

Analysis of The Use of A Manual Steering System On The Km Jetliner to Smoothen The Management of Ships Mounting At Kendari Port

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Abstract.

This study analyzes the use of a manual steering system on the KM. Jetliner in supporting smooth berthing at Kendari Port. The background of this study is based on the importance of the effectiveness of the steering system in ship maneuvers, especially in port conditions with high levels of activity. The purpose of this study is to identify the influence of the manual steering system and the factors that influence the success of berthing. This study uses a descriptive qualitative method with the research subjects of the KM. Jetliner crew who were selected purposively. The research instruments include researchers, observation guidelines, interviews, and documentation. The data analysis technique uses an interactive model in the form of data reduction, data presentation, and conclusion drawing. The results of the study indicate that the manual steering system provides a faster and more precise response than the automatic system at low speed conditions and critical berthing distances. In addition, the success of maneuvers is also influenced by crew coordination, officer experience, and support from bow thrusters and tugboats. The conclusion of this study is that the manual steering system plays a significant role in improving the safety and smoothness of berthing at Kendari Port.

Keywords: Human Factors, Manual Steering System, Marine Navigation, Ship Maneuvering and Steering Control.

I. INTRODUCTION

The steering system is a vital component in controlling a ship's direction, maintaining its course and changing direction during navigational maneuvers. This system generally operates using an oil-based hydraulic mechanism as the pressure medium to move the rudder, allowing the ship to maneuver stably in both open and confined waters. The effectiveness of the steering system is crucial for navigational safety and accuracy, particularly during port operations, which require high precision (Zhang et al., 2022; Kumar & Lee, 2023).

In practice, ship steering systems are divided into manual and automatic, each with complementary functions under different operational conditions. Manual steering is used when the automatic system experiences problems or under certain conditions, such as bad weather, narrow waters, and when the ship is berthing. In these situations, the operator plays a direct role in controlling the ship's direction through a manually operated hydraulic system (Hansen et al., 2021; Li & Chen, 2023).

The main problem with using a manual steering system is the high dependence on the operator's ability to precisely control the vessel. This can potentially lead to delayed steering response, particularly during berthing maneuvers, which require high precision in busy port areas. Technical factors such as hydraulic pressure and pump performance also affect the stability of a manual steering system (Rahman et al., 2022; Smith & Johnson, 2024).

In addition to technical factors, human factors such as crew experience, watch team coordination, and communication during maneuvers are also obstacles that can affect the successful operation of a manual steering system. Inaccurate coordination can result in delayed instructions and increase the risk of ship maneuvering errors during port berthing (Lee et al., 2021; Pratama & Suryadi, 2023).

Furthermore, under operational conditions on the KM. Jetliner, the challenges of using the manual steering system become even more complex due to the need for rapid response and synchronization among the crew. This demonstrates that the success of the docking maneuver is determined not only by the mechanical system but also by the readiness of human resources and the operational procedures implemented on board.

This study aims to analyze the effect of the use of a manual steering system on the KM. Jetliner in supporting smooth berthing at Kendari Port and identify the factors that influence it. The urgency of this research lies in the importance of improving the safety and efficiency of ship maneuvers in ports with high activity levels. The novelty of this study is its focus on the integration of technical aspects of the hydraulic system and human error factors in the context of passenger ship operations in Eastern Indonesia, which is still limited in previous studies.

II. METHODS

This study uses a descriptive qualitative approach to analyze the use of the manual steering system on the KM. Jetliner during its berthing process at Kendari Port. This approach is used to understand the phenomenon in depth based on the crew's direct experiences and practices without statistical analysis, but rather focuses on the meaning and operational processes in the field (Creswell & Poth, 2021; Sugiyono, 2023; Emzir, 2022). This method also allows for a holistic analysis of the technical and non-technical factors in the operation of the manual steering system.

The primary instrument in this study was the researcher herself, supported by observation, interviews, and documentation guidelines. Data collection techniques included direct observation during sea practice on the KM. Jetliner, interviews with the First, Second, and Third Officers, and documentation in the form of photographs and field notes. This technique was used to obtain valid and relevant data regarding the use of the manual steering system during berthing maneuvers (Sugiyono, 2023; Sudaryono, 2022; Lee et al., 2021).

In qualitative research, the population and sample are replaced by purposively selected research subjects. The subjects of this study were the crew of the KM. Jetliner, specifically the navigational officer, involved in the docking process. The primary informant was the Second Officer as the navigational system operator, supported by the First Officer and Third Officer as additional informants based on their direct involvement in ship control (Emzir, 2022; Sugiyono, 2023; Pratama & Suryadi, 2023).

Data analysis used an interactive model that included data reduction, data presentation, and conclusion drawing. Data from observations, interviews, and documentation were reduced to select relevant data, then presented in descriptive narrative form, and conclusions were drawn based on interpretations of field findings (Miles et al., 2020; Hardani et al., 2020; Sugiyono, 2023). The research procedure began with a literature review, data collection during marine practice, data analysis, and systematic compilation of research results (Creswell & Creswell, 2021).

III. RESULTS AND DISCUSSION

Data Presentation

1. Observation Results

Direct observations were conducted during the Sea Practice (PRALA) on the PT. PELNI KM. Jetliner, specifically during berthing at Kendari Port. Observations focused on the use of the manual steering system, the condition of the steering equipment, and the crew's execution of maneuvering procedures. Observations showed that the manual steering system played a crucial role in maintaining the ship's maneuvering accuracy and stability during berthing.

Incident 1 occurred on August 22, 2024, while the vessel was berthing on the port side at Kendari Port. As it approached the dock at a speed of 2–3 knots, the captain used manual rudder to adjust its course due to the influence of crosswinds. Observations showed that the rudder responded quickly enough to the change in steering angle, maintaining the vessel's position and ensuring a safe and controlled berthing process.

Incident 2 occurred on December 15, 2024, after a voyage of 113 NM at a speed of 8–9 knots. During the berthing process, manual steering was used in conjunction with the bow thruster to overcome the tidal current. Effective VHF communication between posts enabled real-time coordination of the ship's position and mooring. This combination allowed the ship to berth successfully without major corrections.

Incident 3 occurred on April 10, 2025, during relatively calm weather conditions. At a distance of 15 meters from the dock, the captain and second officer operated the manual rudder to correct the course. The presence of a mooring team enabled the fast and precise tying of the ropes, demonstrating that the

crew's preparedness and the officers' experience significantly contributed to the success of the mooring maneuver.

2. Interview Results

Table 1 Interview Results

Source person	Interview Results	Summary
Ampera Warman (Captain)	Manual steering systems significantly impact the success of berthing operations. At low speeds below 3 knots, automatic steering systems often respond slowly and inaccurately. Manual steering allows the ship's officer to have full rudder control, allowing for immediate and seamless responses to changes in the rudder angle. This is crucial for making rapid and precise course corrections to address wind and crosscurrents, ensuring the ship remains on the desired berthing course.	Manual steering was chosen because it provides a faster and more accurate response than automatic steering when the ship is making berthing maneuvers at low speeds, thus making it easier to correct the course due to the influence of wind and current.
Dharmansyah Rivan H. (Chief Officer/First Officer)	Manual steering systems play a crucial role in maintaining a ship's position and direction when entering a berthing area. Manually controlled rudders can be held at specific angles to meet maneuvering needs, allowing the ship to more easily adapt to environmental conditions, particularly crosswinds. Automatic steering systems are considered less effective because they tend to return the rudder to its center position slowly, making it easier for the ship to be pushed away from the harbor.	Manual steering allows the rudder to be maintained at a certain angle, making it more effective in overcoming the effects of side winds and maintaining the ship's position when docked.
Andi Hermawan (Second Officer/Second Officer)	The manual steering system has a very direct response and follows every operator command precisely without significant delay. At a critical distance of 10–20 meters from the harbor, a rudder angle change of as little as 5° can determine whether the vessel's course remains aligned or deviates from the berthing course. Therefore, manual steering is crucial for making rapid and accurate course corrections to enhance safety during berthing.	Manual steering provides the immediate and precise response needed for critical course corrections while berthing, thus increasing vessel safety.

3. Documentation Results

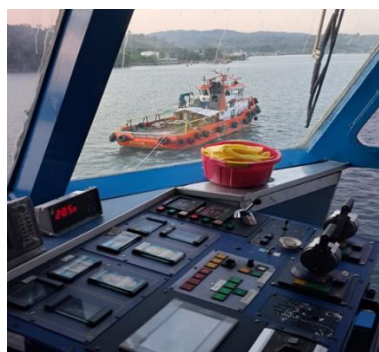


Fig. 1 Manual Steering Wheel (Right Side) KM. Jetliner

Source: Personal Documentation

Manual rudder operation on the starboard side of the KM Jetliner was performed for berthing maneuvers at the starboard port. While berthing, the ship's officer was on the bridge to directly control the course, monitor the ship's distance from the port, and ensure the bow remained parallel to the dock line. The use of manual rudder from the bridge allowed for quick and precise rudder angle corrections, ensuring a safe and smooth berthing process.



Fig. 2 Manual Steering Assisted by Tugboat

Source: Personal Documentation

Manual steering operation on the KM Jetliner assisted by a tugboat When docking at Kendari Port, the main ship remains under manual steering from the bridge, while tugboats provide pushing or pulling assistance to more precisely position the ship's bow and stern.



Fig. 3 Manual Steering (Left Side) Docking Platform

Source: Personal Documentation

Manual steering operation on KM Jetliner from the left side of the bridge During docking at the port. On the port side, the helmsman manually controls the ship's course to align the stern and bow with the port line, especially when maneuvering close to the dock with limited space.

IV. DISCUSSION

Based on observations and interviews regarding the manual steering activity of the KM. Jetliner during berthing at Kendari Port, it can be analyzed that the manual steering system plays a very significant role in the entire maneuvering process. The Captain, Chief Officer, and Second Officer confirmed that the use of manual steering allows full control of the ship's course with an immediate and precise response. Every change in the rudder angle, even if only five degrees, is immediately responded to by the rudder so that the ship remains parallel to the dock, even when exposed to wind or side currents. The use of automatic steering, especially when the ship is moving at low speeds below three knots, tends to provide a slow response, so manual steering is more effective for fast and accurate course corrections, especially when the distance from the ship to the port is very limited, which is around 10 to 20 meters.

The main engine and bow thruster performed stably, facilitating precise manual steering operations. Furthermore, communication between posts via VHF radio was smooth, allowing for real-time information on the distance between the ship's head and the fender, the position of the mooring lines, and wind direction. Weather and environmental conditions also affected the effectiveness of manual steering; when the weather was relatively calm and wind speeds were low, course corrections could be made more easily and quickly. The experience and competence of the officers, particularly the second officer who most frequently operated the manual steering while docked, proved crucial due to their ability to read the ship's condition and make precise course corrections according to the situation on the ground. The readiness of the mooring team also contributed to the smooth maneuvers, with the mooring lines always ready to be thrown and installed when the ship reached its optimal position.

Furthermore, the use of manual steering combined with tugboat assistance demonstrated increased maneuvering precision, particularly during high tides. The lead vessel remained under manual steering, while the tugboat provided push or pull to adjust the ship's bow and stern. This combination allowed the vessel to optimally anchor without the need for repeated major corrections. Observations and interviews revealed the following key points:

1. The use of manual steering has been shown to significantly impact the smoothness of berthing operations. Manual rudder operation allows the ship's officers to make course corrections quickly and precisely, especially when the ship is at a critical distance from the harbor. In wind or current conditions that affect the ship's position, manual steering provides full control over the rudder angle, allowing the ship to maintain a position parallel to the dock or harbor line. Observations show that every $\pm 5^\circ$ change in the rudder angle is immediately responded to by the rudder, keeping the ship on the desired berthing course. Quick decisions and good coordination between the Master and Second Officer are key factors in the success of berthing maneuvers, which emphasizes the importance of the operator's ability to control the steering system manually.
2. The smoothness of the docking movement does not only depend on the manual steering system, but is also influenced by several supporting factors, namely:
 - a. Effective coordination between the bridge and mooring crew is essential to ensure the vessel remains stable while the mooring lines are being deployed.
 - b. The officer's experience and skill in reading environmental conditions, such as current speed, wind direction, and limited space around the port, are the main factors in determining the appropriate response to rudder control.
 - c. Assistance from a tugboat can smooth the position of the ship's bow and stern so that docking maneuvers are more precise.

Crew readiness. Structured docking procedures, along with prior documentation and training, are key factors in ensuring optimal manual steering operation.

V. CONCLUSION

This study shows that the use of a manual steering system on the KM. Jetliner has a very significant role in supporting the smoothness of berthing at Kendari Port. The manual steering system has been proven to provide a faster and more precise response than the automatic system, especially at low speed conditions and critical distances to the dock. The rudder's ability to respond immediately to every change in the steering angle allows the ship to remain on a safe berthing path despite being influenced by external factors such as wind, currents, and limited maneuvering space. In addition to technical factors, the success of the maneuver is also influenced by coordination between the ship's crew, the experience of the officer on duty, the readiness of the mooring team, and the support of auxiliary equipment such as tugboats and bow thrusters that work synergistically in the berthing process.

However, this study has limitations because it only focuses on one research object, namely KM. Jetliner, so the results cannot be generalized to all types of ships or different shipping conditions. In addition, data collection that relies on field observations and interviews is potentially influenced by the subjectivity of respondents and limited observation time during sea practice. Therefore, further research is recommended to expand the research object to several types of ships and different shipping routes and combine quantitative approaches for more comprehensive analysis results. Practically, the results of this study can be a reference for shipping companies and ship crews in improving manual steering operation skills, strengthening team coordination when berthing, and improving the safety and efficiency of ship maneuvers in ports with high activity levels.

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