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Efforts to Implement the International Regulations for Preventing Collisions at Sea (COLREGS) to Prevent Collisions on Board the SPB. Sainty Giant

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Abstract

The implementation of the International Regulations for Preventing Collisions at Sea (COLREGs) 1972 is essential for ensuring navigational safety in Indonesia's strategic waters, where dense international shipping traffic increases collision risks. Although COLREGs have been widely examined, studies specifically addressing watchkeeping responsibilities and navigational aid utilization on Self-Propelled Barges (SPB) in Indonesian crossing situations remain limited. This study aims to analyze the implementation of COLREGs in preventing collisions on SPB Sainty Giant, particularly during crossing situations. A descriptive qualitative approach with a case study design was employed, involving three informants consisting of the Chief Officer, Second Officer, and Able-Bodied Seaman, who were selected using purposive sampling. Data were collected through observation, in-depth interviews, and documentation studies, and were analyzed thematically through data reduction, data presentation, and conclusion drawing. The findings indicate that the implementation of COLREGs on SPB Sainty Giant remains suboptimal, as reflected in watchkeeping officers arriving exactly at the start of their watch

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without sufficient handover time, crew fatigue caused by excessive daytime workload, and inadequate radar adjustment to weather conditions, which resulted in small vessels remaining undetected. These findings highlight the importance of watchkeeping discipline, navigational aid optimization, and crew competency in strengthening collision prevention. This study contributes to maritime navigation and safety literature by extending understanding of COLREGs application in SPB operations. The practical implications emphasize the need for shipping companies and ship masters to improve watchkeeping procedures, provide regular Radar ARPA training, and strengthen crew understanding of COLREGs through simulation-based training. Further research is recommended to examine COLREGs implementation across different vessel types and shipping routes in Indonesian waters.

Keywords: Watchkeeping; Navigational Safety; COLREGs; Collision Prevention; Self-Propelled Barge

INTRODUCTION

Indonesian waters hold a strategic position, situated between the Indian Ocean and the Pacific Ocean. This geographical location renders Indonesian seas a vital route for both national and international shipping (Agastia & Perwita, 2016). High vessel traffic supports economic activities and logistics distribution, yet simultaneously increases the risk of shipping accidents, including ship collisions (Chen et al., 2019) . Ship collisions can cause material losses, threaten human lives, disrupt shipping operations, and potentially pollute the marine environment (Bogalecka, 2024). According to data from the National Transportation Safety Committee (KNKT), shipping accidents in Indonesian waters have shown an increasing trend over the past five years, with collisions being one of the dominant types of incidents (Bowo et al., 2020). This condition demonstrates that navigational safety constitutes a crucial aspect in every shipping activity (Asana et al., 2025).

The density of shipping traffic in strategic straits such as the Sunda Strait, Malacca Strait, and Lombok Strait demands serious attention to the implementation of collision prevention regulations (Wuryaningrum et al., 2024). The Sunda Strait, where this research was conducted, is a high-risk shipping lane with crossing traffic patterns between vessels traversing the strait and those entering or departing from surrounding ports. Such traffic density conditions require watchkeeping officers to possess high alertness and adequate competence in implementing collision prevention regulations (Nugroho et al., 2024).

The International Regulations for Preventing Collisions at Sea 1972 (COLREGs) serves as the primary regulatory framework for preventing ship collisions. COLREGs governs measurement procedures, collision risk assessment, evasive actions, and vessel behavior under various sailing conditions (Uğurlu et al., 2024). However, successful implementation depends not only on the existence of regulations but also on the watchkeeper's ability to interpret navigational situations, maintain situational awareness, communicate effectively, and make appropriate decisions (Suvica et al., 2022). Thus, the competence, discipline, and physical condition of the watchkeeper significantly determine vessel safety during voyages (Barasa et al., 2025).

The researcher argues that COLREGs implementation in Indonesian shipping operations still faces significant challenges (Olaniyi et al., 2024). These challenges are not merely technical but also involve human factors, organizational culture, and the watchkeeping system (Corrigan et al., 2020). The discrepancy between regulatory provisions and field practices can increase collision risk, particularly in crossing situations requiring rapid and precise decision-making. Therefore, a comprehensive analysis of COLREGs implementation is necessary to identify root problems and formulate appropriate corrective measures(Kufoalor et al., 2020).

Previous research indicates that COLREGs implementation still faces various obstacles. (Heffernan & O'Mahony, 2024) found that both senior and junior deck officers demonstrate varying interpretations of COLREGs provisions, which may lead to inconsistent application in the field. These differences in interpretation can result in communication errors and inappropriate avoiding actions. (Feng et al., 2026) examined ship collision avoidance decision-making based on COLREGs and concluded that decision-making effectiveness is highly influenced by the accuracy of situational assessment and the watchkeeper's responsiveness.

Research by (Firdaus et al., 2026) provided a comprehensive review of ship collision risk assessment and safety index development, emphasizing that safety indices must incorporate human factors in their measurements. Highlighted that fatigue remains an unsolved puzzle that continues contributing to accidents at sea, demonstrating that watchkeeper physical and mental conditions significantly influence decision-making quality (Crestelo Moreno et al., 2026). Emphasized that situational awareness is a key safety factor for officers on watch, particularly in complex traffic situations.

Research on Self-Propelled Barges (SPB) operations remains limited compared to conventional vessels. (Prasetya et al., 2022) analyzed overheating issues on SPB main engines, but studies specifically addressing navigation safety and COLREGs implementation on SPBs are scarce. Examined maritime safety governance in Indonesia but focused more on regulatory oversight rather than operational aspects.

Based on this review, the research gap identified is the lack of specific studies examining COLREGs implementation on Self-Propelled Barges operating in Indonesian waters, particularly in crossing situations within high-traffic straits such as the Sunda Strait (Maza et al., 2022). This study aims to fill this gap by analyzing the implementation of watchkeeping duties, navigational aid utilization, and decision-making processes on SPB Sainty Giant.

The novelty of this study lies in its specific focus on COLREGs implementation in the context of Self-Propelled Barge operations, a vessel type that has received limited attention in maritime navigation research (Yanuar et al., 2018). Unlike previous studies that examined COLREGs implementation on conventional cargo vessels or tankers, this study specifically addresses the operational characteristics and challenges faced by SPBs, which operate with unique maneuvering characteristics and crew configurations (Mizythras et al., 2021).

This study is founded on the theoretical framework of COLREGs 1972, particularly Rules 5, 6, 7, 8, 13, 14, 15, 16, and 17. Rule 5 mandates proper look-out using all available means; Rule 6 requires safe speed determination; Rule 7 addresses risk of collision assessment; Rule 8 governs action to avoid collision; Rules 13-17 regulate overtaking, head-on, crossing situations, and the actions of give-way and stand-on vessels. These rules provide the normative foundation for analyzing vessel behavior in crossing situations.

Additionally, this study utilizes the STCW 1978 as Amended in 2010 framework, specifically regarding watchkeeping hour distribution and rest periods, to analyze watchkeeper fatigue and its impact on alertness and decision-making. The situational awareness theory proposed is also employed to analyze watchkeeper capacity in maintaining awareness of vessel surroundings (Jaram, 2021).

This study focuses on analyzing the implementation of the International Regulations for Preventing Collisions at Sea (COLREGs) 1972 on SPB Sainty Giant during its operations in crossing situations within Indonesian waters, particularly in the Sunda Strait. The analysis

encompasses three main aspects: (1) the execution of bridge watchkeeping responsibilities; (2) the utilization of navigational aids including Radar ARPA and compass; and (3) the understanding and application of COLREGs provisions in collision risk assessment and decision-making.

The objective of this study is to analyze the implementation of COLREGs on SPB Sainty Giant and identify factors hindering optimal collision prevention. Specifically, this study aims to: (1) examine the execution of watchkeeping duties and responsibilities regarding crossing situations; (2) evaluate the optimization of Radar ARPA navigational aid utilization; and (3) analyze the role of the compass in detecting collision hazards in accordance with COLREGs. The findings are expected to contribute recommendations for improving navigational safety on SPBs operating in high-risk Indonesian waters.

METHODS

This study employs a descriptive qualitative approach, selected because it aims to describe, elaborate, and analyze the implementation of the International Regulations for Preventing Collisions at Sea (COLREGs) in depth according to actual field conditions. This approach enables comprehensive understanding of COLREGs execution, vessel actions when facing potential collisions, and influencing factors onboard. The qualitative approach is appropriate for this study because it allows the researcher to explore the meanings, interpretations, and experiences of watchkeeping officers in implementing COLREGs in their daily operations.

This study utilizes a case study design, focusing on a single unit of analysis, namely SPB Sainty Giant, to enable in-depth investigation of the phenomenon under study. The case study design was selected because it allows detailed exploration of COLREGs implementation within its real-life context, particularly regarding the interactions between crew members, decision-making processes, and the utilization of navigational equipment (Yin, 2014). The case study approach is particularly suitable for examining "how" and "why" questions regarding operational practices. The unit of analysis is the implementation of COLREGs in watchkeeping duties and ship maneuvering during collision-prone situations. The research was conducted during the author's sea watchkeeping duties onboard SPB Sainty

Giant from August 2024 to August 2025, providing direct access to the operational context and enabling real-time observation of practices.

The informants in this study consist of vessel personnel directly involved in watchkeeping duties and navigational decision-making, namely the Chief Officer, Second Officer, and Able Bodied Seaman (AB). Their selection was based on purposive sampling technique, with criteria including: (1) direct involvement in watchkeeping duties; (2) responsibility in navigational decision-making; and (3) understanding of COLREGs procedures. The Chief Officer serves as the head of the deck department responsible for navigational safety supervision. The Second Officer is the officer on watch during the study period, directly responsible for collision risk assessment and decision-making. The Able Bodied Seaman assists in look-out duties and supports navigational activities. The selection of three informants with different hierarchical levels enables the researcher to obtain comprehensive perspectives on COLREGs implementation from various positions.

Data collection was conducted through three primary techniques, with the author serving as the primary instrument in the qualitative research.

1. Direct Observation

Was conducted to evaluate the compliance between COLREGs regulations and onboard practices, particularly when facing collision-risk situations. Observations were conducted during watchkeeping duties on the bridge, focusing on visual look-out execution, radar and ARPA utilization, decision-making processes, and communication patterns. An observation guide was used to systematically record relevant events and behaviors.

2. In Depth Interviews

were conducted with the Chief Officer, Second Officer, and AB to explore their understanding, experiences, and constraints in implementing COLREGs. Semi-structured interview guidelines were developed to ensure consistency while allowing flexibility for emerging topics. Each interview lasted approximately 45-60 minutes and was conducted in Bahasa Indonesia to facilitate natural communication. Interviews were documented through note-taking and, with informants' consent, audio recording for accurate transcription.

3. Documentation Study

was conducted by reviewing supporting documents including the vessel's safety management system, watchkeeping procedures, navigational records, and relevant ship

documents. This documentation served to strengthen observation and interview results, ensuring data accuracy and reliability. The triangulation of data from these three sources enhanced the trustworthiness of the findings.

Data analysis was conducted qualitatively through thematic analysis following the framework proposed by Braun and Clarke (2006), which involved four main stages: first, data collection from observations, interviews, documentation, and literature was compiled systematically with all interview recordings transcribed verbatim and observation notes organized chronologically; second, data reduction was performed by selecting, focusing, simplifying, and abstracting the data relevant to the research objectives, particularly information regarding COLREGs implementation, collision avoidance actions, and causal factors; third, data presentation was conducted systematically by organizing the reduced data into categories and themes aligned with the research objectives, presented in narrative form supported by tables and direct quotations where relevant, and subsequently compared with COLREGs provisions to evaluate the compliance of field practices; and fourth, verification and conclusion drawing was performed through pattern recognition, thematic analysis, and interpretation based on theoretical frameworks, with member checking conducted by reviewing preliminary findings with informants to ensure accuracy and credibility.

RESULTS

Data collection for this study was conducted while the author performed sea watchkeeping duties onboard SPB Sainty Giant. During observation, it was found that bridge watchkeeping duties were not yet fully optimal, particularly regarding visual look-out, radar and ARPA navigational aid utilization, and decision-making accuracy in crossing situations. These issues serve as the basis for analyzing the implementation of the International Regulations for Preventing Collisions at Sea (COLREGs) 1972 in onboard navigational activities.

1. Bridge Watchkeeping Responsibilities Regarding Crossing Situations

Observation results conducted from August 2024 to August 2025 indicate that bridge watchkeeping duties on SPB Sainty Giant did not fully reflect optimal responsibility in accordance with COLREGs 1972 provisions. This situation was evident from suboptimal

look-out, decision-making delays, and watchkeeping officers' hesitation in determining encounter situations, particularly under crossing conditions.

Based on an interview with the Chief Officer on March 12, 2025, it was revealed that visual look-out had not been consistently executed, particularly during night watches and under adverse weather conditions. In several instances, watchkeeping officers tended to rely more on radar information without adequate visual look-out. This was confirmed by the Second Officer's statement: "During night watches, especially when visibility is limited, I often rely more on the radar because it is difficult to see other vessels with the naked eye. However, I realize that sometimes small vessels are not clearly visible on the radar display." This condition indicates that look-out execution on the bridge still requires improvement. Conducting look-out by relying solely on radar may cause watchkeeping officers to pay less attention to actual conditions around the vessel. Therefore, visual look-out, hearing, and navigational aid utilization must be performed simultaneously to enable earlier detection of potential collision hazards.

In several observed crossing situations, watchkeeping officers demonstrated hesitation in taking evasive action. Based on observation results, the average time required for watchkeeping officers to make evasive maneuver decisions was approximately 5 to 7 minutes after potential collision hazards were identified via radar. In one specific instance on March 24, 2025, when the vessel encountered KM Indimatam-1 in a crossing situation, the Second Officer required approximately 6 minutes to confirm the situation and determine the appropriate action. Such delays occurred because watchkeeping officers required time to confirm target vessel position, read bearings, estimate distance, and determine appropriate actions. The Second Officer explained: "When I detect a target on radar that could be a potential collision risk, I first need to confirm its course and speed, check the bearing changes, and then decide whether my vessel should give way or stand on. This takes time, especially when there are multiple targets." Under certain conditions, decision-making delays may increase danger risk, especially if the other vessel draws closer and no significant bearing change occurs.

2. Compass Utilization to Determine Collision Risks in Crossing Situations

Based on observation results, the compass is utilized as a navigational aid to determine collision risks in crossing situations. The compass is used by periodically reading other vessels' bearings, then comparing bearing changes with target vessel distance changes.

The principle applied is that if another vessel's bearing does not appreciably change while distance is closing, such condition indicates a risk of collision exists.

Conversely, if vessel bearing changes progressively and distance decreases, the vessel is not necessarily on a direct collision course. Observation results on a target vessel in a crossing situation are presented in Table 1.

Tabel 1. Observation Of Target Vessel

Observation Time	Target	Bearing	Range	Bearing Change	Risk
08.00	Kapal A	045°	4,5 mil	Awal	Perlu diamati
08.03	Kapal A	046°	3,8 mil	1°	Resiko rendah
08.06	Kapal A	047°	3,1 mil	1°	Resiko rendah
08.09	Kapal A	049°	2,4 mil	2°	Aman
08.12	Kapal A	052°	1,8 mil	3°	Aman

Source : Observation Result, 2025

Based on Table 1, Vessel A does not show indications of high collision risk. This is evident from progressive bearing changes at each observation time, ranging between 1° and 3°. Although Vessel A's distance decreases from 4.5 miles to 1.8 miles, steadily increasing bearing changes indicate the vessel is not on a direct collision course.

However, the research results indicate that compass bearing practice on SPB Sainty Giant remains low, at only approximately 20% of observed situations during the initial observation period. The Chief Officer explained:

"Junior officers tend to rely heavily on the radar and rarely take manual compass bearings. They think that radar provides sufficient information and that taking compass bearings is an old-fashioned method."

This finding demonstrates that compass utilization still holds an important function in assisting watchkeeping officers to assess collision risk. However, its implementation must remain supported by visual look-out and other navigational aids, such as radar and ARPA, to ensure more accurate observation results.

3. Negative Data, Divergent Findings, or Anomalies

Report negative data, findings that do not follow the general pattern, or anomalies when they are found and relevant to the research focus. Presenting such data is important to demonstrate objectivity, transparency, and integrity in reporting the results.

Negative data or anomalies should be explained factually without excessive speculation. Interpretive explanations regarding possible causes, implications, or relationships with theory and previous studies should be presented in the Discussion section.

Following the internal training conducted by the author and the Chief Officer, and recommendations to increase compass bearing utilization, there were observable improvements. The frequency of taking compass bearings increased to 65% of observed situations, and officers demonstrated better integration of compass observations with radar and ARPA information. After three months of follow-up observation, there were no reported near-miss incidents during watchkeeping duties.

DISCUSSION

1. Analysis and Interpretation of Findings

The finding that COLREGs implementation on SPB Sainty Giant remains suboptimal indicates that several key aspects of maritime safety require improvement. The suboptimal look-out execution, particularly during night watches, contradicts Rule 5 of COLREGs, which mandates maintaining a proper look-out by sight and hearing as well as by all available means appropriate to the circumstances. This finding suggests that watchkeeping officers do not fully understand or implement the principle of comprehensive look-out, which should integrate visual observation, auditory awareness, and technological aids.

The low utilization of Radar ARPA features, particularly CPA and TCPA calculations, suggests that watchkeeping officers lack comprehensive technical competence in using advanced navigational equipment. This condition is concerning because ARPA provides essential information for collision risk assessment that cannot be obtained through simple radar observation alone. The reliance on basic radar display without utilizing ARPA analytical features reduces the accuracy of situational assessment and may result in missed collision risks.

The underutilization of compass bearings demonstrates a tendency toward technology dependence among junior officers. While modern navigational aids are valuable, the compass remains a reliable instrument for verifying radar data and directly assessing collision risk. The initial low frequency of compass bearing practice (20%) indicates that basic

navigational skills are being neglected in favor of electronic aids, contrary to COLREGs Rule 7, which requires using all available means to assess collision risk.

2. Comparison with Theories and Previous Literature

The finding regarding suboptimal watchkeeping execution is consistent with previous research by Heffernan and O'Mahony (2024), who found significant variations in COLREGs interpretation between senior and junior deck officers. Junior watchkeeping officers on SPB Sainty Giant demonstrated similar patterns of hesitation and uncertainty in interpreting crossing situations, confirming that experience and understanding of COLREGs remain significant challenges in maritime operations.

The decision-making delays observed in this study align with findings by Feng et al. (2026), who emphasized that effective collision avoidance decisions depend on the accuracy of situational assessment and watchkeeper responsiveness. The 5-7 minute delay identified in this study exceeds the recommended time for taking evasive action, particularly in crossing situations where vessel distances can close rapidly.

Regarding fatigue, this study's findings support research by Rajapakse and Emad (2023), who identified fatigue as an unsolved puzzle contributing to accidents at sea. The finding that watchkeeping officers sometimes arrive exactly at watch commencement time without adequate handover periods indicates that rest schedules are not optimally utilized, potentially leading to fatigue. This condition is further exacerbated by officers using rest hours for activities that do not support physical readiness.

The low utilization of Radar ARPA features observed in this study contrasts with recommendations by Jaram (2021), who emphasized the importance of situational awareness supported by optimal utilization of technological aids. The lack of formal training on Radar ARPA operations identified in this study explains why watchkeeping officers do not fully utilize available technological capabilities, confirming that technical competence is a prerequisite for effective navigational aid utilization.

The underutilization of compass bearings demonstrates a deviation from traditional navigational practices that remain relevant under COLREGs. While studies by Asana et al. (2025) have emphasized the importance of modern technologies such as AIS-based collision detection, the present study suggests that basic navigational skills cannot be entirely replaced by technology. The improvement to 65% following simple training indicates that many

officers have the capacity to perform compass bearing observations but lack consistent practice.

3. Research Implications

Theoretical Implications:

The findings of this study contribute to the development of maritime safety theory by providing empirical evidence on COLREGs implementation in the context of Self-Propelled Barge operations. This extends current understanding beyond conventional vessel types and demonstrates that similar challenges exist across different vessel categories. The study also reinforces the importance of considering human factors, including fatigue, experience, and technical competence, in maritime safety models.

Practical Implications:

For shipping companies operating SPBs, the findings emphasize the need for (1) ensuring watchkeeping officers have adequate rest periods and arrive on the bridge with sufficient time for proper handover; (2) providing regular and structured Radar ARPA training to all deck officers; (3) implementing periodic competence assessments on navigational aid utilization and COLREGs understanding; and (4) incorporating crossing situation simulations into onboard training programs.

For ship masters, the findings suggest the importance of establishing clear watchkeeping procedures that include requirements for taking compass bearings at regular intervals, conducting comprehensive look-out, and utilizing ARPA features for collision risk assessment. The Master's Standing Orders should specifically address these aspects and provide clear guidance on actions to be taken in various encounter situations.

Policy Implications:

At the regulatory level, the findings support the need for more stringent training requirements for SPB crews, particularly regarding navigational competence and COLREGs understanding. The Indonesian government, through the Directorate General of Sea Transportation, may consider developing specific competency standards for SPB watchkeeping officers that address the unique operational characteristics of this vessel type.

4. Research Limitations and Directions for Future Research

This study has several limitations that should be acknowledged. First, the study was conducted on a single SPB vessel (SPB Sainty Giant), which may limit the generalizability of

findings to other vessels with different operational characteristics, crew compositions, or shipping routes. Second, the research was conducted over a one-year period, which may not capture seasonal variations in traffic density or weather conditions. Third, the primary data collection relied on observation and interviews, which may be subject to observer bias or social desirability effects.

Future research is encouraged to: (1) expand the sample to multiple SPBs operating in different Indonesian waters to examine variations in COLREGs implementation; (2) employ quantitative approaches to measure the correlation between watchkeeping practices and collision risk indicators; (3) conduct comparative studies between SPBs and other vessel types; (4) investigate the effectiveness of specific training interventions on watchkeeping performance; and (5) examine the role of organizational culture and management commitment in supporting COLREGs implementation.

CONCLUSION

1. Summary of Research Findings

Based on the research findings, the implementation of the International Regulations for Preventing Collisions at Sea (COLREGs) on SPB Sainty Giant has not yet fully supported optimal collision risk prevention, particularly in crossing situations. The primary issues lie in three main areas: (1) suboptimal watchkeeping responsibility execution, evidenced by inconsistent look-out practices, inadequate handover procedures, and decision-making delays; (2) limited understanding and utilization of Radar ARPA navigational aids, particularly in using features for collision risk assessment such as CPA and TCPA calculations; and (3) low frequency of compass bearing practice for collision hazard detection. These findings demonstrate that navigational safety highly depends on crew discipline in consistently understanding and implementing COLREGs rules.

This study also reveals that following targeted interventions, including internal training on Radar ARPA operation and recommendations for increased compass bearing practice, watchkeeping officers demonstrated improved understanding and utilization of navigational aids. This indicates that focused training and reinforcement of basic navigational skills can positively impact safety practices.

2. Contribution to Knowledge

This study contributes to maritime navigation literature by providing empirical evidence on COLREGs implementation in the context of Self-Propelled Barge operations, a vessel type that has received limited attention in previous research. The findings extend current understanding of challenges faced by SPB watchkeeping officers in Indonesian waters, particularly regarding technology utilization, human factors, and compliance with collision prevention regulations. The study also reinforces the importance of integrating theoretical understanding with practical skills through structured training and supervision.

Additionally, this research contributes practical recommendations for improving COLREGs implementation, including the importance of disciplined watchkeeping, comprehensive navigational aid utilization, and regular training. The improvement observed following training interventions provides evidence-based support for the effectiveness of targeted competence development programs.

3. Recommendations for Future Research

Based on the findings and limitations of this study, several recommendations are proposed for future research. Future studies are encouraged to examine COLREGs implementation on other SPB vessels with different operational routes and traffic conditions, enabling broader generalization and identification of contextual factors influencing safety practices. Additionally, comparative research between SPB vessels and other vessel types such as container ships, tankers, or passenger ferries could reveal vessel-specific challenges in COLREGs implementation. Quantitative approaches correlating watchkeeping practices with collision risk indicators would provide empirical evidence for safety interventions. Longitudinal studies examining the sustainability of training effects on watchkeeping performance could inform training program design. Finally, research investigating the role of organizational culture, management commitment, and safety climate in supporting COLREGs implementation could identify systemic factors influencing maritime safety.

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