



## **BRIDGE DUTY ON A SHIP: STUDY ON PREVENTING COLLISIONS AT SEA ON THE TRAINING SHIP JOHN LIE**

Haryadi Wijaya\* Hadi Setiawan  
Program Studi Nautika, Politeknik Pelayaran Sulawesi Utara, Indonesia  
\*haryadi.wijaya.hw@gmail.com

### **Abstract**

The knowledge and skills of a ship's crew can play a key role in preventing collisions. The Bridge Watchkeeping Duty becomes crucial in this context, as they are the first to detect potential threats. Given the increasing risks in maritime transportation and the need to prevent ship collisions, several steps can be taken. One of them is to effectively carry out the tasks and functions of the Bridge Watchkeeping Duty. Therefore, this study aims to analyze the Bridge Watchkeeping Duty, specifically, the efforts to prevent sea collisions conducted by the Ship's Bridge Watchkeeping Service, and how its theoretical and practical implementation is carried out in the field. This qualitative study uses a descriptive method to describe and elaborate on the study object, namely the John Lie training ship. The study will include quotations from various data sources such as interviews, field notes, memos, and other official documents. Data analysis in this study uses the techniques of Miles and Huberman. The results of this study indicate that the implementation of these duties and responsibilities must always be based on a deep understanding of various national and international maritime regulations, as well as knowledge of the characteristics of the ship and its surrounding environment. Additionally, implementing regulations such as the 2010 Manila Amendments to the STCW 2010 is also important to ensure the welfare and fitness of the watchkeepers so they can perform their duties and responsibilities optimally. This study has several limitations, such as variables that need to be explored further, such as the psychological aspects of bridge watchkeepers who bear a heavy workload, extreme sea weather conditions, and ship facilities that support collision prevention activities. Thus, this study is expected to provide constructive thoughts and suggestions for maritime transportation stakeholders, particularly sailors and crew members, regarding the importance of properly implementing the Bridge Watchkeeping Duty. Focus on the human aspect in preventing ship collisions at sea through the Ship's Bridge Watchkeeping Service.

**Keywords:** Guard Station, Ship Bridge, Collision Prevention at Sea, Risk Management

### **1. INTRODUCTION**

Maritime transportation has been the backbone of the global shipping system for centuries, connecting various parts of the world through the transportation of goods and commodities on a large scale [1], [2], [3]. Energy efficiency, large capacity, and relatively low cost are reasons maritime transportation is the primary choice for inter-island and international goods crossing [4],[5],[6]. However, despite its efficiency, maritime transportation also harbors various types of substantial risks, including the risk of collisions at sea. According to recorded data from KPLP (Maritime and Coastal Guard Unity) from 2003 to 2008, there has been a significant increase in maritime transportation accidents. Of about 691 accident cases, 13% were collision cases [7], [8]. Therefore, efforts to prevent and mitigate collisions at sea are crucial [9]. Handling and preventing collisions at sea are vital parts of maritime transportation operations and primarily depend on the ship's crew, especially those on duty on the bridge. This immense responsibility requires skill, expertise, and a broad understanding of maritime navigation and applicable regulations. This involves knowledge about sea traffic signs, weather, currents, and other factors that could cause a collision. According to a study by KNKT (National Committee for Transportation Safety), 37% of ship accidents are caused by human error [10], [11] This indicates that the crew's knowledge and skills can play a crucial role in preventing collisions. The Ship's Bridge Duty becomes decisive in this regard, as they are the first to detect potential threats. Given



the increasing risks from maritime transport and to prevent ship collisions, several steps can be taken. One is by effectively executing the duties and functions of the Ships Bridge Duty [12], [13]. The Ships Bridge Duty is a working unit tasked with supervising and controlling the ship's sailing activities, including preventing collisions [14]. The Ships Bridge Duty becomes the front guard in preventing collisions at sea. However, the knowledge and understanding of the Ships Bridge Duty concepts and workings still need improvement.

Referring to previous research and the similarity of previous research with the research to be investigated, the primary focus is on ship-bridge collision incidents. All research attempts to identify contributing factors to collision risk and propose methods or actions for collision prevention. Zhou, Gao, Huang, & Zhang, (2019) focuses on developing a fuzzy logic-based collision warning system considering various variables, while Ma, Zhu, Grifoll, Liu, & Zheng, (2022) examines the effectiveness of active and passive safety measures to prevent ship-bridge collisions. Furthermore, Zhou et al., (2019) studies the influence of collision strength on the bridge on the resulting damages. All research shows the importance of collision prevention for safety and the smooth operation of the ship. However, the difference between previous research and the research to be studied is that despite having the same focus, the research attempts to fill the gap not covered in previous research by emphasizing the role and responsibility of the Ships Bridge Duty in collision prevention. This includes evaluating their practices, understanding the challenges officers face on the bridge, and how these theories and practices are implemented on the ground. Although previous research has proposed methods or formulas to reduce collision risks, most focus on technical aspects and computational methods with little discussion on the role and actions of humans in collision prevention. Additionally, this research is not confined to specific situations like previous research (e.g., ship-bridge or ship-platform relationships) but covers various collision scenarios that could occur at sea. The research object in this study is the Bridge Duty Unit on the John Lie Training Ship. This ship was chosen as the research object because it often makes cross-island and international journeys, so the risk of collision is quite high.

The novelty of this research lies in its focus on the human aspect in preventing ship bridge collisions at sea, that is, through Ship Hull Duty. Although previous studies have discussed various technical factors and computational methods to prevent collisions, this research recognizes that the human element plays a crucial role in real situations. Therefore, this study aims to analyze the practices and responsibilities of the Bridge Duty Unit on the John Lie Training Ship in preventing collisions at sea and how these theories and practices are implemented in the field.

Through this research, it is hoped that it can benefit ship crews and sailors in performing Ship Bridge Duties, especially in preventing sea collisions. In addition, the results of this research are expected to be a reference and consideration for ship management in designing and implementing collision prevention strategies at sea. Several relevant theories and concepts will be examined in this study to understand and analyze Ship Bridge Duties in preventing sea collisions. These theories include maritime navigation, risk management, and accident prevention at sea. Also this study will also review various regulations and standards applicable in shipping, both international and national regulations, to strengthen the analysis and evaluation of Ship Bridge Duties in preventing sea collisions.

## 2. METHODS

This study is qualitative research using a descriptive method, meaning the researcher collects data using words, not numbers [17]. Descriptive research aims to describe and explain the research object, which in this case is the training ship John Lie, in detail [18]. This study will include quotations from various data sources such as interviews, field notes, memos, and other official documents. This explanation indicates that the descriptive method is a type of writing aimed at explaining and providing an overview of an object based on its actual condition at a certain time. The research subjects consist of eight people, including the Captain, 3 Mates, the Bosun, and 3 Helmsmen. The sample was taken using a purposive sampling technique. In this study, the researcher used two data sources: primary data obtained from direct observation and interviews and secondary data obtained from scientific literature. Data analysis in this study used Miles and Huberman's techniques, which consist of data reduction, data display, and conclusion drawing/verification of data [19]. Thus, by using this technique, the researcher can analyze the Bridge Watchkeeping Task, particularly the efforts to prevent collisions at sea carried out by the Bridge Watchkeeping Service and how its theoretical and practical implementation is conducted in the field.



### 3. RESULTS AND DISCUSSION

#### 3.1. Results

##### 3.1.1. Location of the Study

The research was conducted on the Training Ship John Lie, owned by the North Sulawesi Maritime Polytechnic.



Figure 1. John Lie Train Ship [20]

Table 1. Sea Watch Schedule [21]

No	Position	Time	Information
1	Second officer/ second mate	0-04.00	Dog watch
2	Chief officer/ first mate	04.00- 08.00	Morning watch
3	Third officer/ third mate	08.00- 12.00	Forenoon watch
4	Second officer/ second mate	12.00- 16.00	Afternoon watch
5	Chief officer/ first mate	16.00- 20.00	Evening watch
6	Third officer / third mate	20.00- 24.00	Night watch

According to rule 5 of Colreg'72, guards are "always vigilant visually and audibly and by all other means against any changes in the situation." Referring to the above rule, the guards, at any time they carry out their duties, must carry out this rule 5 of Colreg'72. They are required to be visually alert, that is, observing with the naked eye and hearing, and in other ways, to always be responsive to any changes in the situation while they carry out their duties. They are given a moral responsibility for the safety and comfort of the ship and its contents and crew during sailing. Based on the International Rule Preventing Collision At Sea in 1972, the following rules regarding:

- a. All-around observation
- b. Safe speed (rule 6) P2TL
- c. Risk of collision (rule 7) P2TL
- d. Action to avoid collision (rule 8) P2TL
- e. Overtaking (rule 13) P2TL
- f. Head-on situation (rule 14) P2TL
- g. Crossing situation (rule 15) P2TL

##### 3.1.2. Implementation Outcome of STCW 2010 Manila Amendment 2010 on On-Duty Service

Implementing STCW 2010 Manila Amendments 2010 in the context of On-Duty service on the John Lie training ship has affected several aspects. One of the most notable outcomes is the change in seafarers' working hours and rest time. Based on an interview with the ship's captain: "*In reality, there are some*



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difficulties we faced. One of them is adjusting to the changes in working hours and rest periods set by STCW 2010 Manila Amendment 2010," one seafarer revealed (N-P1). In addition, the STCW 2010 Manila Amendment also encourages the enhancement of sailors' knowledge and skills in keeping up with the development of navigation technology and safety equipment. As ships become more modern, continuously updating knowledge and skills related to them is necessary. "It is important for us to continually update our knowledge and skills on the latest navigation technology and safety equipment," he explained (N-P1). This is evidence that the role and contribution of the STCW 2010 Manila Amendments 2010 are quite significant in improving the quality and efficiency of On-Duty Service on ships. Although there are several challenges in the field, these steps are crucial to ensure the safety and comfort of all John Lie training ship crew in performing their duties.

### 3.1.3. Research Result on Collision Hazards

Ship collision is one of the most common types of maritime accidents and poses significant risks to passenger and crew safety. Despite advanced navigation technology making ships safer, there is still a potential for collision if the crew must understand how to operate the navigation system and safety equipment correctly. Based on the interview, it is explained. "Fatigue can be a serious issue. If the crew does not get enough rest, they can make a mistake that could be fatal, such as a ship collision. In addition, not understanding how to operate navigation or safety equipment correctly can be dangerous" (N-P2). Based on interviews with the John Lie Training Ship, it was found that many of them felt tired and lacked rest. This fatigue has a negative impact on their concentration and focus, which can eventually trigger accidents, such as ship collisions. In addition, based on interviews about operating some navigation and safety equipment, this further increases the risk of accidents over time. Despite training, they still need to improve their understanding and use of this equipment. Overall, these interview results indicate that there are still many challenges in preventing collisions at sea, especially on the John Lie Training Ship. Fatigue, lack of rest, and lack of understanding about the ship's navigation and safety equipment are some of the main factors that need to be addressed immediately to prevent future ship collisions.

### 3.1.4. Reasons for deviation of ship duties procedure.

In the study of 'On-Duty' on a ship's bridge and efforts to prevent ship collisions at sea, several factors causing deviation from the procedure were identified. Firstly, crew members' low understanding of on-duty regulations, daily working hours, and rest time must follow international standards (STCW'95). This seems common among new employees who need more knowledge and experience and assistance understanding sea-guarding regulations. Second, there is a need for knowledge and understanding of the importance of fitness for crew members. Optimum physical condition significantly determines their work productivity. Their work results are only optimal if the physical condition supports it. Thirdly, the lack of coordination and communication between superiors and subordinates. Good communication is crucial for maintaining cooperation and coordination among crew members. If communication is minimal or non-existent, employees need to know what to do and might feel less involved in the team. Field observations also show disharmony between officers and their subordinates, who tend to feel marginalized and neglected.

### 3.1.5. Result of Procedure, Impact, and Effort to Prevent Ship Collision

Additional evidence supporting this research finding was provided based on interviews with crew members. A ship officer emphasized a proactive approach to preventing collisions, including maintaining a high level of alertness, effectively using navigation tools, good communication with other ships, and compliance with rules. This member of the crew explained: "Collision prevention involves proactive measures such as being highly alert when we are on board, a good understanding of collision prevention regulations at sea, and the effective use of navigation tools. We also maintain good communication with other ships and ensure that all crew members understand and obey these regulations" (N-P3). Their duty as watch officers on the ship's bridge is the main role in preventing collisions. This requires a deep understanding of rules and procedures, technical expertise in navigation, and incident management skills. Deviations from procedures can increase collision risks, often resulting from poor rules performance, inadequate physical fitness, and poor communication.

However, several efforts can be made to prevent collisions, including increasing knowledge and understanding of rules, maintaining good physical fitness, and improving communication and coordination among crew members. Through such efforts, ships can create a more effective and conducive work environment, emphasizing best practices and preventing collisions.



Furthermore, responses from interviews with watch officers show that effective use of navigation tools, a good understanding of sea collision prevention regulations, and good communication with other ships contribute to increasing safety at sea. This emphasis on proactive approaches and good behavior among crew members aligns with research findings on the importance of rule understanding, physical fitness, and communication in preventing collisions. Therefore, these interview results confirm research findings demonstrating that technical and human factors significantly prevent collisions at sea.

## 3.2. Discussion

### 3.2.1. Implementation of STCW 2010 Manila Amendment 2010 on Bridge Watch

Applying the STCW 2010 Manila Amendments 2010 impacts various aspects of the Bridge Watch on the training ship John Lie. One of the most significant effects is the change in working hours and rest hours for seafarers. As revealed in an interview with the ship's Captain, this change brings challenges. However, this Amendment also encourages improving seafarers' skills and knowledge in adapting to modern navigation technology and safety equipment. Implementing the STCW 2010 Manila Amendment 2010 is vital in ensuring the safety and efficiency of ship operations at sea. This standard guides captains and ship crew in performing their duties effectively, including preventing collisions at sea. The Amendment regulates the allocation of work and rest times for the ship crew to avoid fatigue that can affect their performance and cause a risk of collision [22]. The Amendment emphasizes the importance of sufficient rest time for each ship crew to ensure optimal concentration and alertness while on duty. Further, the Amendment includes guidance on documentation and reporting of work and rest hours [23]. A captain or officer appointed by the Captain must keep track of each crew member's rest time daily, and the Captain or the appointed officer must sign the records. Copies of work hours and rest time records must be given to each crew member and validated by the Captain or the officer on duty.

The Manila Amendment, 2010 of STCW 2010, also requires work and rest schedules to be placed in a location visible to all crew members and written in the ship's language and English. This is an effort to ensure that all crew members understand and comply with this rule, regardless of where they are from. The implementation of STCW 2010 Manila Amendment 2010 in Ship Service Watch has shown positive results in preventing collisions at sea [24]. The ship crew can work more efficiently and safely with a well-structured work and rest system. Fatigue and health-related problems concerning duty discharge can reduce, thereby improving the safety of ships and crew members. However, the success level of this implementation may vary depending on several factors, such as the work culture onboard, the skill and experience level of the Captain and crew members, and their knowledge of correct rules and procedures [25]. Therefore, continuous education and training are vital to ensure that all crew members fully understand and implement the provisions of STCW 2010 Manila Amendment 2010. Overall, this study shows that implementing STCW 2010 Manila Amendment 2010 in Ship's Bridge Watch Service is critical in preventing collisions at sea. A practical work and rest system creates a safe and efficient work environment for all crew members.

### 3.2.2. Collision Hazard

This study aims to analyze the role of the Bridge Guard Service in preventing collisions at sea. Following the substance of these regulations, sufficient rest time for navigation or engine room staff is mandatory to perform their duties to the maximum. Based on interviews with the John Lie Training Ship crew, fatigue and lack of rest are the main triggers for mistakes in operating navigation and safety equipment. This could potentially cause serious accidents such as ship collisions. Furthermore, the need for more understanding and skills in equipment operation is a problem that needs to be addressed immediately. Therefore information about the daily work schedule and rest time should be posted in a place easily seen and accessed by all crew members. Documentation regarding this schedule should be properly managed and signed by the captain or the officer appointed by the captain. According to Capt. EW Manikome's failure to maintain adequate navigation often leads to accidents such as collisions and grounding [26], on the contrary, Capt. Agus Hadi Purwantomo explains that collisions can occur due to human error, equipment failure, procedural errors, rule violations, and external actions [27].

The risk of collision can be identified in various ways, including if the bearing with another ship does not change, if the relative bearing to another ship is very low if the ships are getting closer, and if there is a significant change. To prevent these risks, some recommended actions include rule 15 about crossing situations requiring ships to divert if another ship is on its right side. Based on the data obtained from KNKT



(National Transportation Safety Commission), ship accidents (collisions) due to mistakes made by the Watchkeeping Officer on duty on the bridge and due to sailor's negligence when navigating include [28]:

- a. On 16th December 2015, two Norwegian-flagged container ships MT. Stolt Commitment and MV. Thorco Cloud collided in Singapore waters on Wednesday at 20:30.
- b. On 1st April 2014, Km. Journey, Km. Fatimah III, and Km. Lambelu collided near buoy 10 of the Tanjung Perak port channel in Surabaya.
- c. On 31st May 2013, the Untas Bahari Utama KM and Untas Bengkulu KM collided in the Java Sea, 1.7 Nml, from the Tanjung Priok Port of Jakarta.
- d. On 11th December 2012, Alken Pesat KM and Alpine KM collided in the Tanjung Perak port pool in Surabaya, East Java.
- e. On 26th September 2012, Buhaga Jaya Kmp collided with MT Norgas Cathinka.
- f. On 26th September 2011, Marina Nusantara KM collided with Tk. Pulau Tiga 330-22 in the Barito River navigation channel, Banjarmasin, South Kalimantan.
- g. On Sunday morning, 31st August 2008, the Belanak motor passenger ship of the PT. Angkutan Sungai Danau dan Penyeberangan ferry company collided with a speedboat belonging to a Pamuge fisherman in the West coastal waters, precisely 1.5 miles from Putri Island westward, around 05:30 AM.

### 3.2.3. Procedures to Deal With Emergencies

Research results indicate that there are several critical procedures that need to be implemented in dealing with emergencies, ranging from data collection related to damage, equipment preparation, to the implementation of the Ship-Board Emergency Contingency Plan. The first stage of this procedure involves comprehensive data collection related to the damage that has occurred. The Ship Bridge Duty Service needs to quickly but accurately identify the ship's stability condition, cargo, level of danger for surrounding ships, environmental status, and other relevant aspects. This procedure is very important to determine the extent to which an emergency can endanger lives, property, and the environment. In addition, this data collection can also help the Ship Bridge Duty Service understand the extent of the damage and how to take the most effective steps to overcome it. The second stage involves determining and preparing the equipment needed to cope with the emergency. According to the findings of this study, this stage is a crucial element in emergency handling because it determines the ability of the Ship Bridge Duty Service in dealing with problems and protecting the ship and crew from further danger. This equipment preparation includes selecting tools that are most appropriate for the type of emergency experienced, preparing competent personnel to operate them, and strategic planning for efficient resource use. The third stage is the implementation of emergency work procedures, which specifically involve the implementation of the Ship-Board Emergency Contingency Plan. This plan contains various scenarios and procedures to be run when an emergency occurs. Implementation of this plan requires decisiveness in decision-making and high navigation skills.

The implementation of these procedures is highly related to the human factor. Some studies [18], [29], [30] have shown that the quality of watchkeeping on board is very varied and depends on the individual assessing. Other research [31] also shows that manual navigation equipment is still widely used, implying that human involvement and expertise remain key factors. Thus, the role of ship management and the company in ensuring the quality and competence of the Ship Bridge Duty Service is crucial. Then this shows that the application of theory and practice according to the procedure can minimize risks and negative impacts on life and property safety. Therefore, this study underscores the importance of governance and management in the implementation of the Ship Bridge Duty Service in preventing maritime accidents.

### 3.2.4. Implementation of Guard Duty on The Ship

This study focuses on the Ship's Bridge Watchkeeping Service, the main guard in preventing collisions at sea. There are several key aspects that the navigating watch officer needs to adhere to, including remaining obedient to the SOLAS 1974 Regulations [32]. This includes considering the timely replacement of automatic steering with manual steering and maintaining situations from reaching a dangerous level when automatic steering is in use. Good observation is vital to avoid potential collisions. The watch duties also encompass several key responsibilities in dealing with potential collisions at sea. Some of these involve understanding and mastering International Regulations aimed at preventing collisions at sea and implementing all rules within COLREG 1972. These duties include observing (looking out), moving safely, anticipating and detecting collision threats, and taking appropriate action as early as possible. Furthermore,



there are specific requirements to consider when performing the handover of watch duties. This includes stipulating that watch duties should not be handed over to someone incapable or ill and must inform the Captain. In addition, the relieving officer must ensure that his members are fully ready and capable of performing duties, including adapting to darkness at night before taking over duties. The handover should also ensure that the relieving officer understands and is confident about the Captain's general and specific commands, the ship's position, course, speed, draft, and other factors such as currents, weather, and visible distance.

### 3.2.5. Reasons for the deviation of the on-duty procedure on the ship.

In the study of On-Duty in the ship's Bridge and efforts to prevent ship collisions at sea, several factors causing deviations in the procedure have been identified. First, the low level of understanding of the ship's crew regarding guard rules, daily working hours, and rest times should follow international standards (STCW'95). This is generally seen in new workers who lack knowledge and experience and need help understanding guard rules at sea. Second, need for knowledge and understanding of the importance of fitness for the ship's crew. Excellent physical condition greatly determines their work productivity. Their work gets less than maximum results if physical conditions do not support them. Third, minimal coordination and communication between officers and subordinates. Good communication is essential to maintain cooperation and coordination among the ship's crew. If communication is minimal or does not even exist, workers need to know what they should do and may feel less involved in the team. Field observations also showed disharmony between officers and their subordinates, who tended to feel marginalized and neglected.

### 3.2.6. Efforts were made to prevent ship collisions.

Ship collisions can be prevented through several efforts. First, adequate knowledge of guard rules is essential for the ship's crew, especially the deck part. This lack of understanding can lead to a tragedy, so the company should employ educated, experienced workers and those who know and understand guard rules, daily work rules, and rest times according to international regulations (STCW'95). Second, good physical fitness greatly affects the productivity of the ship's crew. Awareness of the importance of maintaining health should be a priority for every individual on the ship. The captain and ship officers should educate other crews about the importance of fitness and regulate regular rest patterns to prevent performance degradation that could endanger ship safety. Third, The captain also has an important role in promoting good communication and coordination between officers and other ship crews. Not just an official relationship but building relationships outside of duty that can strengthen bonds and create a conducive work environment to encourage all crew performance improvements related to ship productivity and safety and the company [31]. These solutions can be applied on the ship to create a meaningful work environment and life changes. Periodic evaluations of the effectiveness of these solutions are also essential to ensure their implementation delivers the expected results. All these efforts aim to prevent ship collisions and losses incurred.

## 4. CONCLUSION

The importance of Bridge Watchkeeping duties in preventing maritime collisions, by the Manila Amendments to the STCW 2010, is paramount. Key findings indicate that changes in work hours and rest periods as per these amendments have enhanced the safety and efficiency of ship operations. However, significant challenges remain, such as crew fatigue, a lack of understanding of regulations and procedures, and inadequate coordination and communication. This research also emphasizes that human factors, including physical fitness and skills in operating navigational equipment, play a crucial role in collision prevention. Based on these findings, it is recommended that shipping companies and maritime training institutions increase their focus on education and training related to international regulations and the operation of navigational and safety equipment. Strengthening the communication and coordination systems on board and promoting a safety-first work culture is also essential. Captains and ship officers should encourage and practice regular rest habits to prevent fatigue. Implementing stricter monitoring systems for work and rest hours can help ensure adherence to the rules. These recommendations aim to enhance maritime safety and avoid ship collisions. The implications include the need for more effective management of work hours, rest periods, and the use of navigational equipment. Theoretically, this study contributes to maritime literature by emphasizing the importance of integrating human resource management and technology in maritime operations. It also supports stricter policies and regulations in training standards and qualifications



for seafarers, highlighting the critical role of governments and international bodies in ensuring best practices are adopted across the industry. These conclusions benefit seafarers, crew members, and industry stakeholders by promoting better safety practices, which can improve sea security and efficiency.

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