementation of Virtual E-Aton

Implementation of the Virtual E-Aton system which is integrated with Vessel Traffic Service (VTS) and Electronic Chart Display and Information System (ECDIS) as an integrated e-navigation solution according to technological developments.

No	Factual Condition	Impact of Factual Conditions
1.	The implementation of the Hydrographic Survey has been carried out	Conditions that support the Implementation of the Marine Electronic Highway (MEH)
2.	Hydrographic Survey has not been carried out	Conditions that do not support the Implementation of the Marine Electronic Highway (MEH)
3.	New Hazards identified	Conditions that support the Implementation of the Marine Electronic Highway (MEH)
4.	Did not find the latest danger	Conditions that do not support the Implementation of the Marine Electronic Highway (MEH)
5.	Conducted survey and awarding SBNP	Conditions that support the Implementation of the Marine Electronic Highway (MEH)
6.	Carrying out Broadcast to provide Information to the Shipping World	Conditions that support the Implementation of the Marine Electronic Highway (MEH)

Table 3 Topics and factual conditions regarding the Implementation of Virtual E-Aton

No	Factual Condition	Impact of Factual Conditions
1.	Carry out periodic maintenance activities	Conditions that support the Implementation of Virtual E-Aton
2.	Doing regular activities with Japan	Conditions that support the Implementation of Virtual E-Aton
3.	Equation as a Navigation-Sailing Aid	Conditions that support the Implementation of Virtual E-Aton
4.	As a support for shipping safety	Conditions that support the Implementation of Virtual E-Aton
5.	Application reliability for software and equipment must be upgraded and can be integrated	Conditions that support the Implementation of Virtual E-Aton
6.	Don't agree because in practice it still requires a Physical SBNP	Conditions that support the Implementation of Virtual E-Aton

Implementation of Virtual E-Aton which is operated as a Sailing-Navigation Assistance Facility. Technology adoption

reflects the existence of desirable conditions. Attention to shipping safety aspects by implementing Virtual E-AtoN which is operated as a Sailing-Navigation Assistance Facility in accordance with technological developments.

Results of Focus Group Discussion (FGD)

The result of the focus group discussion is that participants understand shipping safety. E-navigation of the governments of Indonesia, Malaysia, Singapore in collaboration with IHO, IMO and Worldbank. Cooperation to create a project as an embryo of e-navigation in the Malacca Strait and the Singapore Strait. Furthermore, equipment related to current, tide, and wind data is provided by several sensor stations installed in three coastal countries.

E-navigation according to IMO MSC85, 2007 explained that "E-navigation is harmonized collection, integration, exchange, presentation, and analysis of maritime information onboard. Ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment." Difference between E-AtoN and Virtual E-AtoN. E-AtoN or Virtual E-AtoN is AtoN that is installed but does not use physical, only virtual which will be listed on ENC's. AIS AtoN cannot be called E-AtoN because the Sailing-Navigation Aids are visual and electronic. Virtual AtoN is a breakthrough that can provide the latest navigational hazard marking. Navigational aids that are physical in nature still require 2-3 days for the latest navigational hazard markings.

The Joint Hydrographic Survey was conducted by three coastal countries (Indonesia, Malaysia and Singapore) and Japan. Survey Joint Hydrographic Survey and carried out in three stages from 2018 - 2020.

Based on the MoU, Indonesia, Malaysia, Singapore, Malacca Straits Council and surveyors were carried out by the three countries with assistance from Japan. ENC's can be produced by Indonesia, Malaysia and Singapore and Japan. In the Straits of Malacca and Singapore (SOMS) there are Malacca and Singapore Strait ENC's (MSENC's) carrying out the finalization of ENC's. Marine maps of Indonesia, either in paper charts or electronically, are produced by the Indonesian Navy's Pushtidrosal. The data will be shared with the British Admiralty. The regulation on the discussion of Virtual Aids to Navigation is carried out at IMO which is one part of the NCSR meeting which will then be issued an IMO resolution related to SOLAS. IMO is obliged to implement the rules and follow the technical rules already contained in the IALA Guidelines.

The provisions must not provide for the effect of law, regulation or law or provisions. There are guidelines that are technical in nature, so PM 25 of 2011 regarding Sailing-Navigation Assistance Facilities and PM 26 of 2011 concerning Shipping Telecommunication are technical in nature, some are related to law enforcement. E-navigation is a big concept of surveillance and maritime communication. E-electronic navigation, electronic AtoN or Virtual AtoN based on AIS and Satellite. Satellite is used for e-navigation based on Positioning,

Navigation and Timing (PNT) related to e-navigation in the form of Virtual AtoN.

Documentation results

The Tanjung Pinang Class I Navigation District improves shipping safety. The sinking ship of the Tanjung Pinang Class I Navigation District gave a marking in the form of five units of Cardinal Beacon Buoys at the location of the sinking of the MV. Thorco Cloud, so ships can pass safely. The Batu Berhanti Beacon Buoy is often hit by ships and washed away in the waters of Singapore, MV Shahraz and MV Samudera Sakti in the Rambu Suar and Batu Berhanti Beacon Buoys, the condition of the Beacon Beacon and Beacon Buoy are in good working condition. This condition has been reported by the VTS Batam operator. The Wavemaster 5 ferry also ran aground at Karang Galang Batam. It can be seen from the location that there are Sailing Navigation Assistance Facilities in the form of Beacon Signs. In the Karang Galang documentation, it looks like it ran aground during the day. Looking at the Indonesian Marine Map Number 349 of 2014 it is very clear that there is Karang Galang. The implementation of Virtual AIS AtoN owned by VTS Batam belonging to the Class I Navigation District of Tanjung Pinang has yielded results. Sailing-Navigation Assistance Facilities were installed and the Virtual AIS AtoN was not hit by passing ships.

Integration, harmonization and standardization between VTS (AIS, Radar and Radio Navigation) with Ships can be developed. Sailing-Navigation Assistance Facilities are related to shipping safety facilities in supporting shipping safety.

This research is in line with previous research, namely cruise navigation aids. Research Zaman et al., (2015) shows that ship safety will increase significantly if ships follow the guidelines for the use of navigational aids set. Automatic Identification System (AIS), the current condition of ships in the Malacca Strait area can be monitored properly (Yaacob & Koto, 2018; Zaman, 2016; Zaman et al., 2021). Research Meng et al., (2014) analyzed the characteristics of ship traffic in the Singapore Strait with the finding that with the limitations of the Automatic Identification System. This study supports research conducted by Zaideen et al., (2017) on potential strategies for navigational safety and protection of the marine environment in the Straits of Malacca and Singapore. This research will assist in setting priorities for future efforts to improve navigational safety for the protection of the marine environment with regard to international and regional initiatives.

D. Conclusion

The factual conditions of e-navigation regulations and virtual electronic Aid to navigation in supporting the implementation of e-navigation and virtual aid to navigation as a support for the development of electronic navigation-sailing aid technology. Regulation of the Minister of Transportation number PM 25 of 2011 concerning Sailing-Navigation Assistance Facilities reflects the existence of desirable and undesirable conditions to realize shipping safety. The factual conditions that reflect undesirable conditions for the implementation of e-navigation and the concept of virtual electronic aid to navigation are different understandings of shipping safety.

Different understanding of e-navigation in data integration. Aspects of shipping safety, there are still ships running aground and incidents. The Minister of Transportation Regulation Number PM.25 of 2011 has no explanation yet, but it is in the IALA. The implementation of e-AtoN and Virtual e-AtoN can be implemented but only for large ships and not for fishing boats.

The factual condition of the implementation of the Marine Electronic Highway (MEH) creates shipping safety in the Singapore Strait with precision navigation. Marine Electronic Highway (MEH) which has not yet carried out a Hydrographic Survey. Not finding the latest dangers, there are still those who have not mastered the regulations and still do not know the agency that will issue ENC's. The statements above reflect unfavorable conditions for the implementation of the Marine Electronic Highway (MEH).

Virtual E-AtoN which is integrated with Vessel Traffic Service (VTS) and Electronic Chart Display and Information System (ECDIS) as an integrated e-navigation solution according to technological developments. The factual conditions reflect that the application of Virtual E-AtoN is operated as a Sailing-Navigation Assistance Facility in accordance with technological developments reflecting the desired conditions.

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